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## Factorial invariance, scale reliability, and construct validity of the job control and job demands scales for immigrant workers: The Multi-Ethnic Study of Atherosclerosis (MESA)

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### Abstract

Immigrants have a different social context from those who stay in their home country or those who were born to the country that immigrants now live. Cultural theory of risk perception suggests that social context influences one's interpretation of questionnaire items. We examined psychometric properties of job control and job demand scales with US- and foreign-born workers who preferred English, Spanish, or Chinese (n=3114, mean age=58.1). Across all groups, the job control scale had acceptable Cronbach's alpha (0.78–0.83) and equivalent factor loadings (CFI<0.01). Immigrants had low alpha (0.42–0.65) for the job demands scale regardless of language, education, or age of migration. Two job-demand items had different factor loadings across groups. Among immigrants, both scales had inconsistent associations with perceived job stress and self-rated health. For a better understanding of immigrants' job stress, the concept of job demands should be expanded and immigrants' expectations for job control explored. (149/150 limit)

### Keywords

job stress; factor analysis; internal consistency; acculturation; health disparities

### INTRODUCTION

As immigrants' presence in the US workforce increases, their experience of job stress has become a significant concern. A few recent studies have provided evidence linking job stress and poor health among immigrant workers (1, 2, 3, 4). To examine immigrants' job stress, researchers must reconsider the applicability of self-report measures developed for native workers.

Job stress measures typically ask the worker to assess potentially harmful aspects of the job (e.g., level of demands). According to the cultural theory of risk perception (5), risk is “a social and cultural construction—not an ‘objective’ entity to be measured independently of the context in which hazards occur” (p. 106) (6). Immigrant workers are in a unique social context, different from the one experienced by workers in their home countries or by workers who were born in the country where immigrants now live. Unlike those who remain in the home country, immigrants must adjust to the new dominant culture. They are also different from those native to the new country, such as dominant language proficiency and legal status.

Immigrants’ unique position has implications for measuring job characteristics via self-report. For example, those who migrated as adults may have work experience in their native countries, which would provide a different point of reference in their assessing work in the new country. Heine et al. (7) pointed out that individuals in different cultural contexts have different reference groups for implicit social comparisons, which obscures cross-cultural comparisons. Commonly used job stress measures do not specify reference groups, but respondents make implicit social comparisons of their job with jobs of others similar to them. For immigrants, social comparisons can be made with various reference groups (e.g., others in the home country, other immigrants in the US, US-born Americans in the workplace). Because different reference groups can change responses (7), questionnaire items without explicit reference can result in lower scale reliability among immigrants.

Another concern is the potentially different salience of questionnaire items as an indicator of a construct, which may make the construct non-equivalent between groups. Fujishiro et al. (8) found that US-born workers considered “having freedom to decide how to do one’s job” an important aspect of job control; however, Latino immigrants in the same occupation had difficulty in understanding the phrase in relation to job control. Similarly, Grzywacz et al. (9) reported that Latino farm workers considered decision making power irrelevant to their work. These findings suggest that for immigrant workers, some items may not represent salient aspects of a construct.

Finally, an established relationship between a scale score and health status among native workers may not exist among immigrant workers (10). Immigrants may have low expectations for their working conditions (e.g., “It could have been worse.”) (11), and thus the scale score may underestimate their harsh working conditions. In addition, immigrants are often aware of their vulnerable standing in the workplace and reluctant to report negative aspects of their jobs (12, 13). These situations would reduce the association between working conditions and health among immigrants.

The demand-control model (14) is a leading theory of job stress in the past several decades. According to the model, jobs with high demands and low control pose higher risk for health (for a review, see 15). The measures of job control and job demands (the Job Content Questionnaire, JCQ) have been translated into many languages (e.g., 16, 17, 18, 19); however, none of the validation studies addressed potential problems related to immigrant status. In this study, we examined scale reliability and factorial invariance of the job

demands and job control scales in immigrants and non-immigrants. We also explored associations of the two scales with perceived job stress and self-rated health status.

