External Validation of Psychological Job Demands in a Bus Driver Sample

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Abstract: External Validation of Psychological Job Demands in a Bus Driver Sample: David GIMENO, *et al.* Occupational Health Research Unit, Department of Health and Experimental Sciences, Universitat Pompeu Fabra, Spain—Psychosocial risk factors have been considered as characteristics of the work environment rather than an individual issue, but their presence in the workplace is usually measured by self-reported questionnaires, based on worker attitudes. The objective of the study was to compare a self-reported measure of psychological job demands in a bus driver sample with selected indicators of bus company activity, as external 'objective' indicators, in order to assess its external validity. The final sample included 713 drivers in 41 routes. Self-reported measures of psychosocial work risk factors were obtained by the Job Content Questionnaire (JCQ). Four external indicators were available for each route: passengers, break times, bus incidents, and regulating actions. Spearman's correlation coefficient was estimated to assess the validity. Correlation coefficients showed that self-reported psychological demands were statistically significant correlated ($p < 0.05$) with two external indicators: bus incidents ($\rho = 0.397$), and regulating actions ($\rho = 0.475$). Self-reported psychosocial risk factors have been compared with independent external indicators of the psychosocial work environment, trying to avoid any subject's perception. According to our results, psychological demands measured by the JCQ seem to reflect the actual psychosocial work environment. Other studies are necessary to confirm these results and to assess job control and job social support. This would be another step in improving our knowledge of the quality

of measurement of psychosocial risk factors. (*J Occup Health* 2004; 46: 43–48)

Key words: Psychological demands, Job control, Job social support, Job Content Questionnaire, Validity

Psychosocial risk factors have been considered as characteristics of the work environment rather than an individual issue¹. Nevertheless, the presence of psychosocial risk factors in the workplace is usually measured by self-reported questionnaires, on the basis of worker attitudes². This includes the 'individual method', where the psychosocial environment is assessed by the individual worker's responses to a number of questions, and the 'average method', in which the average score of the responses given by workers in a particular job is assigned to all the workers in that job. Controversy over these two ways of measuring psychosocial risk factors is mainly directed at the validity of the worker's perception as a measure of psychosocial factors at work^{3–5}.

A number of studies have assessed psychosocial risk factor instruments by using three different approaches: (a) comparing the scores given by the instrument according to some selected key variables, such as sex, age or occupation⁶; (b) evaluating the associations of psychosocial factors with health outcomes⁷; and (c) examining correlations among psychosocial factors themselves⁸. Nevertheless, none of these approaches has assessed the validity of measurement, understanding validity as an expression of the degree to which a measurement measures what it purports to measure⁹. Another approach in assessing psychosocial risk factors has been the 'independent method' in which psychosocial risk factors are evaluated by experts or observers independently of the perception of the exposed workers, assuming that this method would produce more 'objective' data than other methods, but this method is not independent of any perception, as are experts or

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observers who similarly used their perception to rate the exposure of psychosocial risk factors¹⁰⁻¹⁵.

An alternative approach to progress in this validation process could be the use of some 'external indicators' related to the work environment, a method which has the advantage of being independent and non-perceived based measures^{16, 17}. Other studies have used 'objective' kinds of measures, such as traffic congestion¹⁸ or types of bus routes¹⁹, instead of self-perception measures to assess the psychosocial work environment. A limited number of these studies have explored how measures of the perceived psychosocial work environment were related with objective assessments of job stressors^{13, 20-22}. Nevertheless, the correlations, although significant, were generally small. Perfect correspondence between subjective and objective stressor measurements could not be expected^{5, 16}, but whether self-reported measures are correlated with external independent indicators would allow us to assess the external validity of those self-reported measures. In this paper, we examine the external validity of a self-reported measure of psychological job demands in a bus driver sample by comparing it with several external indicators of bus company activity, taking them as 'objective' indicators.

Subjects and Methods

Sample

The study was conducted between April 2000 and April 2001 in the Metropolitan Bus Company of Barcelona in Spain, as a part of a cohort study on sickness absence and psychosocial risk factors. By and large, this bus company is a modern one and many changes have been implemented in the last years to improve the conditions of buses, drivers and passengers. These changes include separate bus lanes, route reconfigurations to avoid complicated points, a computerized control system and bus stop redesign, etc. Also, even though different kinds of buses are driven, all of them have been designed taking into account ergonomic questions and have air conditioning among other facilities.

