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Validation of Alternative Formulations of Job Strain

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Abstract: Validation of Alternative Formulations of Job Strain: Delphine S. Courvoisier, *et al.* Clinical Epidemiology Division, Geneva University Hospitals and Faculty of Medicine, University of Geneva, Switzerland—Objective: To examine the construct validity of different formulations of job strain based on the demand-control(-support) model in the context of a hospital-based survey. **Methods:** We defined the best measure of job strain as the one that would be better predicted by professional status and job characteristics and better predict health outcomes, stress and back-pain leave. We received 1,298 responses from collaborators at the University Hospitals of Geneva who responded to a questionnaire survey including all the constructs cited above and the Job Content Questionnaire. **Results:** The difference between decision latitude and psychological demands (strain by subtraction), corresponded to the definition of the best measure of job strain and significantly, albeit weakly, predicted all outcomes. The logarithmic approach was the second best measure of job strain and was in fact a better predictor of stress. **Conclusions:** We would encourage researchers to explore different formulations of job strain, in particular the subtraction approach, to compute strain from demands and decision latitude.
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Key words: Construct validity, Job Content Questionnaire, Job strain, Karasek

Karasek and Thorell's "job strain" model[1–3] is one of the most influential models of the health effects of work-related stress. According to the original model, job strain is highest among workers who are faced with high work-load demands and low job-decision latitude[2] (demand-control model). A later model also includes social support as a moderator of the effect of demand and control on job strain[4]. Valid measures of job strain are needed for research and prevention purposes.

The Job Content Questionnaire[4] (JCQ) is the most used scale to assess job strain. Its internal validity has been studied in a wide variety of work settings and in many countries (for a review of these studies[1]). However, these studies did not validate a global job strain scale but rather various subscales of the JCQ[5–10]. Indeed, there are no definitive guidelines on how to compute a unique job strain score from the subscales scores. Despite the lack of guidelines, most studies of job strain use some composite score of demand, control, and support as a measure of job strain.

This situation has led to several operationalizations of job strain[11, 12]. The most common procedure is the *quadrant approach*. The demand and control scales are divided at the median and job strain corresponds to above median demand and below median autonomy. When the support scale is included, iso-strain (i.e., isolated strain) is defined as job strain and below median support. The *quotient approach* divides demand by control, thereby creating a continuous variable. The *logarithm approach* takes the logarithm of the quotient. The *subtraction approach* creates a continuous variable by computing demand minus control. For the quotient, logarithm, and the subtraction approaches, the inclusion of the support scale is mostly done by adding support as an additional predictor. The *total approach* includes the main effects and interactions of all dimensions of the demand-control-support model as predictors of an external outcome variable. This approach could be considered as a gold standard since no information is lost by dichotomizing and combining dimension scores. The quotient, logarithm, subtraction and total computations presented above assume that the relationship between job strain or components of job strain and the outcomes are linear. The *quantile approach* has been developed to verify if this assumption is appropriate. Demand, control and support are divided into quantiles (e.g. quartiles or

