Immigrant Farmworkers' Health-Related Quality of Life: An Application of the Job Demands-Control Model

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ABSTRACT. *This study tests basic predictions from the demands-control model of occupational stress in Latino immigrant farmworkers. Cross-sectional data were obtained from 151 farmworkers in eastern North Carolina via face-to-face interviews conducted in Spanish during the summer of 2005. Results suggest that farmwork is characterized by low psychological demand and low control, or that it is a "passive job." Multivariate analyses provided little support for predictions. Isometric load, an indicator of physical job demands reflecting how frequently workers maintain awkward postures for long periods, was associated with poorer physical health, and high worker control was associated with better mental health. However, pace of work, an indicator of psychological job demand, was unassociated with physical and mental health, and physical exertion, another indicator of physical job demand, was not robustly associated with health outcomes. The results suggest that core predictions from the demands-control model do not hold for immigrant farmworkers, and they foreshadow possible ways of refining the model.*

Keywords. *Demands-control model, Farmworkers, Health-related quality of life, Immigrants, Latinos, Organization of work, Workplace safety.*

The literature documenting the health effects of psychosocial workplace characteristics is burgeoning, yet several groups of workers have not been studied. Immigrant Latinos reflect the largest and one of the fastest growing segments of the labor force (Toossi, 2002), but there is little documented evidence to indicate whether factors like "control" or "psychological demands" are associated with health among these workers. Recognizing that immigrants from Mexico are primarily interested in acquiring financial security for their families, psychosocial aspects of work may not be interpreted as stressors, thereby minimizing their potential effect on worker health (Grzywacz et al., 2007). In essence, the absence of work is more stressful than jobs without control or those that are routine and monotonous in nature. Similarly, little research has been undertaken in labor-intensive occupations where both the physical and psychosocial elements of the work environment have the potential of affecting worker health. This oversight has contributed to a general minimization in the occupational health psychology literature of the

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potential health effects of physical versus psychosocial demands inherent in workers' jobs.

In this study, we test basic hypotheses from the job demands-control model (Karasek, 1979; Karasek and Theorell, 1990) in a sample of immigrant Latino farmworkers. Research with special populations provides important insights for testing the utility of theories frequently used in occupational health psychology (Schnall et al., 1994). Recognizing that widespread applicability is one of the hallmarks of good theory, the empirical basis for a particular theory would be reinforced if its fundamental relationships were supported in diverse circumstances, such as those represented by special populations. By contrast, if theoretical relationships are not supported, then the null findings can inform how a theory should be refined, or the null findings can be used to circumscribe the theory's boundaries. Recognizing that immigrant Latinos will become more common in the labor force (Toossi, 2002) and they frequently work in labor-intensive or otherwise marginalized jobs (Mosisa, 2002), it is important to determine if their health is shaped by job demands and control. Further, special populations like immigrants and farmworkers frequently shoulder the burden of poor health (Villarejo, 2003), including elevated rates of occupational injuries and illness (Frank et al., 2004; Villarejo and Baron, 1999). It is therefore important to document how elements of immigrants' jobs, like the relative levels of demand and control, are related to health to determine if occupational stress contributes to health inequalities.

Background

The Model

The job demands-control model is a dominant framework in occupational health psychology research. The original model argued that psychological strain and poor health among workers is a function of two features of the work environment: demands and control (Karasek, 1979). Demands are the patterned and unexpected psychological stressors that arise while carrying out the tasks and responsibilities associated with a job. Demands may be inherent in the job tasks, such as those requiring intense concentration, or they may arise from social interaction in the workplace such as poor supervision. Control refers to the degree of freedom workers have over which tasks are performed and how those tasks are accomplished. Demands and control are combined to create a four-fold taxonomy of different job types: passive jobs (low control/low demand), active jobs (high control/high demand), low strain jobs (high control/low demand), and high strain jobs (low control/high demand).