A total of 2,188 bus drivers on 100 bus routes were enrolled in the study. Out of this population, 1,536 drivers from 81 routes responded to the questionnaire, with an average response rate of 70.2%. These bus drivers work mainly on a single route and 70% of them had more than one year working on the same route, although it is possible that occasionally they drive for a certain period on another route. Bus drivers who did answer all the psychosocial questions (n=94) were excluded. In order to obtain a stable estimation of psychosocial factors, we considered that a response rate of at least 50% of the staff per route and a minimum of 5 subjects per route (n=336) were necessary. We also excluded from the analyses part-time drivers or those workers who had less than 3 months seniority on the bus route (n=393). Excluding these drivers, who are more

likely to work in multiple or changing routes, misclassification of a driver on a route would be minimum. Therefore, the final sample, on which all the analyses are based, included 713 bus drivers on 41 bus routes.

Self-reported measures

A Spanish language version of the Job Content Questionnaire (JCQ) was used to obtain self-reported measures of psychological demands, job control and job social support²³. Psychological demands and job control were each measured by 9 items, and social support by 10 items. Response categories were presented on a four-level scale, ranging from 1 (absolutely do not agree) to 4 (absolutely do agree). Thus, the original scales ranged from 9 to 36 points in the case of psychological demands and control, and from 10 to 40 for social support. These scales were transformed by moving the origin to zero, which became the lowest level of each risk factor (the lowest psychological demands, and the highest job control and job social support). The scales ranged from 0 to 27 points for demands and control, and from 0 to 30 for social support. Finally, the median score of individual responses was estimated for each bus route to obtain the final score for each bus route. Demographic and job related variables were collected by the same questionnaire and completed with data provided by the bus company.

The fit of the model was evaluated in a confirmatory factor analysis at the individual level by the principal components method with orthogonal Varimax rotation. Our results were consistent with the three psychosocial dimensions hypothesized by the model (2). Internal consistency of each factor was examined with Cronbach's coefficient alpha (α)²⁴ exhibiting a satisfactory internal consistency: $\alpha=0.83$ for psychological demands, $\alpha=0.89$ for job control, and $\alpha=0.92$ for job social support.

External indicators

Four indicators, as a proxy of work stressors, were available from the bus company for each route for the year 2000. *Passengers*, refers to the total annual number of customers who used the route. This variable may indicate job demands because a driver's primary task is to serve the public, and because more passengers could lead to increased demands for information by riders, or the need for more careful driving. *Bus incidents*, includes the number of mechanical failures and traffic accidents of each bus. *Regulating actions*, means the frequency of route modifications made by the bus company inspectors on the spot to avoid events affecting the bus route (i.e., demonstrations, traffic accidents on the road, etc.). Bus incidents and regulating actions can indicate job demands too, given that in both these situations bus drivers must wait for others to help, which could lead to a need to rush the job to keep to schedule. *Break times* reflects the

Table 1. Characteristics of the study population

Variables	n	%
Gender		
Female	4	0.6
Male	709	99.4
Age (yr)		
<30	38	5.3
30–39	304	42.6
40–49	192	26.9
50–59	158	22.2
>59	21	2.9
Marital status		
Single	67	9.5
Married/with partner	599	85.0
Separate/divorced/widow	39	5.5
Living with children under 6 years old		
Yes	205	29.1
No	500	70.9
Years on the route		
Less than 1/2	43	6.0
>1/2–1	159	22.3
>1	511	71.7
Work shift		
Morning	334	46.8
Evening	284	39.8
Mixed	95	13.3
Total	713	100

time that takes a bus to complete a round, from the origin to the end of each bus route. Break times can be assessed as an external indicator of job demands related to work time pressure because drivers have to fit the timetable previously programmed by the company. Finally, external indicators, not including break times, were divided by the number of services that are planned in each bus route. This means that the bigger the values for each indicator, the higher the exposure of the bus driver to stressors. We were unable to obtain any external indicator of job control and job social support from the company, although we decided to include self-reported measures of them in the analysis for exploratory purposes. As the four external indicators were specifically selected to represent job demands, we expect them not to be correlated with self-reported measures of job control and job social support.

