# Original Article

# Confirmatory Factor Analysis of the Finnish Job Content Questionnaire (JCQ) in 590 Professional Musicians

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## Abstract

**Background:** Poorly functioning work environments may lead to dissatisfaction for the employees and financial loss for the employers. The Job Content Questionnaire (JCQ) was designed to measure social and psychological characteristics of work environments.

**Objective:** To investigate the factor construct of the Finnish 14-item version of JCQ when applied to professional orchestra musicians.

**Methods:** In a cross-sectional survey, the questionnaire was sent by mail to 1550 orchestra musicians and students. 630 responses were received. Full data were available for 590 respondents (response rate 38%). The questionnaire also contained questions on demographics, job satisfaction, health status, health behaviors, and intensity of playing music. Confirmatory factor analysis of the 2-factor model of JCQ was conducted.

**Results:** Of the 5 estimates, JCQ items in the "job demand" construct, the "conflicting demands" (question 5) explained most of the total variance in this construct (79%) demonstrating almost perfect correlation of 0.63. In the construct of "job control," "opinions influential" (question 10) demonstrated a perfect correlation index of 0.84 and the items "little decision freedom" (question 14) and "allows own decisions" (question 6) showed substantial correlations of 0.77 and 0.65.

**Conclusion:** The 2-factor model of the Finnish 14-item version of JCQ proposed in this study fitted well into the observed data. The "conflicting demands," "opinions influential," "little decision freedom," and "allows own decisions" items demonstrated the strongest correlations with latent factors suggesting that in a population similar to the studied one, especially these items should be taken into account when observed in the response of a population.

**Keywords:** Psychometrics; Factor analysis, statistical; Surveys and questionnaires; Job satisfaction; Music; Finland

## Introduction

**W**ork stress is recognized worldwide as a major risk to workers' health and the successful functioning of their organizations.[1] Reduced motivation, deterioration in productivity and work safety, and depressive symptoms are common results of poorly functioning work environments leading to dissatisfaction for the employees as well as financial loss for the employers.[1,2] Over 20 years ago, a self-administered instrument—the Job Content Questionnaire (JCQ)—was de-

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signed to measure social and psychological characteristics of work environments.[3,4]

The JCQ has gained great popularity and has undergone extensive study. The questionnaire has been translated into several languages containing a varying quantity of items.[5-24] The modified Finnish version of the JCQ includes 12 or 14 items and has been used for many years.[25] Studies on the JCQ have been conducted across a broad occupational spectrum including general populations[7,20] as well as specific professions.[5,6,8,9,11-13,15-19,23] Most research on the topic has concerned health-service workers.[5,6,8,11,12,22,23] It has been suggested that the psychometric properties of JCQ may vary when applied to those in dissimilar occupations.[10]

The psychometric properties of the JCQ have not been studied amongst workers employed in any creative artistic environment. Such occupations may have their own explicit special features, and the expectation is that the impact of job strain may also affect artists differently than if they were members of the general population.[26-31] The factor structures of questionnaires like JCQ may also be distinctive within this particular population and therefore, the JCQ may measure latent characteristics amongst musicians differing from those of other populations. A nationally representative sample of professional musicians may provide researchers and practitioners with a unique opportunity to investigate the measurement properties of the JCQ amongst people engaged in creative activity. Knowledge of JCQ psychometric properties may be useful when planning broader surveys and assessing occupational hazards in artistic work environments. The objective of this study was thus to investigate the factor construct of the Finnish 14-item version of the JCQ when applied to professional orchestra musicians.

## Materials and Methods

The questionnaire was sent by mail to 1550 orchestra musicians and students (all 1000 Finnish orchestra musicians, all 500 musicians studying orchestra music in Sibelius Academy, and 50 retired orchestra musicians). The survey comprised 630 responses. Full data were available for 590 respondents (response rate 38%). The questionnaire also contained questions on demographics, job satisfaction, health status, health behaviors, and intensity of playing music. Their job status was categorized into "studying," "working," or "retired." Perceived work ability was defined as a score on an 11-point numeric rating scale (NRS) from '0' meaning "working is impossible" to '10' indicating "the best work ability compared to the best level during a lifetime." Perceived general health was assessed by a similar 11-point NRS ranging from '0' meaning "the worst possible health" to '10' indicating "the best possible health." Respondent age was re-

For more information on Malay version of the JCQ among public hospital female nurses see
http://www.theijoem.com/ijoem/index.php/ijoem/article/view/632

**TAKE-HOME MESSAGE**

- Work stress reduces motivation, causes deterioration in productivity and work safety leading to dissatisfaction for the employees and financial loss for the employers.

