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Do time-invariant confounders explain away the association between job stress and workers' mental health?: Evidence from Japanese occupational panel data

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ABSTRACT

It is well known that job stress is negatively related to workers' mental health, but most recent studies have not controlled for unobserved time-invariant confounders. In the current study, we attempted to validate previous observations on the association between job stress and workers' mental health, by removing the effects of unobserved time-invariant confounders. We used data from three to four waves of an occupational Japanese cohort survey, focusing on 31,382 observations of 9741 individuals who participated in at least two consecutive waves. We estimated mean-centered fixed effects models to explain psychological distress in terms of the Kessler 6 (K6) scores (range: 0–24) by eight job stress indicators related to the job demands-control, effort-reward imbalance, and organizational injustice models. Mean-centered fixed effects models reduced the magnitude of the association between jobs stress and K6 scores to 44.8–54.2% of those observed from pooled ordinary least squares. However, the association remained highly significant even after controlling for unobserved time-invariant confounders for all job stress indicators. In addition, alternatively specified models showed the robustness of the results. In all, we concluded that the validity of major job stress models, which link job stress and workers' mental health, was robust, although unobserved time-invariant confounders led to an overestimation of the association.

1. Introduction

It is well known that job stress is negatively associated with workers' mental health. Specifically, three major stress models—the job demands-control (JD-C), effort-reward imbalance (ERI), and organizational injustice models—have provided theoretical grounds for empirical research on this issue. The JD-C model proposes that employees who face heavy job demands and low control over work are in a job-strain situation, which is likely to increase psychological distress (Karasek, 1979). The ERI model argues that an imbalance between higher effort spent on work and lower reward obtained from it has a stressful impact on workers (Siegrist, 1996). Finally, the organizational injustice model hypothesized that procedural and/or interactional injustices are key sources of workplace stress (Elovainio et al., 2001; Elovainio et al., 2002).

While cross-sectional data from population or large-scale surveys have been widely used to assess the validity of these models (de Jonge et al., 2000; Dragano et al., 2008; Inoue et al., 2013a; Wang et al., 2008), an increasing number of studies have utilized longitudinal data, since cross-sectional analyses have endogeneity issues (Buddeberg-Fischer et al., 2008; Clays et al., 2007; Inoue et al., 2013b; Kivimäki et al., 2003; Stansfeld et al., 2012; Theorell et al., 2014). Even with the use of longitudinal information, however, most of these studies have compared the data over two time points, specifically, baseline and follow-up years. Such prospective cohort studies have often focused on how the job stress in the baseline year (or its change during the baseline and follow-up years) explained mental health or other health variables in the follow-up year.

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These studies have not fully controlled for time-invariant factors—what is called "fixed effects"—which may confound the association between job stress and workers' mental health. This probably led to biased estimates of the association between job stress and workers' mental health, given that both these variables are subjectively assessed, and are likely to be related to common individual attributes (McKenzie et al., 2014; Podsakoff et al., 2003). This potential bias cannot be fully avoided even if we place an interval between the observations of job stress and mental health, because both of these variables are affected by the time-invariant factors.

In the present study, we sought to validate previous observations on the association between job stress and workers' mental health, by removing the effects of time-invariant factors. To this end, we applied fixed effects models to the data from three to four waves of a large-scale occupational Japanese cohort survey. We considered Kessler 6 (K6) scores as an indicator of psychological distress, and examined their associations with eight job stress indicators related to the JD-C, ERI, and organizational injustice models.

1.1. Time-invariant factors

There are two types of time-invariant factors: observed and unobserved. Observed time-invariant factors, which include gender and educational background, are usually determined from a survey. Their effects can easily be controlled by including them as covariates in a regression analysis. In contrast, unobserved time-invariant factors are not observable from a survey, and hence, cannot be controlled in conventional regression analyses.