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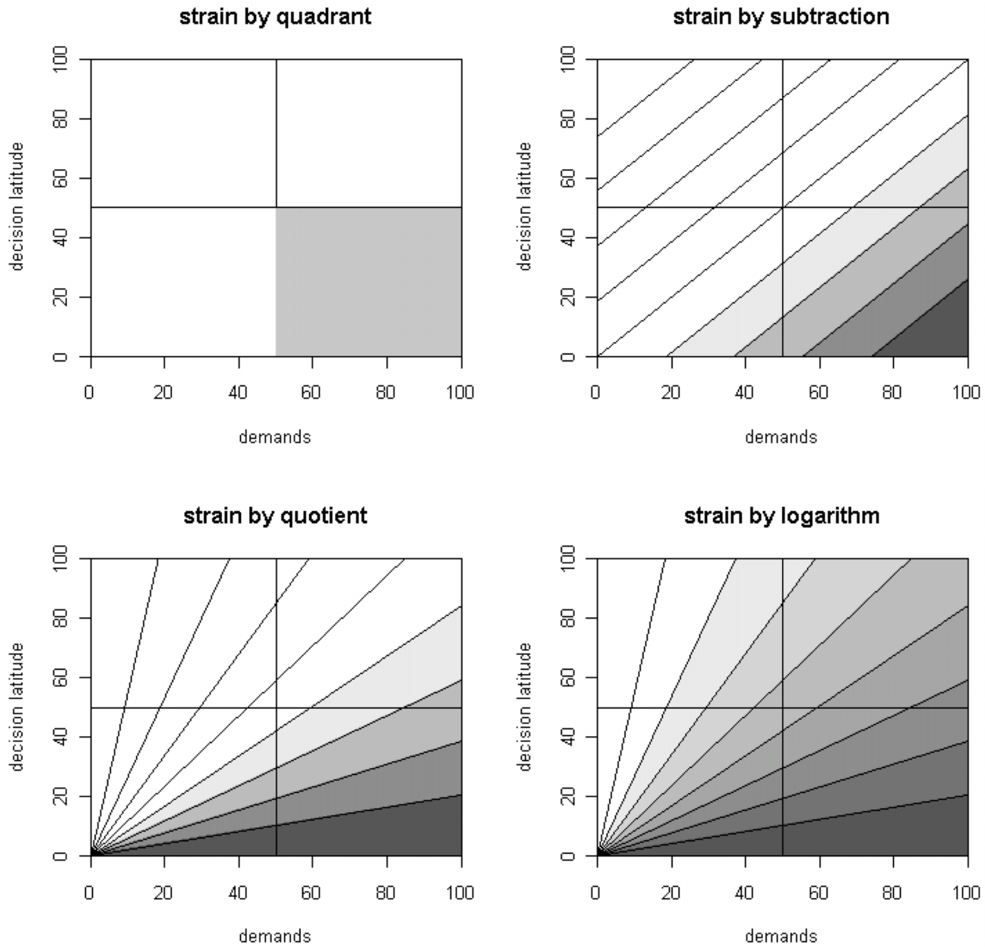

Fig. 1. Alternative formulation of job strain.

quintiles). Patterns of outcomes are then examined across the resulting cells. Currently little evidence is available to establish which one of these approaches is superior to the others.

It is important to note that, depending on how job strain is computed, its interpretation differs. Fig. 1 presents strain levels by latitude and demands. With the quadrant approach (top left panel of Fig. 1), job strain is either present or absent and will be considered present only if both conditions (i.e. high demands and low latitude) are met. Moreover, the cutoff of demands and latitude will depend on the sample or on national values. With the subtraction, quotient, and logarithmic approaches, job strain has more gradations and can be considered as already high even if demands are low or latitude is high. The main difference between these three approaches is that job strain by subtraction is composed equally of demands and latitude (top right panel of Fig. 1). Thus, decreasing demands by one point or increasing latitude by one point will have the same effect on strain. On the contrary, strain by quotient (bottom left panel of Fig. 1) or by logarithm (bottom right panel of Fig. 1) can more easily be decreased by increasing latitude when demands are high (above 50) and by decreasing demands when demands are already low (below 50). The main difference between strain by quotient and strain by logarithm is that taking the logarithm of the quotient places imbalances of the same order (for example 0.5 and 2) the same distance from 1 (when control and demands are equal). Moreover, large discrepancy between demands and control are less distant from small discrepancy with the logarithmic approach than with the quotient approach (as indicated in the bottom right panel of Fig. 1 by a slower darkening of the areas). Since the different approaches will yield different measures of job strain, it is important to determine which strain formulation is the most appropriate.

Most studies have examined the impact of job strain on mental health[13–20] or on various outcomes related to cardiovascular disease (CVD)[21–26]. Most have focused on one main outcome. Very few studies have examined the construct validity of alternative formulations of job strain, and these studies disagree on which formulation is the best. While some conclude that the impact of job strain is consistent across formulations of job strain[11, 12], others find that tertile cutoffs better predict various mental health outcomes and sickness leave[27–29]; and another study finds that the logarithmic approach is a better predictor than tertile cutoffs[30]. However, none of these studies compared all the above mentioned approaches.