- The Job Content Questionnaire (JCQ) is a good tool to measure social and psychological characteristics of work environments.

- Psychometric properties of the JCQ may vary when applied to those in dissimilar occupations and have not been studied amongst workers employed in any creative artistic environment.

- The "conflicting demands," "opinions influential," "little decision freedom," and "allows own decisions" items demonstrated the strongest correlations with latent factors suggesting that amongst workers employed in any creative artistic environment similar to the studied one, especially these items should be taken into account.
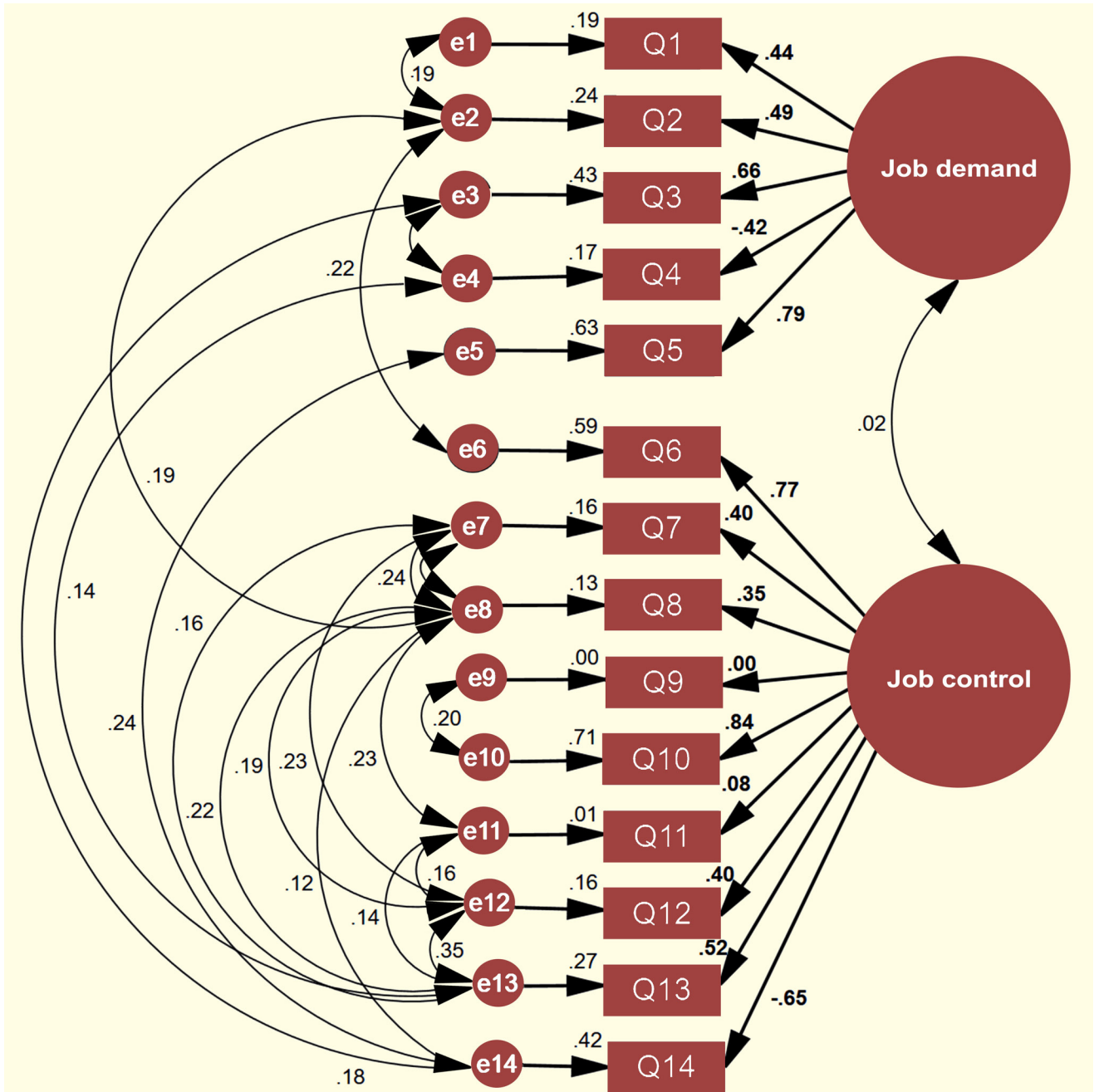
**Figure 1:** Confirmatory factor analysis of 14-item Job Content Questionnaire (JCQ).
JCQ items—Q1: Work fast; Q2: Work hard; Q3: Excessive work; Q4: Insufficient time; Q5: Conflicting demands; Q6: Allows own decisions; Q7: Requires creativity; Q8: Learn new things; Q9: Repetitive work; Q10: Opinions influential; Q11: High skill level; Q12: Variety; Q13: Develop own abilities; Q14: Little decision freedom.
Circles represent unobserved and rectangles observed variables. 'e' variables represent a measurement error associated with the observed variable (variance that is not predicted by the latent factor). Single-headed arrows represent strength of correlation between two variables while double-headed arrows strength of correlation between two covariant variables.