After 25 years of research and several critical reviews, four major conclusions can be drawn about the demands-control model (Belkic et al., 2004; de Lange et al., 2003; Kristensen, 1995; Schnall et al., 1994). First, there is only modest support for the hypothesis that the interaction of high demands and low control is particularly devastating to worker health, but there is good evidence suggesting that demands and control have important independent effects on worker health and well-being (de Lange et al., 2003). This suggests that the health-related implications of demands and control on the job are best viewed in additive rather than interactive terms. Next, tests of the model should include different domains of demands and control because facets of control such as the amount of variety in a worker's tasks and responsibilities are also important to worker health and may not be captured by measures of control (Kristensen, 1995). Likewise, the distinction between psychological demands and physical demands is not entirely clear, because some physical demands elicit bio-physiological responses comparable to psychological demands (Karasek and Theorell, 1990), and other demands,

such as exposure to environmental hazards in the workplace, can generate substantial psychological stress among workers (Gee and Payne-Sturges, 2004). Finally, evidence indicates that there is sufficient variation within specific occupational groups to adequately evaluate the job demands-control model in homogeneous samples of workers (de Lange et al., 2003). This evidence contradicts earlier claims that heterogeneous worker samples are necessary for testing the model (Kristensen, 1995) and suggests that the model can be useful for understanding within-group differences in occupational health outcomes.

Although the previous critical reviews focused on cardiovascular outcomes, there is also good evidence suggesting that job demands and worker control contribute to other indicators of health (for review, see Kristensen, 1995). Prospective evidence from a national cohort found that high job demand and low control predicted declines in functional health status, and that decreases in psychological demands and increases in decision latitude were associated with reductions in fatigue, exhaustion, and emotional distress (Cheng et al., 2000; Janssen and Nijhuis, 2004). Substantial cross-sectional evidence from around the world has linked indicators of job demands and control to a variety of physical and mental health outcomes (D'Souza et al., 2003; Godin and Kittel, 2004; Grzywacz and Dooley, 2003; Jamison et al., 2004; Stansfeld et al., 1995). Most recently, Kudielka and colleagues (2005) found that several indicators of job demands and control were independently associated with physical and mental health-related quality of life, a finding that parallels earlier research from a U.S. cohort (Lerner et al., 1994).

The Present Study

In this study, we examine basic hypotheses from the job-demands control model of occupational health in a sample of immigrant Latino farmworkers working in crop production. There are approximately 4.2 million farmworkers and their dependents in the U.S., resident in 42 of the 50 states (HRSA, 1990). National Agricultural Workers Survey (NAWS) survey data, which excludes H2A workers, show that the national farmworker population became predominantly Latino and Mexican in the 1990s (Mines et al., 1997). In 2002, 84% of migrant and seasonal farmworkers in the U.S. self-identified as Hispanic, and 75% of all farmworkers were born in Mexico (Carroll et al., 2005). Many of these farmworkers are legal residents of the U.S.; 25% are U.S. citizens, and 21% are legal permanent residents. Approximately half of farmworkers live in the U.S. without proper documentation. Another sizeable, albeit unknown, proportion of immigrant farmworkers come to the U.S. annually with H2A visas, which authorize nonimmigrant aliens to work in agricultural employment in the U.S. for a specified time period, normally less than one year. The North Carolina Employment Security Commission, for example, estimates that approximately 8,000 to 9,000 of approximately 40,000 migrant farmworkers are in the state on H2A visas.

Karasek and Theorell (1990) characterized farmers as having "active jobs" or those where job incumbents have high control over their work environments and highly psychological demands. However, "farmers" and "farmworkers" occupy notably different occupations. Whereas farmers need to keep abreast of new developments in agriculture and frequently acquire this knowledge through post-secondary education and continuing education, farmworkers learn through short-term, on-the-job training. Farmers, regardless of the size of their operation, engage in business planning, such as deciding which crops to plant, they monitor markets, they maintain a variety of records (e.g., tax records, service records for equipment), and they may manage several employees. Farmworkers, by contrast, are frequently hired for discrete periods to perform specific tasks (e.g., planting and harvesting). In short, whereas farmers can be

characterized as “managers” or “business owners,” farmworkers are generally laborers: they perform strenuous work under a variety of conditions, and the work is frequently seasonal.