In this study, we tested the construct validity of several formulations of job strain as measured by the JCQ in the context of a hospital-based survey. We first examined which formulation of job strain was best determined by job characteristics. We then assessed which formulation was the best predictor of several outcomes: physical and mental health, sickness leave for back pain, and self-perceived work-related stress. Based on this construct validation, we define the best measure of job strain as the one that is best predicted by job characteristics, and the one that better predicts the outcomes.

Methods

Participants

After institutional (University Hospitals of Geneva) ethics approval, participants were recruited in 2006 from among the staff of University Hospitals of Geneva, in Geneva, Switzerland. The questionnaires, in the French language, were sent to the home addresses of 2,700 persons, 450 per professional group (medical doctors, nurses, nursing assistants, technical staff, administrative staff, and other health professionals). After two reminders, 1,298 persons had answered (48% response rate); the response rate was 44.2% for medical doctors, 58.4% for nurses, 37.1% for nursing assistants, 44.7% for technical staff, 43.6% for administrative staff, and 47.3% for other health professionals. The median age of the participants was between 41 and 50 yr and about two thirds (65.9%) were female. Of the 1,298 respondents, 16% were medical doctors, 20.8% were nurses, 13.4% were nursing assistants, 17.1% were other health professionals, 15.9% were technical staff, and 15.9% were administrative staff. Among the participants, 20.2% had supervisor responsibilities and 79.8% did not.

Questionnaires

The survey included several questionnaires measuring socio-demographic status, stress, health, back pain, job characteristics, and job strain.

1) Job Content Questionnaire (JCQ)

Job strain was measured by the 31-item Job Content Questionnaire[2]. Response categories were presented on a 4-level Likert-type scale (‘totally disagree’, ‘disagree’, ‘agree’, ‘totally agree’). The JCQ can measure up to 6 subscales. The control dimension is called “decision latitude” (9 items) and comprises “skill discretion” (i.e. the ability to work in an independent manner; 6 items) and “decision authority” (i.e. the possibility to make decisions; 3 items). The demand dimension is called “job demands” (14 items) and comprises psychological (9 items) and physical (5 items) demands. Finally, the support dimension (8 items) is composed of supervisor (4 items) and coworker (4 items) support.

2) Socio-professional status

Respondents’ socio-professional status was assessed by job category, supervisor status, age and gender. There were six job categories: medical doctor, nurse, nursing assistant, administrative staff (e.g. secretary, human resources staff), technical staff (e.g. architect, cook, cleaning staff, information technology staff), and other health professionals (e.g. chemist, biologist, physiotherapist, social worker). Supervisor status was coded as one if the respondent directed collaborators or otherwise as zero.

3) Job characteristics

Respondents evaluated the frequency of eight job characteristics in their work: working on a computer, carrying loads, handling of patients, positions maintained for a long time, poorly adapted work station, pushing or pulling loads, night work, working more than 8 hours per work day. Frequency was assessed on a 4-point scale: never, sometimes, often, and very often. The job characteristics were dichotomized by collapsing the first two and the last two categories.

4) Outcomes

Respondents were asked to evaluate their work-related stress on a zero- to ten-point numerical scale. Physical and mental health were assessed by the French version of SF-36[31]. Health was also assessed by a single self-reported question: “In general, do you think you health is: 1) poor, 2) fair, 3) good, 4) very good, 5) excellent”. Finally, sickness leave due to back pain during the last year was assessed by self-report. Answers were dichotomized as either no leave or at least one day of leave.

Analyses

First, we verified the factorial structure of the JCQ using exploratory factor analysis appropriate for an ordinal response scale (Weighted Least Square Mean-and Variance-Adjusted estimator, WLSMV)[32]. Factors were allowed to correlate. Based on the results of this analysis and on the demand-control-support model, we derived a standardized score (between 0 and 100) for each dimension of the questionnaire. In a second step, we computed job strain scores according to each approach: quadrant, quotient, logarithmic, subtraction, and quantile. To test the demand-control and the demand-control-support models, for each approach, we obtained one score with support and one without. For readability, all continuous scores were then rescaled so that minimum strain equaled 0 and maximum strain equaled 100.