## METHODS

### Participants and data collection

The Multi-Ethnic Study of Atherosclerosis (MESA) is a prospective study designed to assess racial/ethnic variations in subclinical cardiovascular disease (for details, see 20). In 2000, six field centers in New York, Maryland, North Carolina, Illinois, Minnesota, and California recruited 6814 community residents, 45-84 years old and free of clinical cardiovascular disease. The participation rate was 60% among the eligible. In the second wave of data collection (2002-04), 3132 respondents (46% of the cohort) were currently working for pay. Of those, 3126 (99.8%) provided complete data on job control and job demands (18).

During their visit to one of the six field centers, the respondents filled out the questionnaire in English, Spanish, or Chinese. If they expressed difficulty reading or completing the questionnaire, or if research staff recognized such problems, the questionnaire was administered by a trained interviewer. Spanish and Chinese users were more likely to need this assistance (53% in each group) than English users (4% among US-born, 11% among foreign-born). In total, 415 participants (13%) required interviewer assistance. The MESA study protocol was approved by the Institutional Review Board in field centers as well as at the National Heart, Lung, and Blood Institute; written informed consent was obtained from each participant.

### Translation of the Questionnaire

Questionnaires were translated into Spanish and Chinese by certified translators. The Spanish version was reviewed by Spanish-speaking field center staff and by a native Spanish-speaking MESA investigator. Final versions were approved by the Hispanic Recruitment Coordinator at Columbia University. The Chinese version was reviewed by native Cantonese- and Mandarin-speaking staff at two field centers where Chinese-American participants were recruited.

### Measures

**Job control and job demands**—Job control was measured with JCQ's original nine items, and job demands with five items (18). Each item had a four-point response scale ("never/almost never" to "often").

**Nativity**—Respondents were asked if they were born in one of the 50 states of the US, Puerto Rico, or another country. Those who were born in Puerto Rico and other countries were categorized as foreign-born. Immigrants were asked the number of years spent in the US. The age of migration was dichotomized to indicate whether or not the respondent had migrated as an adult (> 21 years old). This variable was used as a proxy for pre-migration work experience.

**Race/ethnicity**—All participants were asked to self-identify one of four racial/ethnic groups: non-Hispanic white, Chinese American, non-Hispanic black, or Hispanic.

**Education**—Information on educational attainment (less than 12 years, 12 years or high school equivalent, and more than 12 years) was obtained from the questionnaire.

**Occupation**—Four open-ended questions were asked to determine the respondent's occupation (e.g., "What is your job title?" "What are your main duties on the job?"). Trained coders assigned the 3-digit 2000 US Census Occupation Code to the responses and categorized them into four groups: management/professional, office/sales, service, and blue-collar jobs.

**Perceived job stress**—As part of a chronic stress scale (21), participants were asked if they experience ongoing difficulties with their job; and if they did, they were asked to indicate the level of stressfulness. Responses were dichotomized as no ongoing difficulties or not stressful (0) and moderately/very stressful (1).

**Self-rated health**—A single item, "In general, would you say your health is excellent, very good, good, fair, or poor?", was used to assess self-rated health. Responses were categorized as fair/poor (=1) and excellent/very good/good (=0).

## Data analysis

Of the 3126 respondents with JCQ data, 12 were excluded because of missing data on other variables. The rest (n=3114) were categorized in four according to nativity and language used in data collection: US-born English users (n=2199), foreign-born English users (n=386), foreign-born Spanish users (n=282), and foreign-born Chinese users (n=247).

First, Cronbach's alpha was calculated (22) by nativity-language group, education, and age of migration. This was to explore if internal consistency varied by translated language (23), literacy level (24), or pre-migration work experience (the age of migration as a proxy) (7). Next, we conducted multi-group confirmatory factor analysis (CFA) to examine factorial invariance across nativity-language groups using AMOS 18 (25). For each scale, a one-factor model was specified. We assessed two models: in Model 1, the magnitude of factor loadings were allowed to vary across groups; in Model 2, factor loadings were constrained to be equal across all groups (25).

Model fit was evaluated with Root Mean Squared Error of Approximation (RMSEA), Non-Normed Fit Index (NNFI), and Comparative Fit Index (CFI). General guidelines suggest that RMSEA <0.05 indicates close fit, 0.05 RMSEA<0.08 reasonable fit, 0.08 RMSEA<0.10 acceptable fit, and RMSEA 0.10 unacceptable fit (26). For CFI and NNFI, a value of 0.90 or higher indicates acceptable fit, 0.94 or higher good fit (26). To compare Models 1 and 2, we used the change in CFI ( CFI) (27): CFI 0.01 indicates that two models are equivalent (27); 0.01< CFI 0.02 equivalence can be assumed; CFI>0.02 no equivalence (28).