Farmwork is an interesting and unique occupation for studying the health effects of job-related demands and control. The nature of farmwork accentuates the basic concepts of the model. Farmwork is repetitive, involves performing specific tasks that frequently cannot be completed with machinery, and is highly time dependent, all factors that contribute to high demand. Tasks in farmwork are heavily prescribed and shaped by timing within the agricultural season, thereby providing workers with little opportunity to control how or when they perform their tasks. Planting practices, for example, are highly crop specific in how and when seeds are planted to reach maximal yield. However, while highly routinized during specific periods of the agricultural season, there is substantial variety in the tasks that are performed across the season; tasks necessary during planting are very different from those required during harvest. Likewise, there is an ebb and flow in the intensity of the work, with substantial pressure during planting and harvesting and less time pressure during the growing season. Thus, farmwork is an occupation that is inherently demanding and provides workers with little control, yet the cyclical nature of the occupation as well as other factors (e.g., focal crop, region of the country) contribute to substantial heterogeneity in demands and control within the occupation.

However, substantial stressors inherent in the farmworker lifestyle make it a challenging occupational group for applying the job demands-control model. Farmworkers frequently leave family, friends, and community for protracted periods of time, and a substantial proportion of farmworkers are ambivalent about these separations (Grzywacz et al., 2006). Once in the U.S., farmworkers confront a variety of stressors ranging from documentation problems to discrimination and exploitation (Hovey and Seligman, 2005). Farmworkers live in crowded and frequently inadequate housing (Early et al., 2006; Gentry et al., 2007), and a substantial proportion of farmworker households are food insecure (Quandt et al., 2004), meaning that household members have insufficient money to have access to a sufficient food supply. Farmworkers are paid low wages and have limited access to health and social services when personal needs arise (Arcury and Quandt, 2007). Against the backdrop of these and other stressors that threaten farmworker health, the salience of job demands and control to farmworker health may be minimal.

Nevertheless, based on the fundamental principles of the job demands-control model and previous research, we put forward three hypotheses:

- Hypothesis 1: Greater levels of both psychological and physical job demands will be associated with poorer physical and mental health-related quality of life among farmworkers.
- Hypothesis 2: Higher levels of job-related control will be associated with better physical and mental health-related quality of life among farmworkers.
- Hypothesis 3: Job-related control will serve as a buffer such that the effects of psychological and physical job demands on physical and mental health will be weaker for farmworkers with greater job-related control.

Materials and Methods

Sample and Data Collection

The data for this study were part of an ongoing project, *Casa y Campo*, a community-based health education project based on a three-way collaboration among

environmental health researchers, health care providers, and community advocates. An important element of this collaboration is regular collection and analysis of data focused on specific environmental or occupational health issues. In 2005, the focus was on occupational stress and farmworker health, including oral health. Data focused on these issues were collected from a sample of 151 male farmworkers employed in Harnett, Johnston, and Sampson counties, North Carolina.

Participants were selected using a site-based sampling plan (Arcury and Quandt, 1998), which is a method for recruiting a representative sample in a population that is difficult to enumerate (Faugier and Sargeant, 1997; Muhib et al., 2001; Parrado et al., 2005). A list of farmworker camps in the study area was compiled with the assistance of the North Carolina Farmworkers Project (NCFP), a non-profit service organization. Investigators purposefully selected camps from the list to ensure variability in camp size and incorporation of both H2A and non-contract camps. Trained interviewers visited the camps with members of the NCFP to explain the project and to inform camp residents that interviewers would return to the camp to collect data during the subsequent weeks. Upon later returning to the camps, interviewers recruited farmworkers on a first come, first serve basis. Farmworkers were informed of the purpose of the study and that, if they participated, they would complete an interviewer-administered survey that would take approximately 20 minutes to complete. Farmworkers were also informed that individuals who completed the survey would receive a non-monetary incentive (toothbrush, toothpaste, cap with study logo) valued at less than $10.00, and that no names or other personal identifiers would be recorded. Informed consent was obtained from all participants. Farmworkers were recruited from 28 camps, enrolling 1 to 10 workers per camp, depending on total camp size. All farmworkers in small camps were allowed to participate. Procedures for recruitment and data collection were approved by the Wake Forest University School of Medicine institutional review board.