Approach	With support	Without support
Subtraction	$DL - Dpsy + \frac{Ssup + Scol}{2}$	$DL - Dpsy$
Quotient	$\frac{DL}{Dpsy} \times \frac{Ssup + Scol}{2}$	$\frac{DL}{Dpsy}$
Logarithmic	$\log\left(\frac{DL}{Dpsy} \times \frac{Ssup + Scol}{2}\right)$	$\log\left(\frac{DL}{Dpsy}\right)$
Quadrant	Strain = 1, if $DL < \text{med}(DL)$ & $\frac{Ssup + Scol}{2} < \text{med}\left(\frac{Ssup + Scol}{2}\right)$ & $Dpsy > \text{med}\ Dpsy$; Strain = 0, otherwise	Strain = 1, if $DL < \text{med}(DL)$ & $Dpsy > \text{med}\ Dpsy$; Strain = 0, otherwise

where *DL* is decision latitude, *Ssup* is supervisor support, *Scol* is coworker support, *Dpsy* is psychological demands, and med( ) is the median of the variable in parentheses.

Before assessing construct validity, we examined whether the relationships between measures of job strain derived from the JCQ and the validation outcomes were linear using graphical analyses. To determine if the continuous job strain scores had a linear relationship with all continuous outcomes, we plotted each strain score against each outcome. We then used loess curves (based on local non-parametric regression) to help decide if the relationship was linear. For back pain leave (dichotomous outcome), we inspected the proportion of respondents with leave for each quintile of each strain score.

Construct validity was examined using two methods. First, we examined whether the socio-professional and job characteristics were associated with strain by logistic regression (for the quadrant approach) or linear regression (for the other approaches). Job strain should be significantly related to job characteristics, since the JCQ aims at capturing strain caused by work characteristics and environment. The second method was to examine the relationships between each formulation of job strain and the outcomes, using logistic regression (for back pain leave) and linear regression (for mental and physical health as well as stress). The effect sizes were estimated by the Nagelkerke method for logistic regressions. Based on the effect size of each formulation on the outcomes, we then proposed guidelines on the best way to compute job strain as measured by the JCQ.

Results

Factor analysis

WLSMV factor analysis of the 31 items of the JCQ scale shows that, based on the eigenvalues and the scree plot, a model with six factors was the best model for either sex and professional subgroup (details not shown, available from the first author). The factor structure of the JCQ was equivalent across sex and supervisor status. We did not try to estimate models with more than six factors because they are not theoretically meaningful. However, for each sex and job description, the last factor explained less than 5% of the common variance. Moreover, the eigenvalues of the sixth factor were very close to one and only two items (awkward body position and awkward arm position) had significant loadings on that factor. Thus, a five-factor solution was retained. The order of the factors was stable across groups: the first factor is decision latitude, the second is physical demands, the third is psychological demands, the fourth was supervisor support and the fifth was coworker support. All items loaded highly on their factor (>0.40 for decision latitude except for one loading at 0.36, >0.70 for physical demands, >0.40 for psychological demands except for one loading at 0.34, >0.75 for both supports) and low on the other factors (<0.40 for all dimensions). Correlations between factors were low, with all correlations below 0.30 except the correlations between decision latitude and both supports as well as the correlations between coworker and supervisor support.

Dimensions of the JCQ

Based on the results of the factor analysis, we computed scores for five dimensions. Table 1 presents the mean, standard deviation and Cronbach's alpha of each dimension. All dimensions had good reliability. Decision latitude and supports were generally high and physical demands were low. Physical demands and supervisor support had a greater variance than the other scales.

Job strain scores

Graphical analysis of the relationships between job strain and the outcomes showed that the linearity assumption was respected (data not shown). Therefore, the best formulation of job strain could be determined by using the effect sizes of the regressions of the outcomes on job strain scores.