Statistical analysis

The unit of analysis chosen was the bus route. Thus, firstly, median scores and interquartile range were estimated to describe the psychosocial risk factors for each bus route, and box-plots by bus route were blotted in a graph with these data. Secondly, median score of

Fig. 1. Distribution (box-plot) of psychological risk factors (psychological job demands, job control and job social support) scores by bus route (N=41).

self-reported psychosocial work risk factors were pooled within each bus route. Spearman's rho (p) correlation coefficient²⁵⁾ and its statistical significance were estimated to assess the correlation between indicators of activity and self-reported psychosocial risk factors at the group level (i.e., bus route).

Results

The sample study (Table 1) consisted mainly of men (99.4%), between 30 and 39 yr of age (42.6%), most of them married or living with a partner (85.0%), and did not have children under 6 yr old (70.9%). Nearly 72% of the drivers had more than one year on the route and, commonly, the work shift was either morning shift (46.8%) or evening shift (39.8%).

Distribution of the three psychosocial risk factors is shown in Figure 1. The median score for psychological demands and job control was 13 in both cases, and very close to the middle point of the control rank scale (13.5 points). For social support, the median score was 12 with values below the middle point of his rank scale (15 points). Total ranks varied from 11 to 16 for psychological demands, from 11 to 15 for job control, and between 10

Table 2. Description of external indicators of bus routes (N=41) in Barcelona (Spain) in 2000

Variables	Minimum	Maximum	Mean	Standard error
Passengers (in miles) ¹	30.33	186.66	102.97	5.04
Break times (in minutes)	30	75	51.71	1.65
Bus incidents ¹	11.69	28.77	18.04	0.61
Regulating actions ¹	10.00	119.21	36.82	3.62

¹: The total number was divided by the number of services planned on each bus route.

Table 3. Correlation matrix (rho coefficient) of psychological risk factors and external indicators on bus routes (N=41) in Barcelona (Spain)

	Passengers	<i>p</i>	Break times	<i>p</i>	Bus incidents	<i>p</i>	Regulating actions	<i>p</i>
Psychological job demands	0.102	0.524	0.021	0.896	0.397	0.010	0.475	0.002
Job control	-0.039	0.809	0.009	0.958	0.185	0.247	-0.001	0.996
Job social support	-0.063	0.693	-0.094	0.560	0.118	0.463	-0.020	0.903

and 14 for social support (data not shown). We can observe the variability of each bus route's median scores with respect to the global median value of each psychosocial risk factor.

Passengers and regulating actions indicators (Table 2) showed a wide variability: from 30,000 customers and 10 regulating actions to 1,860,000 passengers and 119 regulating actions. Conversely, the bus incidents indicator ranged only between 12 and 29. Finally, there were drivers who took a break every 30 min and others who stopped only every 75 min.

Table 3 shows the correlation coefficients for psychological risk factors and activity indicators. In all cases correlation coefficients were lower than 0.5. Psychological demands and bus incidents ($p=0.397$), and psychological demands and regulating actions ($p=0.475$), showed the highest values, both being statistically significant, $p<0.05$. Job control and job social support were not significantly correlated with any of the external indicators.

Discussion

Following the 3S-matrix proposed by Kristensen as a research program for the study of stressors, stress and sickness²⁶, we have assessed the relation between two different methods of measuring psychosocial work risk factors: the average method and an independent external method. Self-reported psychosocial measures, in agreement with the Karasek's model², have been compared with independent external indicators of the psychosocial work environment to assess the construct validity of self-reported psychosocial work risk factors, thus avoiding the subject's perception.

Our results showed an expected positive and statistically significant association between self-reported psychological demands and two external indicators, *bus incidents* and *regulating actions*. These associations could be explained by changes the bus drivers are obligated to make on their route or schedule plans in case of regulating actions (i.e. traffic injuries) and bus incidents

other hand, contrary to our expectation, *passengers* and *break times*, hypothesized 'objective' measures of job demands, did not show a significant correlation with self-reported psychological demands. These unexpected results could be due to the high stability of our driver population (70% of them had more than one year working on the same route), and also the stability of those two external indicators as well. This is likely to produce some kind of healthy-worker effect, because only the healthiest individuals would be likely to continue in the company for a long period, and drivers become familiarized with the amount of passengers and the timetable of their proper route. That possible selection bias effect was reinforced by the fact that we excluded from the analysis drivers who did fill out the questionnaire or those who worked on routes with low response rates. Presumably these two groups of workers had a more unfavorable work environment than the drivers analyzed. Finally, as expected, the exploratory analysis of social support at work showed that none of the external indicators matched the self-reported job control and job social support measures. The fact that none of the hypothesised external indicators of job demands were correlated with self-reported measure of job control and job social support reinforces the specificity of the selected external indicators.