Data were collected through face-to-face interviewer-administered survey questionnaires during June and July 2005. The interviewers were native Spanish speakers. Interviewers participated in a six-hour training session and completed practice interviews before being approved to conduct study interviews. The interview included demographic and personal data (age, marital status, educational attainment, years resident in the U.S., years worked in agriculture, and location of permanent home), the 12-item Short Form Health Survey (SF-12) (Ware et al., 1996), and the job content questionnaire (JCQ) (Karasek and Theorell, 1990). The SF-12 and the JCQ have been cross-validated in a variety of populations and languages including Spanish (Gandek et al., 1998).

Dependent Variables: Health-Related Quality of Life

Two measures of health-related quality of life were created from the SF-12 (Ware et al., 1996). The SF-12 contains a subset of items from the parent form, the Short Form-36 health survey. The SF-12 is an internationally validated tool that taps eight domains of health: social functioning, mental health, physical functioning, role limitations due to physical and emotional health, general health perception, vitality, pain, and social functioning. Responses to questions across these eight domains of health are used to calculate two summary variables: physical health-related quality of life, and mental health-related quality of life. The scoring algorithm to arrive at the summary scores was developed and standardized against a national population to yield average scores of 50 ($\pm$10 SD) (Ware et al., 1993). Higher values on both variables indicate better health-related quality of life.

Independent Variables

A modified version of 33 items from the JCQ (Karasek and Theorell, 1990) was used to measure control and demand characteristics inherent in farmwork. The selected items measured several features of work, including decision authority or control, psychological demand, skill discretion, physical exertion, and hazardous conditions. Pilot testing indicated that immigrant Latinos had difficulty responding to the affective response categories of the original JCQ ("strongly agree" to "strongly disagree"); consequently, we modified the items and response categories using a four-point frequency-based set ("never" to "always"). Reports based on nationally representative data files that made comparable changes to JCQ response formats suggest that frequency-based response sets do not undermine the validity of the items (e.g., Grzywacz and Dooley, 2003).

Data obtained from the modified JCQ were subjected to principal components analysis with varimax rotation to evaluate the underlying structure of the items. These analyses produced 11 factors with eigenvalues greater than 1. After eliminating items with a low primary factor loading (<0.50) and those with a high loading on a secondary factor (>0.30), four interpretable factors remained (table 1). Three items reflecting the temporal dimension of work, or the pace of work, loaded on the first factor ($\alpha = 0.83$, 95% CI = 0.78-0.88). Three items, originally intended to measure decision authority, loaded on the second factor ($\alpha = 0.75$, 95% CI = 0.68-0.82). Two items tapping the frequency with which farmwork requires heavy physical exertion loaded on the third factor ($\alpha = 0.60$, 95% CI = 0.42-0.73). Finally, the fourth factor was comprised of two items reflecting isometric load or the frequency of performing tasks that require maintaining bodily positions for extended periods of time ($\alpha = 0.78$, 95% CI = 0.71-0.85). For all four variables, pace through isometric load, values were summed, with higher values indicating higher levels of the latent construct.

Table 1. Results of principal components analysis with varimax rotation of data from the Job Content Questionnaire modified to assess frequency of experience in farmwork.

	1	2	3	4
How often does you job require you to work very fast?	**0.874**	-0.089	0.216	0.093
How often are you asked to do an excessive amount of work?	**0.774**	0.206	0.037	0.128
How often does your job in farmwork require you to work very hard?	**0.753**	-0.008	0.285	0.225
How often do you have the freedom to decide how you do your farmwork?	0.096	**0.805**	-0.119	0.069
How often are you allowed to make your own decisions about your work?	-0.025	**0.738**	-0.011	-0.006
How often do you have a lot to say about what happens on your job?	0.079	**0.699**	-0.108	-0.035
How often does your work require rapid and continuous physical activities?	0.171	0.010	**0.768**	0.113
How often does your job require a lot of physical effort?	0.183	-0.065	**0.694**	0.011
How often does your job in farmwork require you to work for long periods of time with your body in physically awkward positions?	0.158	0.050	0.087	**0.808**
How often does your job in farmwork require you to work for long periods of time with your head and arms in physically awkward positions?	0.227	0.079	0.149	**0.789**

Analyses

Univariate statistics such as means and standard deviations were calculated to describe the relative levels of demand and control in farmwork, as well as farmworker health-related quality of life. Pearson correlation coefficients were computed to evaluate the bivariate correlation of job demands and control concepts with health-related quality of life. Multivariate OLS regression models were fit to test the hypothesized relationships among indicators of job demand, control, and farmworker health-related quality of life.