Best measure of job strain

Table 2 presents the percentage of variance of each formulation of job strain, computed either with or without the consideration of support, explained by job characteristics. Table 3 presents the percentage of variance of each outcome explained by each formulation of job strain. Based on these results, the subtraction

Table 1. Means (standard deviations) of the JCQ dimensions by sex and professional group, and Cronbach's alpha

		Decision latitude	Physical demands	Psychological demands	Supervisor support	Coworker support
Whole sample		67.09 (15.33)	38.29 (26.33)	53.18 (15.71)	61.46 (21.36)	71.33 (15.83)
Sex	Female	66.45 (14.77)	37.69 (25.87)	53.28 (15.67)	61.43 (21.07)	71.50 (15.51)
	Male	69.12 (16.26)	37.28 (25.87)	53.44 (15.88)	62.08 (21.46)	70.69 (15.81)
Profession	Nurse	69.09 (12.09)	49.89 (23.49)	57.53 (15.32)	58.75 (19.87)	72.27 (14.50)
	Nurse assistant	58.79 (13.06)	57.60 (20.22)	50.00 (14.62)	65.14 (23.54)	72.76 (15.52)
	Doctor	76.36 (11.10)	26.84 (21.08)	61.03 (13.90)	61.04 (18.02)	71.71 (13.76)
	Other health professionals	71.47 (14.44)	30.07 (23.07)	49.38 (14.78)	59.90 (22.59)	71.73 (15.26)
	Logistics	60.65 (18.29)	45.14 (25.65)	46.85 (15.15)	65.43 (20.72)	69.22 (17.04)
	Administration	63.21 (15.02)	19.46 (19.13)	52.76 (15.69)	61.97 (22.55)	69.86 (17.54)
Reliability		0.80	0.77	0.88	0.88	0.85

Table 2. Percentage of variance of each formulation of strain, computed either with or without including support, explained by job characteristics (working on a computer, carrying loads, handling of patients, positions maintained for a long time, poorly adapted work station, pushing or pulling loads, night work, working more than 8 h per work day)

	Approach used to compute job strain from decision latitude, demands, and support			
	Subtraction	Quotient	Logarithm	Quadrant
Support included	12.4	1.3	11.4	8.2
Support not included	18.1	1.4	13.1	9.5

Table 3. Percentage of variance of each outcome explained by each formulation of strain

Outcomes	Strain with support				
	Subtraction	Quotient	Logarithmic	Quadrant	All dimensions independent
Back ache leave	1.8	0.1	1.5	0.0	7.5
Health (one item)	3.7	0.0	2.8	1.2	7.8
Physical health	2.1	0.0	1.3	2.7	7.9
Mental health	11.0	1.4	10.2	4.7	12.9
Stress	9.4	0.1	10.5	4.8	29.6
	Strain without support				
	Subtraction	Quotient	Logarithmic	Quadrant	All dimensions independent
Back ache leave	1.5	0.1	1.2	0.1	5.8
Health (one item)	2.6	0.0	1.6	1.6	7.7
Physical health	2.0	0.0	0.1	0.1	8.0
Mental health	9.2	1.4	7.5	5.0	11.3
Stress	11.4	0.1	12.2	5.3	28.8

Table 4. Mean (SD) strain by socio-professional status and job characteristics considered separately (univariate analysis) or together (multivariate analysis)

Socio-professional status	Modalities	Univariate	p	Multivariate by type of determinants	p	Multivariate	p
Sex	F	43.21 (10.25)	<0.05	41.90	0.48	45.22	0.51
	H	42.01 (10.92)		41.39		44.75	
Age	<30 yr	45.05 (09.58)	0.02	43.33	0.11	45.48	0.69
	31–40 yr	43.48 (09.50)		42.35		45.59	
	41–50 yr	42.22 (11.23)		41.10		45.27	
	51–60 yr	42.39 (10.67)		41.99		45.49	
	>60 yr	38.87 (11.15)		39.46		43.12	
Supervisor	Yes	39.43 (09.08)	<0.01	39.58	<0.01	43.33	<0.01
	No	43.74 (10.64)		43.71		46.64	
Profession	Nurse	44.08 (09.75)	<0.01	42.11	<0.01	44.30	<0.01
	Nurse assistant	45.31 (11.48)		43.26		45.92	
	Doctor	42.26 (09.27)		42.17		44.94	
	Other health professionals	38.93 (10.09)		37.27		42.31	
	Logistics	42.49 (11.69)		41.87		45.05	
	Administration	44.73 (10.13)		43.19		47.40	
Job characteristics	Frequency						
Working on a computer	Low	42.48 (11.25)	0.94	46.57	0.22	44.55	0.23
	High	43.00 (10.09)		43.62		45.42	
Carrying loads	Low	41.39 (09.84)	<0.01	40.95	<0.01	42.95	<0.01
	High	47.25 (11.11)		49.23		47.03	
Handling of patients	Low	42.02 (10.32)	<0.01	44.70	0.10	45.68	0.14
	High	44.77 (10.60)		45.49		44.30	
Position maintained for a long time	Low	40.91 (10.23)	<0.01	43.25	<0.01	43.79	<0.01
	High	45.35 (10.27)		46.93		46.19	
Poorly adapted work station	Low	41.38 (10.05)	<0.01	42.44	<0.01	42.61	<0.01
	High	48.54 (10.19)		47.75		47.37	
Pushing or pulling loads	Low	41.53 (10.09)	<0.01	42.72	<0.01	43.92	0.03
	High	47.33 (10.56)		47.47		46.05	
Working more than 8 h per day	Low	42.14 (10.59)	0.03	46.70	0.82	44.12	0.03
	High	43.97 (10.19)		43.49		45.85	
Night work	Low	41.92 (10.55)	<0.01	43.16	<0.01	44.07	0.03
	High	45.69 (09.72)		47.03		45.90	