Unobserved time-invariant factors are further divided into two types. The first type ("known unknown") has some theoretical or empirical grounds, even though such information is not collected from a survey. For example, negative affectivity has been found to influence self-reported stressors and strains (Burke et al., 1993). Personality traits are also known to be an important confounder; in particular, neuroticism is closely related to job strain and other stress (Garbarino et al., 2013; Törnroos et al., 2012). It is reasonable to predict that negative affectivity and neuroticism negatively affect workers' mental health as well, thereby leading to an upward-biased association between job stress and mental health in the absence of control. Meanwhile, preceding studies also have suggested that the association is likely to be moderated by Antonovsky's sense of coherence (SOC; Feldt, 1997; Urakawa and Yokoyama, 2009) and emotional intelligence (Mikolajczak et al., 2007; Ogińska-Bulik, 2005), although they may not be fully time-variant. In addition to these individual-level confounders, there are the employer/workplace-level ones. For example, studies have shown that workplace social capital moderates the association between job stress and mental health (Sapp et al., 2010; Oshio et al., 2014), implying that it may lower their observed association.

Another type of time-invariant factors ("unknown unknown") has no theoretical or empirical grounds and cannot be identified, and hence cannot be controlled in conventional regression analyses. There may potentially be various time-invariant factors of this type, and we cannot rule out the possibility that they affect the association between job stress and mental health.

1.2. Fixed effects models

To control for all time-invariant factors—regardless of whether they are observed, unobserved, "known unknown," or "unknown unknown"—fixed effects models have been widely used in recent years. The fixed effects model analysis is conducted as follows, as long as the model is linear (Baltagi, 2013; Wooldridge, 2010). First, all variables (including independent and dependent variables and covariates) are mean-centered: that is, each variable is subtracted by its mean over the surveyed waves for each individual. In this process, observed time-invariant factors (such as gender and educational attainment) are all reduced to zero. Unobserved time-invariant factors are also (conceptually) reduced to zero, even if their values are not actually collected. Then, the regression model to explain the mean-centered dependent variable by the mean-centered regressors is estimated. All time-invariant factors are dropped from this regression, making it possible to fully control for their confounding effects.

There is another type of fixed effects model: the first-differenced fixed effects model. In this type, each variable is subtracted by its one-wave-lagged value. Then, the regression model to explain the first-differenced dependent variables by the first-differenced regressors is estimated. All time-invariant factors are dropped from this regression and their confounding effects are controlled, as in the case of the mean-centered fixed effects model.

An increasing number of studies have applied fixed effects models in job stress and mental health analyses, albeit separately. For example, it has been found that controlling for time-invariant unobserved individual attributes tends to make the association between job stress and the body mass index more obscure (Azagba and Sharaf, 2012). In addition, fixed effects models also have revealed that job stress is positively related to smoking, even after controlling for time-invariant factors (Ayyagari and Sindelar, 2010).

Meanwhile, more attempts have been made to address the determinants of mental health by using fixed effects models. Notably, these models have been employed to assess how changes in mental health or psychological well-being are related to changes in socioeconomic status (Andrés, 2004; Flint et al., 2013; Lorant et al., 2007; McKenzie et al., 2014), family nursing-care provisions (Oshio, 2014), and other such variables. To our knowledge, however, the association between job stress and workers' mental health is largely understudied in the framework of fixed effects model analysis.

2. Methods

2.1. Study sample

We used panel data from four waves of surveys of an occupational cohort study on social class and health in Japan (Japanese Study of Health, Occupation, and Psychosocial Factors Related Equity; J-HOPE). This study was conducted by an inter-disciplinary team to investigate whether there are health inequalities across socioeconomic strata and how they are associated with psychosocial job characteristics. The first wave was conducted October 2010 and December 2011, and the following waves were conducted approximately one year after the previous ones. Data were collected from annual worksite health checkups, which are mandatory for all Japanese employees. The recruitment periods varied among the study sites; the health check-ups were conducted in a fixed month every year for all employees, in each employee' birth month, and so on.

The study population consisted of employees working for thirteen firms, three of which joined only the first three waves. The surveyed firms covered twelve industries and the surveyed respondents were classified into nine occupation types. The original sample consisted of 10,753; 11,405; 10,977; and 6553 respondents in the first to the fourth waves, respectively (response rates: 77.0%, 81.7%, 78.6%, and 67.0%, respectively). The dataset included 39,683 observations of 14,140 individuals (10,550 men and 3590 women) who joined at least one wave. The attrition rates were 18.3%, 13.2%, and 16.5% in the second, third, and fourth waves, respectively. The