Broaching the validation of self-reported measures implies that there has to be a reference (gold) standard of what we intend to measure. We have used the external indicators as a gold standard for the psychosocial factors. Nevertheless, to be considered as gold standard, first, the question of how well the indicators used match the work environment and tasks that drivers have to face at their workplace is to be answered. Studies on bus drivers typically measure job hassles, conflicting demands or traffic congestion when studying work stressors^{12, 13, 17}. Although we were not able to be provided with such indicators by the company, the indicators used in this study represent other drivers' work characteristics and their working environment. On the other hand, despite some authors' arguments on conceptual problems²⁷) in the demand-control model when measuring self-reported psychosocial risk factors, it is now the most widely used model in the study of the psychosocial work environment.

External indicators were obtained from the company and were route-specific indicators. That is, they don't refer to individuals. Probably the most important variation could be attributed to subjective perception. We must take into consideration the fact that Karasek's demand-control-support model is not about individuals' perceptions of their workplace but about their workplace. In our case, the bus route could be considered as the drivers' workplace. By computing the median scores for self-reported psychosocial work factors and pooling them within each bus route, we have avoided variation between drivers on the same bus route.

From a methodological point of view, psychosocial work risk factors seem to have long-term stability²⁸), especially for a steady state population. Moreover, a time reference is not specified in the JCQ questions, which makes it easy for past working conditions to be reflected in the actual driver's responses thus causing bus drivers to report not only the current psychosocial work environment, but also previous working conditions. Conversely, activity indicators have been measured just for one specific year, which may limit the results²⁹). Estimating the average of several years' values for activity indicators and delimiting a reference time period in the JCQ questions or using other questionnaires would be a complementary approach to enhance the validity process.

Low coefficient correlation values for self-reported psychosocial work risk factors and external indicators are not really unexpected^{5, 16}), but coefficient values in our study (0.40 and 0.48) are higher than those reported in previous studies^{13, 20, 21}), which have low significant coefficient values, ranging between 0.04 and 0.37. Our moderate coefficient values suggest that self-reported psychological demands represents fairly well driver's work psychosocial demands. An explanation of our higher values is that both external indicators, bus incidents and regulating actions, are strongly related with one of the primary tasks of the

bus driver, to stay on schedule. Occurrence of bus incidents and regulating actions make it difficult to accomplish the main task, becoming a source of stress for bus drivers, as other authors have noted^{12, 15, 30}).

In addition, in our case, our moderate coefficient values could also be due to narrow variability in the self-reported psychosocial work risk factor score. For instance, their rank scales varied between 4 and 5 points. To increase the number of response categories in the JCQ with a more than four-level scale should be considered in the future to improve the comparative process.

The use of self-reported measures is based on the assumption that there is a correspondence between the work environment and the worker's perception of the work environment⁵). Trying to validate self-reported measures opens the discussion on whether is possible to make a general validation versus a specific validation. If we consider that in each work environment the working conditions are particular, consequently the finding of an 'objective' measure has to be specifically related to that specific workplace. Still, a more comprehensive coverage of every particular working situation, organisation or workplace, and of the working conditions that constitute psychosocial work risk factors, is needed³¹).

In summary, taking into consideration the above limitations, psychological demands measured by the JCQ seem to reflect the actual psychosocial work environment of bus drivers, but although it is not always easy (or possible) to get good 'objective' indicators of the psychosocial work risk factors, it is necessary to continue looking for better refined external independent indicators as a proxy of the psychosocial environment, especially for job control and job social support. On the other hand, the indicators examined here are easily collected, and this study should be replicated. These types of studies should be a priority in the occupational health psychology field as has been underlined recently³²). Further investigation may lead to improvement of our knowledge of the measurement's quality of psychosocial work risk factors and could serve as a useful tool in implementing organizational actions to lower the stressor level in the workplace.

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