approach, with or without support, was the best measure of job strain. Both measures were the most highly related to job characteristics and the best predictors of all outcomes, except stress. Adding support to the measure of job strain did not much increase predicted variance, except for mental health. In fact, the percentage of explained variance of stress was even higher when job strain was computed without support. Thus, we retained the subtraction approach without support as the best summary measure of job strain. The logarithmic approach was the second best measure of job strain and was in fact a better predictor of stress.

Construct validity of the best measure of job strain

Strain as computed by the subtraction approach without support had a mean of 43.05 and a standard deviation of 10.50. A value of zero represents no strain (high decision latitude and low psychological demands) and a value of 100 represents the highest possible strain.

1) Strain and socio-professional status and job characteristics

Taken together, socio- professional variables and job characteristics explained 18.2% of job strain. However, socio-professional variables alone explained only 6.5% of strain, while job characteristics explained 15.4%. Thus, if information on job characteristics is available, it is not necessary to have additional information on socio-professional status. Table 4 presents job strain means by socio-professional status and job characteristics considered separately (univariate analysis) or together (multivariate analysis). In the multivariate analysis, all

Table 5. Coefficients and effect sizes of the regression of each outcome on strain

Outcomes	Coefficient	*p*	% variance only strain	% variance strain entered after job characteristics
Back ache leave	0.03 (OR: 1.03)	0.002	1.5	0.3
Health*	–0.16	<0.001	2.6	1.6
Physical health	–0.15	<0.001	2.0	0.4
Mental health	–0.31	<0.001	9.2	8.8
Stress	0.34	<0.001	11.4	8.2

*: 1) poor, 2) fair, 3) good, 4) very good, 5) excellent.

Table 6. Proportion of back ache leave and mean (standard deviation) of each of the other outcomes by quantile of strain

	Quintiles of strain					*p* value for
Outcomes	1	2	3	4	5	linear trend
Back ache leave	2.9%	9.4%	15.1%	21.1%	25.0%	<0.001
Health*	2.70	2.69	2.36	2.18	2.05	<0.001
	(0.98)	(0.82)	(0.75)	(0.77)	(0.81)	
Physical health	54.49	53.43	50.82	47.19	46.66	<0.001
	(5.79)	(6.99)	(8.80)	(10.09)	(8.05)	
Mental health	51.60	48.11	45.42	44.90	40.74	<0.001
	(8.56)	(9.09)	(10.49)	(11.86)	(15.41)	
Stress	4.88	5.15	5.72	6.06	6.25	<0.001
	(1.99)	(2.29)	(2.23)	(2.22)	(2.50)	

*: 1) poor, 2) fair, 3) good, 4) very good, 5) excellent.

job characteristics except working on a computer, patients' handling and working more than 8 h per day had a significant influence on job strain. Moreover, with respect to socio-professional status, only job-related variables (profession and supervisor status) predicted strain.