Results

Workers ranged in age from 18 to 64, with the average being 32 (SD = 9.1) years. About one-quarter of the sample was less than 25 years of age, and 17% were over 40 years (table 2). Over 78% were married or living as married. Over half the sample had only a primary education, which is approximately equivalent to an elementary education in the U.S. All participants were born in Mexico, except for one person born in Puerto Rico. Forty-seven percent reported that this was their first year in the U.S.; about one-quarter had been in the U.S. more than 5 years. On average, participants reported working in agriculture for 5 (SD = 3.1) years. However, only about 1 in 7 participants (16%) reported that this was their first year working in agriculture, while nearly half (41%) reported working in agriculture for more than 5 years. This sample represented a migrant worker population, as 92.7% reported that Mexico was their permanent home. The vast majority of these farmworkers reported working in the major crops in North Carolina, including tobacco (n = 131, 86.8%), followed by sweet potatoes (n = 85, 56.3%)

Table 2. Description of sample; farmworkers in North Carolina, 2005 (N = 151).

		N	%
Age (years)	<25	36	24.0
	25 to 40	89	59.3
	>40	25	16.7
Marital status	Not married	31	20.5
	Married or living as married	118	78.1
	Other	2	1.3
Education	Primary	77	51.0
	Secondary	56	37.1
	More than secondary	18	11.9
Time in U.S. (years)	≤1	71	47.0
	1 to 5	44	29.1
	>5	36	23.8
Time working in agriculture (years)	≤1	24	15.9
	2 to 5	65	43.0
	>5	62	41.1
Location of permanent home	North Carolina	10	6.7
	Florida	1	0.7
	Mexico	139	92.7
Follows the crops	No	102	68.0
	Yes	48	32.0
Camp type	H2A camp	93	62.0
	Non-contract camp	32	21.3
	Mixed H2A and non-contract	25	16.7

and cucumbers (n = 30, 19.9%). Approximately one-third of participants (32.0%) reported following the crops. The majority of participants (62.0%) lived in a camp where all occupants were believed to hold an H2A visa (based on the owner of the camp), whereas 21.3% of participants lived in a non-contract camp, and 16.7% lived in a combined H2A/non-contract camp.

Average scores for several indicators of demand and control in farmwork were at or below the midpoint of the possible range (table 3). Physical exertion was the only indicator where the average score was greater than the midpoint. Pace of work, an indicator of psychological job demand, was significantly correlated with both indicators of physical job demands, physical exertion and isometric load. Greater isometric load was associated with poorer physical health-related quality of life, but none of the other indicators of demand or control were correlated with the health outcomes. Decision authority had a slight skew (skew = 1.38); consequently, for subsequent analyses, it was dichotomized such that individuals scoring 6 or higher (mean +0.5 SD) were coded as having "high authority" to minimize analytic problems associated with skewed variables and to facilitate interpretation (Dunlap et al., 1995).

Ordinary least squares regression models predicting physical health-related quality of life yielded weak support for the study hypotheses (table 4). Consistent with the first hypothesis, greater isometric load was associated with poorer physical health-related quality of life. However, none of the other demand characteristics were associated with physical health, thereby producing limited support for the first hypothesis. There was no support for the second hypothesis predicting that greater decision authority would be associated with better health. There was a significant interaction effect between decision authority and physical exertion; however, the nature of the effect contradicted the third hypothesis. That is, among individuals with low decision authority, greater physical exertion was associated with better physical health, whereas physical exertion had benign and possibly negative health effects for individuals with high decision authority. None of the other interaction terms were significant, providing no support for the third hypothesis.

Minimal support was also found for the study hypotheses when regression models were used to predict mental health-related quality of life (table 5). There was no support for the first hypothesis; none of the demands of farmwork were associated with mental health-related quality of life. Consistent with the second hypothesis, individuals with high decision authority had higher mental health-related quality of life than individuals with low decision authority. Partially consistent with the third hypothesis, trend level evidence suggested that greater isometric load was associated with poorer mental health-related quality of life among individuals with low decision authority. Otherwise, there was no robust evidence supporting the idea that decision authority would buffer the health-related effects of job demands (hypothesis 3).