ported in full years on the day of response to the questionnaire without rounding.

## Job Strain

According to the Karasek model, job strain was understood as a conflict between job demand and job control.[3] In this study, it was assessed by using a 14-item Finnish adaptation of the JCQ. The first five items 1–5 described psychological "job demand;" the last items, 6–14, described "job control" (Fig 1). Responses were scored as '1' meaning "completely agree," '2' "agree," '3' "cannot say," '4' "disagree," and '5' indicating "completely disagree." The total score for job demand was calculated as a mean of the scores from items 1–5. When more than two responses were missing, the total score for items 1–5 was also considered missing. The total score for job control was calculated as the mean of individual scores from items 6–14. When more than five responses were missing, the total score for items 6–14 was also considered missing. The presence of job strain for each respondent was dichotomized as "yes" or "no." Job strain was considered present if a job-demand score was above and a job-control score was below the sample's median value.

## Confirmatory Factor Analysis (CFA)

### Estimating the model

The estimation procedure used the maximum likelihood method considering covariances supplied as input as being unbiased. For simplicity, the estimates were reported in standardized form as correlation coefficients. A correlation of <0.2 was considered "poor," 0.21–0.4 "fair," 0.41–0.6 "moderate," 0.61–0.8 "substantial," and >0.8 "perfect."

### Testing the model goodness of fit

In order to assess how well the model matched the observed data, the root mean square error of approximation (RMSEA) was used. First, the model fit was tested assuming there were no covariances between unique factors. After that, the modification indices suggested by the software were used to add covariance between factors (double-headed arrows in Fig 1) one at a time, each time testing the RMSEA closeness to the value of <0.05, or at least <0.08—the threshold for accepting the model fit.[32,33] Every insertion was considered plausible if it made logical sense and did not violate the assumption that the common and the unique factors are uncorrelated. After achieving the RMSEA value of <0.05, no further covariances were imputed and the goodness of fit was assessed by $\chi^2$ test. As the sample was relatively small considering the requirements of CFA, in an attempt to reduce dependence on sample size, the choice was the relative (or "normed") $\chi^2$ test. Relative $\chi^2$ is a $\chi^2$ estimate divided by the degrees of freedom. A relative $\chi^2$ value <5.0 was considered an indication of a good fit.[34]

All analyses were conducted using IBM® SPSS® Statistics for Windows®, ver 22.0 (IBM Corp. Released 2013, Armonk, NY, USA); IBM® SPSS® Amos™, ver 23.0 (IBM® Corp. Released 2013, PA, USA); and Stata/IC Statistical Software, release 14 (StataCorp LP, TX, USA).