2) Strain and health outcome

Table 5 presents the regression coefficients and the effect sizes of the regression of the outcomes on strain. Strain significantly, albeit weakly, influenced all outcomes. For example, an increase of one standard deviation in strain (10.50) was associated with a decrease in mental health by 3.08 points (the standard deviation of mental health was 9.92: $-0.31 \times 9.92 = -3.08$). The percentage of variance explained, when strain was entered after job characteristics, shows that job strain does not predict back pain leave and physical health better than job characteristics. However, job strain remained a good predictor for self-rated health, mental health and stress. Finally, Table 6 presents the proportion of back pain leave and the mean and standard deviation of each of the other outcomes by quantile of strain.

Discussion

We examined the construct validity of different formulations of job strain as measured by the JCQ. As could be expected, the factor structure of the JCQ found in this study was similar to the structure found in other studies[10, 33, 34], and each dimension score showed good reliability. The associations between all formulations of strain and outcomes did not show any threshold effect; strain had a linear relationship with health outcomes. We defined the best measure of strain as the one that would be best predicted by socio-professional status and job characteristics, and that would best predict health status, stress and back-pain leave. Based on this definition, the best measure was the difference between decision latitude and psychological demands (strain by subtraction). Support was not included in this measure because it did not much improve the relationships between the health outcomes and strain, and even decreased the variance in job strain explained by job characteristics. This does not necessarily mean that support is irrelevant for individuals, but rather that support did not vary substantially across job characteristics in the setting of this study, and that it was not sufficiently related to the health outcomes to justify inclusion in the strain equation.

As discussed in the introduction, strain by subtraction is equally sensitive to a decrease of demands or an increase in latitude. Interventions aiming at reducing strain can thus target both dimensions equally. Our results are similar to those reported in several studies that compared alternative formulations of strain[11, 27, 29, 30], which showed that all formulations predicted the outcomes. In particular, one study[27], that also used effect sizes to compare the different strain formulations, found that tertile and linear formulations were the best, and almost equivalent, predictors of carotid intima-media thickness.

This study showed that the most common definition of strain (the quadrant approach), that is when strain is defined as below-median decision latitude and above-median demands, is not the most appropriate. However, it is important to note that using each dimension of the JCQ as a separate variable, with or without support, yields much more information (e.g. has higher explained variance) for all outcomes. The difference in explained variance is especially high for self-reported stress at work. Clearly, job strain as defined in the Karasek model and work stress as understood by the respondents are different constructs. In studies of self-perceived work stress, the original dimensions of strain should be kept separate.

The best measure of strain significantly, albeit weakly, predicted all health-related outcomes. Even though the effect sizes were relatively low, the changes in health status, back pain leave or stress were substantial. For example, while only 2.9% of respondents reporting low strain had taken at least one day off during the previous year for back pain, this proportion increased to 25.0% for respondents reporting high strain. Similarly, with respect to physical health, the difference between mean mental health for low strain versus high strain respondents was 10.86. This difference represents more than one standard deviation of mental health.

One limitation of this study is that the best measure of strain was determined against a limited number of outcomes. For example, given the nature of a questionnaire survey, we did not measure cardio-vascular diseases, even though job strain has been associated with such outcomes. Another limitation is that the survey was conducted in a single type of workplace, among hospital employees. Other work contexts may lead to different results, since the types of jobs and the nature of work would differ. In particular, socio-professional status was rather homogeneous and that may be the reason why it was not an important predictor of job strain. Moreover, all measures were obtained by self-reports, which can be influenced by personality traits such as a predisposition to negative emotions[35]. This could lead to an overestimation of the association between job strain and the outcomes. However, this overestimation should be equally important for all strain formulations and thus should not influence which formulation of strain is the best predictor of health outcomes. Finally, the response rate was less than optimal which raises the issue of selection bias. However, while selection bias may have affected the absolute levels of the measured variables, we do not see a plausible mechanism that would have caused bias in the measures of association.

Conclusion

On the basis of the results of this study, we would encourage researchers to explore different formulations of job strain, in particular the subtraction approach to compute strain from demands and decision latitude. If the best approach is continuous, thresholds could then be used to categorize individuals into gradations of work-related strain.

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