Table 3. Descriptive statistics and intercorrelation among farmworker job characteristics, and physical and mental health-related quality of life (HRQOL) among immigrant farmworkers.[a]

Variable	Mean	SD	Range	1	2	3	4	5
Pace	6.61	3.07	3 to 12					
Decision authority	4.88	2.45	3 to 12	0.06				
Physical exertion	5.93	1.87	2 to 8	0.36**	-0.03			
Isometric load	4.57	2.18	2 to 8	0.36**	0.07	0.28**		
Physical HRQOL	52.05	5.02	29.7 to 61.1	-0.04	-0.13	0.05	-0.21*	
Mental HRQOL	53.20	7.91	23.6 to 63.2	-0.15	0.10	-0.14	-0.15	0.01

[a] * = $p < 0.05$; ** = $p < 0.01$ (two-tailed).

Table 4. Summary of hierarchical regression analysis for variables predicting farmworker physical health (*N* = 151).[a]

Variable	Model 1 B (SE B), and β	Model 2 B (SE B), and β	Model 3 B (SE B), and β	Model 4 B (SE B), and β
Age	-0.02 (0.01), -0.37**	-0.02 (0.01), -0.36**	-0.23 (0.01), -0.36**	-0.02 (0.01), -0.37**
High authority (A)	0.31 (0.84), 0.03	0.30 (0.85), 0.03	0.22 (0.83), 0.02	0.32 (0.85), 0.03
Pace	0.11 (0.14), 0.07	0.15 (0.17), 0.09	0.10 (0.14), 0.06	0.12 (0.14), 0.07
Physical exertion (PE)	0.32 (0.23), 0.12	0.32 (0.23), 0.12	0.69 (0.28), 0.25**	0.32 (0.23), 0.12
Isometric load (IL)	-0.51 (0.19), -0.22**	-0.50 (0.19), -0.21**	-0.51 (0.19), -0.22**	-0.45 (0.23), -0.18*
Interaction terms:				
A × Pace		-0.13 (0.26), -0.05		
A × PE			-0.90 (0.42), -0.21*	
A × IL				-0.19 (0.38), -0.05
R^2	0.159	0.155	0.180	0.155
F for change in R^2	6.57**	0.23	4.51*	0.25

[a] Psychological demand, physical load, and exertion were each centered on their respective sample mean; * = $p < 0.05$ and ** = $p < 0.01$.

Table 5. Summary of hierarchical regression analysis for variables predicting farmworker mental health (*N* = 151).[a]

Variable	Model 1 B (SE B), and β	Model 2 B (SE B), and β	Model 3 B (SE B), and β	Model 4 B (SE B), and β
Age	-0.02 (0.01), -0.15¤	-0.02 (0.01), -0.17*	-0.02 (0.01), -0.16¤	-0.02 (0.01), -0.17*
High authority (A)	3.84 (1.40), 0.22**	3.87 (1.39), 0.23	3.88 (1.40), 0.23**	3.78 (1.39), 0.22**
Pace	-0.22 (0.24), -0.08	-0.41 (0.28), -0.16	-0.22 (0.24), -0.08	-0.27 (0.24), -0.10
Physical exertion (PE)	-0.15 (0.38), -0.03	-0.14 (0.38), -0.03	-0.32 (0.48), -0.07	-0.13 (0.38), -0.03
Isometric load (IL)	-0.31 (0.32), 0.09	-0.36 (0.32), -0.10	-0.31 (0.32), -0.09	-0.63 (0.38), -0.17¤
Interaction terms:				
A × Pace		0.57 (0.44), 0.13		
A × PE			0.41 (0.71), 0.06	
A × IL				0.96 (0.62), 0.16
R^2	0.065	0.069	0.061	0.075
F for change in R^2	3.05**	1.65	0.34	2.45

[a] Psychological demand, physical load, and exertion were each centered on their respective sample mean; ¤ = $p < 0.10$, * = $p < 0.05$, and ** = $p < 0.01$.