Construct validity was assessed by associations of job control and job demands with perceived job stress and self-rated health (29). According to the demand-control model (14),

we expected that low job control and high job demands to be associated with moderate/high levels of job stress. The two scale scores were also expected to have significant associations with self-rated health (30, 31, 32, 33, 34). Given a high prevalence of “cases” (reporting “moderately/very stressful” and “fair/poor” health), we estimated prevalence ratios (PRs) using Poisson regression.

## RESULTS

### Demographic Characteristics

The sample included 915 (29%) immigrants (Table 1). A majority (79%) migrated to the US as an adult. Foreign-born English users were less likely to have migrated as an adult (64%) compared to Spanish and Chinese users (83% and 96%, respectively;  $\chi^2=89.2$ ,  $df=2$ ,  $p<0.001$ ). Three-quarters of the sample had more than a high school education, but the proportion was notably lower for foreign-born Spanish users (29%). They also had a smaller proportion of management/professional occupations (11%) than any other nativity-language group (42-54%).

### Scale Reliability

Table 2 presents Cronbach’s alphas for the job control and job demands scales. For all nativity-language groups, job control had an acceptable level of internal consistency (i.e., 0.70)(35), and there were no significant differences across groups. Among the US-born respondents, those with less than 12 years of education had a significantly lower Cronbach’s alpha than those with more than 12 years of education. Within each foreign-born group, there were no significant differences across education levels and age of migration.

In contrast, the job demands scale had an acceptable level of scale reliability only for US-born workers. The differences in alpha coefficients between the US- and foreign-born workers were statistically significant; but among the foreign-born workers, the 95% confidence limits overlapped. Within the nativity-language groups, there was no significant difference in alpha coefficients by education or age of migration.

### Factorial invariance across nativity-language groups

Table 3 shows the goodness-of-fit indices of Models 1 and 2 for the two measures. For the job control scale, RMSEA, NNFI, and CFI all indicated good fit for both models. Moreover, CFI was less than 0.01, indicating factor loadings were equivalent across the four groups.

For the job demands scale, however, the models fit the data less well. When the factor loadings were constrained as equal across the four groups (Model 2), CFI declined by 0.033, indicating non-equivalence across the four groups. As shown in Table 4, “conflicting demands” had a non-significant factor loading among foreign-born English and Spanish users and was significant in the opposite direction among foreign-born Chinese users. The “sufficient time” item had a non-significant factor loading among foreign-born Chinese users. When equality constraints for these two items were removed (Model 3 in Table 3), CFI was 0.012, an acceptable level (28).

### **Construct validity: Associations with perceived job stress and self-rated health**

Table 5 summarizes associations of the two scales with two well-being measures. All analyses were adjusted for age, sex, occupation, and the mode of survey administration (self vs. interviewer). In addition, the US- and foreign-born English models were adjusted for race/ethnicity. All foreign-born models also included the years spent in the US. Among the US-born workers, a one standard deviation increase in the job control score was associated with 19% lower prevalence of reporting moderate/high levels of job stress, and 31% lower prevalence of reporting fair/poor health. The foreign-born respondents, however, had no associations between job control and job stress. Among foreign-born English and Spanish users, high job control was associated with low prevalence of reporting fair/poor health. Foreign-born Chinese users did not have a significant association between job control and either of the well-being measures.

The job demands scores were associated with job stress in all groups except for foreign-born Spanish users. In contrast, the job demands scores were not associated with self-rated health in any of the four groups. Calculating the job demands score with three items (excluding “conflicting demands” and “sufficient time”) resulted in identical patterns of associations.

## **DISCUSSION**

This study examined the psychometric properties of two commonly used job stress measures among US- and foreign-born workers in three languages. The job control scale had both high internal consistency and factorial invariance across all groups. The job demands scale, however, had low Cronbach’s alpha among immigrants. The factor loadings were also not equivalent across four groups. The associations with two relevant constructs (perceived job stress, self-rated health status) did not consistently demonstrate expected patterns among foreign-born workers.