## Results

### Descriptive Statistics

The mean age of 590 respondents was 37.5 (SD 12.8) years for the 338 (57%) men and 252 (43%) women, of whom 65% were working, 31% studying, and 4% retired. The median work history was 14 (IQR 5 to 25) years; 40% played violin or viola. Their perceived work ability was generally good, with a mean score of 8.1 (SD 1.9) of 10 points. Their general health they rated as a mean of 7.6 (SD 1.6) points. Job satis-

faction was high with a median of 8 (IQR 7 to 9); the satisfaction with their salaries was low with a median of 3 (IQR 2 to 5). Of the respondents, 125 (21%) reported an elevated level of job strain, based on their responses to the JCQ.

## Confirmatory Factor Analysis (CFA)

The model for describing the structure of the 14-item JCQ was built on two factors—"job psychological demand" and "job control," as explained above. The first CFA run, conducted without any covariances between the single 14 JCQ items, produced a model fit that appeared to be inappropriate, with an RMSEA above 0.08. Using modification indices suggested by the software, covariances were imputed one at a time until the RMSEA decreased to 0.067 (90% CI 0.057 to 0.077), showing an acceptable fit as being below 0.08. At this point, the relative $\chi^2$ value was 3.5 (below the cut-off point of 5.0) with 58 degrees of freedom.[4] In other words, the model presented in Figure 1 demonstrated good ability to describe the data from the study sample.

Of the five JCQ items in the "job demand" construct, the "conflicting demands" (question 5) explained most of the total variance in this construct (79%), demonstrating almost perfect correlation. A respective estimate of "excessive work" (question 3) showed a substantial correlation of 0.66. Other items of this construct indicated moderate correlations of 0.42 to 0.49.

In the construct of "job control," "opinions influential" (question 10) demonstrated a perfect correlation index of 0.84 and the items "little decision freedom" (question 14) and "allows own decisions" (question 6) showed substantial correlations of a respective 0.77 and 0.65. Items 7 ("requires creativity"), 12 ("variety"), and 13 ("develop own abilities") showed moderate correlations, item 8 ("learn

new things") fair, and items 9 ("repetitive work") and 11 ("high skill level") indicated poor correlations.

## Discussion

In this cross-sectional study on 590 professional orchestra musicians investigating the factor construct of the Finnish version of 14-item JCQ, "conflicting demands" (question 5) explained most of the total variance in the "job demand" construct, whereas "opinions influential" (question 10) explained most of the total variance in the construct of "job control."

This was the first study on the topic conducted in Finland among professional musicians—a profession that may differ from the general population because of its creative characteristics. Few studies have employed CFA to investigate the structure of the JCQ. The study conducted by Idrovo, *et al*, on a Mexican 8-item modified JCQ reported almost equal correlations for all eight items included in the proposed 3-factor model.[35] Aboa-E´boule, *et al*, included nine items from the JCQ in a broader inventory considering all nine JCQ items related to an "extrinsic effort" latent factor.[36] In that study, the strongest correlation (0.6) between unique and common variables was for a "work fast" item. The study by Żołnierczyk-Zreda, *et al*, tested the 4-factor model of a 52-item Polish version of the JCQ, reporting moderate or substantial correlations for almost every item.[24] There is no evidence-based explanation for the strong correlation that we found here between "conflicting demands" and "opinions influential" and latent traits. We can only speculate that at least, in part, this finding can be explained by the specific features of the artistic profession here under study. For example, the discrepancy between poor satisfaction with salary and high work satisfaction that emerged in this sample could hardly be expected in the

majority of occupations.

The main weakness of the study was low response rate (38%). This may affect the generalizability of the results across the entire field of professional musicians. Generalizability may also be affected by the differences between JCQ translations used in this and previous research.

Further research on the factor construct of the JCQ in diverse populations is necessary. Additional to factor structure, other psychometric properties of the JCQ should be investigated as well, for instance by Rasch analysis or item response theory.

In conclusion, the 2-factor model of the Finnish 14-item version of the JCQ proposed in this study fitted well the data obtained. The "conflicting demands," "opinions influential," "excessive work," "little decision freedom," and "allows own decisions" items demonstrated the strongest correlations with latent factors suggesting that in a population similar to this one, especially these items should be taken into account.

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## Conflicts of Interest: None declared.

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