Discussion

The job demands-control model is widely used in occupational stress research, and there is solid evidence suggesting that greater demands are associated with poorer health but that greater control is associated with better health (Belkic et al., 2004; de Lange et al., 2003; Kristensen, 1995; Schnall et al., 1994). In spite of evidence supporting basic tenets of the job demands-control model, there are some notable gaps in this literature. In particular, the absence of job demands-control research in immigrant Latino populations or in labor-intensive occupations raises questions about the applicability of the theory to diverse worker groups and whether the model gives sufficient attention to the physical nature of work in predicting health-related outcomes. In this study, we examined basic predictions from the demands-control model using data from immigrant Latino farmworkers, mostly of Mexican descent.

Given the fact that this is the first occupational stress study of immigrant farmworkers, it is necessary to acknowledge the limitations of the study so that the results can be interpreted in the context of weaknesses. First, our results are based on cross-sectional, self-report data, so causal inferences cannot be made. It is quite possible, for example, that health-related quality of life influenced the way people responded to questions about their work. The results of this study have limited generalizability because the sample was small and not randomly selected. One casualty of the small sample is that several of the estimated associations had large standard errors, suggesting that they may be unreliable and should be interpreted as preliminary.

Perhaps the most serious limitation is the unknown validity of the instruments used to measure "demand" and "control" in farmwork. In the absence of previous farmworker research, it is unknown whether the modified JCQ items adequately captured the inherent demands and opportunities for control in farmwork, or how interpretable the items were for immigrants from Mexico. Informal process evaluation by our research team suggests that farmworkers understood and were able to respond to the items. However, several of the items used to measure psychological demands and control in this study were subjected to cognitive testing after completion of the reported study by Aguirre International for possible inclusion in future panels of the National Agricultural Workers' Survey (NAWS). Unpublished results of the cognitive testing suggest that farmworkers may have had difficulty understanding and responding to questions, particularly those originally designed to assess "skill discretion" and "psychological demand." Participants in the cognitive testing expressed confusion about both the meaning of main concepts (e.g., does a "high degree of skill" mean a lot of experience?) and its relevance to farmwork. Poor comprehension of the intent of several items may have contributed to the absence of a clear and coherent factor structure underlying the modified JCQ items.

Limitations notwithstanding, the results of this study contribute to the literature in several ways. This is one of the first occupational stress studies focused on immigrant Latinos, the fastest growing segment of the U.S. labor force (Toossi, 2002) and a segment of the population that frequently works in labor-intensive or otherwise marginal jobs (Mosisa, 2002). This study also provides one of the first characterizations of farmwork in terms of confronted demands and control. In light of our factor analyses suggesting that the modified JCQ items could not be combined in ways to create the typical measure of psychological demands, which is usually constructed from nine items, good comparative data do not exist. Nonetheless, the fact that average values for most indicators of demand and control were below the midpoint of the possible range suggests that farmworkers have relatively low levels of both demand and control. On one hand, this description suggests that farmwork is not, on average, overly stressful; on the other hand, farmwork also provides workers with little opportunity to control when and how they work. Viewed

from the demands-control model, farmwork would be characterized as a "passive job," a type of job with relatively benign health effects.

The results of this study yielded relatively little support for basic predictions offered by the job demands-control model and suggest that job demands and control play little role in farmworker health. Only two predictions received strong support: greater isometric load was associated with poorer physical health-related quality of life, and high decision authority was associated with better mental health-related quality of life. Given the limitations of this study, it is important to avoid over-interpreting the pattern of results, but the number of null associations in this analysis raises questions that will need to be explored in future research. For example, are measures of psychological demand, like pace of work, truly unassociated with farmworker health? If they are, then is the null association due to other competing demands such as poor housing (Early et al., 2006) or food insecurity (Quandt et al., 2004), or is there some factor that protects immigrant Latinos from the well documented health effects of psychological demands? Answers to questions such as these have important implications for refining the job demands-control model as well as other theories of occupational stress (e.g., effort-reward imbalance). Practically, results of more definitive studies of the effects of job demands and control on farmworker health would be useful for prioritizing approaches for improving farmworker health. If psychological demands are unrelated to health outcomes, then attempts to make farmwork less stressful would likely have minimal health effects. Consequently, although attempts to humanize farmwork by making it less stressful are important from a social justice perspective, advocates interested in protecting farmworker health may want to prioritize interventions that target other hardships inherent in the farmworker, such as housing quality or access to health care and services.