### **Low internal consistency for the job demands scale among immigrants**

While the job control scale had an excellent alpha coefficient in all groups, for the job demands scale, all immigrant groups had low alpha coefficients. Notably, the low alpha coefficients were not attributable to language used, education level, or age of migration. The CFA results revealed two items (“sufficient time” and “conflicting demands”) as the source of low internal consistency. While eliminating problem items to improve reliability is a realistic compromise, it also narrows the scope of the construct. This may result in missing some important aspects of work experience.

Differences in reliability between US- and foreign-born workers suggest that the concept of job demands may need to be expanded so that it would apply to both native and immigrant workers. Qualitative studies on immigrant workers’ job stress inform the effort to capture job demands experienced by them. For example, de Castro et al. (13) documented that work schedule problems such as long hours, undesirable shifts, and frequent shift changes are common complaints from immigrant workers in various occupations. Including work schedule issues in the concept of job demand may be a fruitful direction for future research.

## Construct validity

Since our findings for US-born workers are consistent with previous studies (15, 36), we consider that the two scales have acceptable construct validity for the US-born workers in our sample. Among the immigrants, however, the two scales' associations with two well-being measures were not consistent. One might attribute the different associations between native and immigrant workers to the different types of jobs they tend to have. In our study, however, this alternative explanation is unlikely because the proportions of the four occupational categories were similar across groups except for foreign-born Spanish users, and the regression analyses were adjusted for occupation.

Qualitative studies have reported that immigrant workers' priority is to maintain employment and that working conditions, including job control, were of secondary concern (12, 13, 37). Lack of control can make a job stressful when one expects to have control. Immigrants, who realize their outsider position (3, 12, 13), may not expect to have much control over work (38). Consequently, the level of control may not be relevant when they assess the level of job stress. Future studies should investigate how immigrant workers' expectations regarding work experience in the country of settlement play a role in their perceptions of job stressors and well-being.

Although job control was not associated with perceived job stress, it had a significant association with self-rated health status among foreign-born English and Spanish groups. The different associations of job control with perceived job stress and general health suggest that multiple mechanisms may link job control to health. Even though self-rated health has predictive validity for mortality and morbidity (39, 40), more objective measures of specific health conditions (e.g., hypertension, cardiovascular disease) should be examined in relation to job control among immigrants.

## Strengths and limitations of the study

This study took advantage of the available data collected from a diverse group of current workers, representing four racial/ethnic groups, both native and immigrant workers, and a full spectrum of occupations. This study used all of the original items of the JCQ's job control and job demands scales. The large sample size allowed us to explore the scales' psychometric properties within various subgroups.

There are also several caveats. MESA was not designed to be a nationally representative sample of US- and foreign-born workers. Given the high proportion of managers and professionals, the generalizability of the findings may be limited. About half of Spanish and Chinese users provided data in an interviewer-administered questionnaire, which might have introduced interviewer bias even though all interviewers were trained to follow a strict study protocol. One particular concern for interviewer-administered survey is social desirability bias, which could spuriously inflate internal consistency. In our data, however, Cronbach's alpha was not significantly different between the self- and interviewer-administered groups. As a sensitivity analysis, we conducted CFA without interviewer-administered data. The results were virtually identical. Finally, when constructs used for validity testing are also self-report, as was the case with this study, there is ambiguity as to which measure is

responsible for a lack of association (29). Future studies with explicit focus on immigrant workers' job stress should use objective health measures to help establish the validity of JCQ among immigrants.

## Conclusion

Because many immigrants come to the US for employment, workplace experience is likely to have strong impacts on their health and well-being. Yet immigrants' experience of work stress has been an understudied topic. This study contributes to the growing literature by examining the usefulness of the JCQ measures among immigrants. We found that the use of different languages, education level, or age of migration does not influence scale reliability; however, US- and foreign-born workers assessed job demands in different ways, and had different associations of job characteristics with well-being. For a better understanding of immigrants' job stress, we should explore alternative ways of measuring job demands that captures both immigrant and native workers' experiences. In addition, expectations for workplace experience may be a key concept for understanding immigrants' job stress.

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Table 1

Characteristics of the sample by nativity and language used in data collection.

Characteristic	U.S.-born		Foreign-born (n=915) <sup>a</sup>			Total (n=3114)
	English (n=2199)	English (n=386)	Spanish (n=282)	Chinese (n=247)	Total (n=3114)	
Mean age in years (SD)	58.7 (8.4)	56.4 (7.6)	56.9 (7.5)	57.1 (7.1)	58.1 (8.2)	
Male, n (%)	1146 (52.1%)	196 (50.8%)	158 (56.0%)	141 (57.1%)	1641 (52.7%)	
Age of migration, 21 years old, n (%)	--	200 (63.5%)	206 (83.4%)	220 (96.1%)	626 (79.1%)	
Mean years spent in the US (SD)	--	31.3 (12.6)	23.6 (12.2)	18.1 (10.2)	27.1 (15.1)	
Race/ethnicity						
White, n (%)	1229 (55.9%)	83 (21.5%)	1 (0.4%)	0 (0.0%)	1313 (42.2%)	
Black, n (%)	748 (34.0%)	103 (26.7%)	0 (0.0%)	0 (0.0%)	851 (27.3%)	
Hispanic, n (%)	208 (9.5%)	126 (32.6%)	281 (99.6%)	0 (0.0%)	615 (19.7%)	
Chinese, n (%)	14 (0.6%)	74 (19.2%)	0 (0.0%)	247 (100.0%)	335 (10.8%)	
Education						
<12 years, n (%)	86 (3.9%)	30 (7.8%)	152 (53.9%)	45 (18.2%)	313 (10.1%)	
12 years or high school equivalent, n (%)	302 (13.7%)	51 (13.2%)	47 (16.7%)	49 (19.8%)	449 (14.4%)	
>12 years, n (%)	1811 (82.4%)	305 (79.0%)	83 (29.4%)	153 (61.9%)	2352 (75.5%)	
Occupation						
Management/Professional, n (%)	1169 (54.2%)	193 (50.9%)	32 (11.9%)	99 (41.6%)	1493 (49.1%)	
Sales/Office, n (%)	488 (22.6%)	70 (18.5%)	33 (12.3%)	50 (21.0%)	641 (21.1%)	
Service, n (%)	223 (10.3%)	71 (18.7%)	119 (44.4%)	42 (17.6%)	455 (15.0%)	
Blue-collar, n (%)	277 (12.8%)	45 (11.9%)	84 (31.3%)	47 (19.7%)	453 (14.9%)	
Job moderately or very stressful, n (%)	407 (18.6%)	74 (19.2%)	22 (7.8%)	25 (10.1%)	528 (17.0%)	
Self-rated health, Fair/poor, n (%)	141 (6.4%)	38 (9.8%)	49 (17.4%)	77 (31.2%)	305 (9.8%)	

<sup>a</sup> Foreign-born includes those who were born in Puerto Rico.

**Table 2**

Cronbach’s alpha and 95% confidence limits (95%CL) for job control, job demands for four nativity-language groups by education and the age of migration.

Scale	US-born		Foreign-born			
	English	English	English	Spanish	Chinese	Chinese
<b>Job control</b>	<b>Alpha</b>	<b>(95% CL)</b>	<b>Alpha</b>	<b>(95% CL)</b>	<b>Alpha</b>	<b>(95% CL)</b>
All	0.82	(0.81, 0.83)	0.79	(0.75, 0.82)	0.79	(0.76, 0.83)
Education						
<12 years	0.69	(0.60, 0.78)	0.71	(0.56, 0.86)	0.79	(0.74, 0.84)
12 years, or high school equivalent	0.76	(0.72, 0.80)	0.65	(0.51, 0.79)	0.76	(0.66, 0.86)
>12 years	0.82	(0.81, 0.84)	0.81	(0.77, 0.84)	0.77	(0.70, 0.84)
Age of migration						
<21 years old	--	---	0.78	(0.73, 0.82)	0.75	(0.67, 0.83)
21 years old	--	---	0.79	(0.75, 0.84)	0.81	(0.77, 0.85)
<b>Job demands</b>	<b>Alpha</b>	<b>(95% CL)</b>	<b>Alpha</b>	<b>(95% CL)</b>	<b>Alpha</b>	<b>(95% CL)</b>
All	0.75	(0.73, 0.76)	0.57	(0.50, 0.63)	0.65	(0.58, 0.71)
Education						
<12 years	0.68	(0.58, 0.79)	0.40	(0.06, 0.74)	0.64	(0.54, 0.73)
12 years or high school equivalent	0.70	(0.65, 0.76)	0.58	(0.40, 0.76)	0.55	(0.35, 0.75)
>12 years	0.75	(0.74, 0.77)	0.58	(0.50, 0.65)	0.71	(0.61, 0.81)
Age of migration						
<21 years old	--	---	0.57	(0.47, 0.66)	0.52	(0.35, 0.70)
21 years old	--	---	0.57	(0.47, 0.66)	0.68	(0.61, 0.75)