The relative salience of physical demands, particularly isometric load, versus psychological demands like the pace of work is interesting. Recognizing that these farmworkers do not rely on machinery and are involved in crops that are low to the ground (i.e., tobacco, sweet potatoes, and cucumbers), it may not be surprising that holding postures for extended periods of time was associated with poorer physical health. Nonetheless, these results raise questions about whether occupational stress researchers should give greater attention to physical demands of work, particularly when studying workers in labor-intensive occupations. Indeed, Karasek and Theorell (1990) noted (pp. 137-138) that research focused on physically intensive occupations is needed because physical demands of jobs may interact with psychosocial job characteristics in a variety of ways to produce negative outcomes. Future research with farmworkers and other physically intensive occupations should explore whether psychological job demands intensify or compound the effects of physical job demands on worker health.

The results of this study, if replicated in subsequent research, foreshadow possible ways to refine or circumscribe the job demands-control model. Consistent with calls to elaborate and study different dimensions of "demand" and "control" (Kristensen, 1995), it may be useful to expand the "demands" concept to include exposure to hazardous working conditions. As Karasek and Theorell (1990) mentioned, the distinction between psychological demands and those that may appear more physical in nature is not clear because physical demands can yield similar physiological and biochemical sequelae to psychological demands. Assuming that physical demands are more common in manual occupations than in service or professional occupations, and that exposure to physical demands is interpreted as stressful (Gee and Payne-Sturges, 2004), expanding the conceptual universe of the "demands" concept to include factors like physical exertion or exposure to hazardous conditions may help broaden the applicability of the demands-control model.

The results of this study also suggest that predictions from the job demands-control model may need to be refined by considering broader features of workers' contexts. In our sample, there was no evidence that psychological demand, specifically the pace of work, was associated with health. Although the null findings may be attributed to restricted range in the occupationally homogeneous sample, they may also reflect the fact that farmworkers come to the U.S. to acquire financial security for themselves and their families (Chavez, 1992). For these workers, any work may be better than no work, particularly if it provides steady income. This pressing reality may minimize the threat ascribed to psychologically demanding job characteristics and may dampen the stress response and subsequent implications for health (Grzywacz et al., 2007). This interpretation is consistent with previous research documenting substantial intercultural variation in the attributes of good jobs (Hofstede, 1984) and, by extension, the elements of jobs that have the potential of eliciting a stress response. These comments are not intended to suggest that attempts to redesign farmwork to enhance levels of control and reduce psychological demands among workers are unnecessary; indeed, we maintain it is a critical point of social justice. Rather, we raise these comments to suggest that researchers need to consider contextual and cultural factors when developing predictions from the demands-control model.

Finally, the results of this study point to significant areas for future occupational stress research among farmworkers. Occupational stress research based on more generalizable samples is needed. A highly promising alternative is to incorporate measures of occupational stress in existing data collection efforts such as the National Agricultural Workers Survey. Research is needed to better identify job-related stressors inherent in farmwork. Our ongoing research program suggests that discrimination and harassment may be endemic in farm labor contracting and is extremely stressful for farmworkers. Similarly, the lack of stability in farmwork from year to year and across the agricultural season due to factors outside of workers' control (e.g., immigration policies, weather) presents significant hardship for farmworkers. Research exploring these and other stressors in farmwork and their health-related implications is needed. Underlying each of the previous areas of research is the profound need for researchers to develop and validate measures of occupational stressors. In light of the virtual absence of occupational stress research among immigrant farmworkers, these high-priority areas are essential for determining the extent to which stressors inherent in farmwork undermine the health of an already vulnerable population.

Conclusion or Summary

This study found limited support for basic predictions from the job demands-control model when it was applied to immigrant Latino farmworkers. Although they must be viewed as preliminary given limitations in study design, the results suggest that the demands-control model may benefit from differentiating and measuring both physical and psychological job demands. This model refinement may be particularly important when researchers include or focus on workers in labor-intensive occupations. The results and previous theory also suggest that contextual factors may circumscribe the salience of job demands and control to worker health, and that researchers should consider these factors when developing predictions from the demands-control model. Additional research with under-studied worker populations, like immigrant Latinos, is sorely needed to replicate these findings and to advance theories of occupational stress.

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