**Table 3**

Chi-square values and other goodness of fit indices for measurement invariance models across four nativity-language groups.

Model	$\chi^2$	<i>df</i>	RMSEA	NNFI	CFI	CFI
Job control						
Model 1: Unconstrained	611.024	100	0.038	0.928	0.942	--
Model 2: Factor loading constrained	656.782	121	0.041	0.917	0.939	0.003
Job demands						
Model 1: Unconstrained	188.824	16	0.059	0.878	0.951	--
Model 2: Factor loading constrained	318.672	28	0.058	0.883	0.918	0.033
Model 3: Factor loading partially	238.858	22	0.056	0.888	0.939	0.012

constrained

Notes: In unconstrained models (Model 1), the magnitude of factor loadings was free to vary across the four nativity-language groups. Factor loading constrained models (Model 2) assumed equal factor loadings across all groups. CFI represents the difference between unconstrained and more constrained models. Model 3 for job demands allowed two of the five factor loadings to be unconstrained.

**Table 4**

Factor loadings of job demand items by nativity-language group.

Item	US-born		Foreign-born					
	English users (n=2193)		English users (n=386)		Spanish users (n=280)		Chinese users (n=287)	
	Factor loading	p	Factor loading	p	Factor loading	p	Factor loading	p
Work fast	1.000		1.000		1.000		1.000	
Work hard	1.222	<0.001	1.024	<0.001	1.154	<0.001	1.011	<0.001
Excessive amount of work	1.322	<0.001	1.117	<0.001	0.766	<0.001	0.677	<0.001
Sufficient time	0.595	<0.001	0.278	<0.001	0.189	0.001	0.131	0.062
Conflicting demands	0.514	<0.001	0.003	0.976	0.113	0.132	-0.316	0.003

Table 5

Prevalence ratios (PRs) of reporting perceived job stress and fair/poor self-rated health associated with a 1 standard deviation change in Job control and job demands

Well-being measure	US-born		Foreign-born					
	English users (n=2193)	PR (95% CL)	English users (n=386)	PR (95% CL)	Spanish users (n=280)	PR (95% CL)	Chinese users (n=287)	PR (95% CL)
Job control								
Job stress (moderately/very stressful)	0.81	(0.72, 0.91)	1.02	(0.73, 1.42)	1.26	(0.75, 2.13)	0.70	(0.41, 1.21)
Self-rated health (fair/poor)	0.69	(0.57, 0.83)	0.50	(0.32, 0.80)	0.77	(0.57, 0.97)	1.15	(0.85, 1.54)
Job demands (5 items)								
Job stress (moderately/very stressful)	1.32	(1.18, 1.46)	1.68	(1.20, 2.36)	0.98	(0.61, 1.56)	2.08	(1.19, 3.63)
Self-rated health (fair/poor)	1.10	(0.92, 1.30)	1.11	(0.70, 1.77)	0.97	(0.73, 1.29)	1.03	(0.77, 1.38)
Job demands (3 items)								
Job stress (moderately/very stressful)	1.26	(1.13, 1.41)	1.58	(1.12, 2.22)	0.93	(0.61, 1.42)	1.84	(1.10, 3.09)
Self-rated health (fair/poor)	1.07	(0.90, 1.28)	1.02	(0.66, 1.59)	0.96	(0.74, 1.26)	1.01	(0.77, 1.31)

Notes: Adjusted prevalence ratios associated with 1 standard deviation increase of each of the independent variables are reported. Separate models were fit to the data for each of the four nativity-language groups. Job control and job demands were included in the models separately. All models were adjusted for age, sex, education, and occupation. Foreign-born models were also adjusted for years in the US and the age of migration. In addition, the US- and foreign-born English models were adjusted for race/ethnicity.