MEDIATION EFFECTS OF OVERCOMMITMENT ON EFFORT, REWARD, INSOMNIA, AND WELL-BEING AS MODERATED BY GENDER, AGE, AND JOB POSITION

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Abstract. This study aimed to detect the mediation effect of over-commitment between occupational stress, insomnia, and well-being; and the moderating role of gender, age and job position are also to be analyzed. One thousand six hundred eighteen valid samples were recruited from electronic manufacturing service industry in Hunan Province, China. All the data were collected by self-rated questionnaires after written consent. This paper introduced Effort-Reward-Insomnia-Well-being model, and it was fitted and validated through the structural equation model analysis. The results of single factor correlation analysis indicated that the coefficients between most of the items and dimensions presented statistical significance. The final fitting model had satisfactory global goodness of fit (CMIN/DF=3.99, AGFI=0.926, NNFI=0.950, IFI=0.956, RMSEA=0.043). Both of the measurement model and structural model had acceptable path loadings. Effort associated with insomnia indirectly and related to well-being directly and indirectly; reward could have either directly associated with insomnia and well-being, or indirectly related to them through over-commitment. Covariates as gender, age and position made differences on the association between occupational stress and health outcomes. Over-commitment had the ability to mediate the relationships between effort, reward, and health outcomes, and mediation effect varied from different working conditions and outcomes under different covariates.

Keywords: effort reward imbalance model, insomnia, occupational stress, structural equation model, well-being

INTRODUCTION

With the rapid development of science and technology, psychological problems of occupational population have also increased accordingly (Zhi *et al*, 2014). This situation is not only reflected in developed societies as North America and Europe, but also in the developing areas like China. Occupational stress is a kind of psychological distress caused by conditions related to job (Carillo, 2011). It is often defined as a physiological, psychological, and behavioral reaction when the ability or resources cannot meet the demands

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from work, which lead to poor health and injury. Obvious chronic effects could occur when exposed to long-term stress, such as counterproductive behavior (Chraif and Anitei, 2011), overreaction (Yoshida *et al*, 2014), and unrecovered health damage (Tang, 2014). The health outcomes often manifest as low health perception, insomnia, complaint, depression, and so forth (Tang, 2014). Consequently, occupational stressors have received increasing attention among occupational hazards beyond chemical, physical, and biological factors. More specially, when exposed to long-term stress, it will increase the risk of inordinate circadian rhythms; therefore, affecting sleep quality of occupational population (Buselli *et al*, 2016).

The consequences of sleep deprivation and sleepiness have been noted as the most important health problem in our modern society (Yazdi *et al*, 2014). Keeping high sleep quality is a basic guarantee for the daily work productivity and is of great significance in restoring from fatigue and experiencing positive mental state. To the contrary, insomnia refers to various abnormal performances in the process of sleep. It induces increase in mortality, morbidity, accidents and errors, absenteeism in the workplace, decrease in productivity, and deterioration of personal and professional relationships (Bonin *et al*, 2014). Therefore, how to avoid insomnia and promote health has gradually become an important public health issue.

To date, this issue has drawn increasing attention to the relationships between occupational stress and sleep quality (Cuffee *et al*, 2014). For example, one study indicated that occupational stress was associated with a series of insomnia, like trouble falling asleep, and early awakening in electronic product manufacturing workers (Ota *et al*, 2005). Another cohort study also found that over-commitment related with sleep disorder among male, and higher effort and lower reward significantly associated with sleep disorder in women (Fahlen *et al*, 2005).

Among various models of occupational stress, the Effort-Reward-Imbalance (ERI) model postulates that occupational stress is not merely a product of working effort (workload, responsibility, or other demands), but also a result by the interaction between effort and rewards that people receive (Choi *et al*, 2014). The model predicts that perceptions of meaningful rewards will promote employee health and work satisfaction; whereas, the imbalance between efforts and rewards will lead to a sustained strain response (Siegrist, 1996). Unlike many other models of job stress, the ERI proposes a personal component; predicting that the experience of effort-reward imbalance will be more frequent (and more damaging) in employees who are over committed to work (Chen *et al*, 2016).

'Over-commitment' is defined as "a set of attitudes, behaviors and emotions that reflect excessive striving in combination with a strong desire of being approved and esteemed" (Chen *et al*, 2016). It reflects a cognitive-motivational pattern of coping with demands that is characterized by an extreme ambition in combination with a special need for control and approval, which was found to exacerbate the negative effects of effort-reward imbalance for the work-related outcomes (Bellingrath *et al* 2010), and Kinman and Jones (2008) indicated that over-commitment is an independent risk factor for employee health and does not necessarily compound the negative impact of high effort-low reward conditions. However, the intrinsic variable over-commitment, has yet received sufficient attention com-

paring to the other two extrinsic dimensions as effort and reward (Loerbroks *et al*, 2016). What the most familiar conclusion in this study area is 'high efforts in combination with low rewards increase the risk of strain', and how 'over-commitment', as the 'important outsider', acts in the relationship of stress and health has not been explicit. Therefore, some scholars have made some exploration. For instance, a previous research (Kinman and Jones, 2008) analyzed the moderating effect of intrinsic over-commitment in the relationship between effort-reward and health outcomes, and the hypothesis had been positively confirmed. Nonetheless, it is still unclear that: does over-commitment have part of impact on health under the influence of effort and reward? In other words, do effort and reward affect health outcomes through over-commitment? If so, how much is this effect?

On the other hand, there is evidence that effort-reward imbalance is related to impaired health status in occupational samples (Fahlen *et al*, 2005; Cuffee *et al*, 2014). However, the validity of the stress model in predicting job satisfaction and well-being is considerably less clear. Moreover, concerning aspects related to psychosocial occupational health, the authors of the present study found very few publications on occupational stress, insomnia and well-being in manufacturing workers. Therefore, the present study was designed to analyze the relationship between occupational stress, insomnia and status of well-being simultaneously.

After considering the above aspects, three hypotheses are to be confirmed: 1) Effort, reward, and over-commitment are directly associated with insomnia and well-being among electronics manufacturing employees; 2) Overcommitment mediates the relationship between effort, reward and health outcomes, and the mediating effect varies from different stressor-outcome relationships; 3) Demographic variables of gender, age and position have moderating effect in such association.

MATERIALS AND METHODS

Population and investigation process

This cross sectional study recruited the staff of the electronic manufacturing service industry in Hunan Province as the research object. Before the field survey, the Chinese Center for Disease Control and Prevention organized the study group, united with the Provincial Prevention and Treatment Center of Occupational Disease, communicated with the companies to be surveyed, and informed the purpose and significance of the investigation. Upon the consent of the local unit, we conducted on-site mobilization. Formal investigation was carried out during June-to-July 2015.

The investigators of unified training conducted the field survey, and the questionnaire was completed on the spot and recovered after the audit. The inclusion criteria of study samples: (1) the participants had worked for ≥ 1years continuously in their positions, (2) there was no history of mental illness and no history of psychotropic drug use for one week before the investigation, (3) there was no long-term sick leave history, and (4) they voluntarily participated in the survey with informed consent.

Demographic variables

We included gender and age as covariates in the model, because these demographic variables may confound the results (Bakker *et al*, 2004)). Moreover, we also included type of position as a covariate, because preliminary analysis showed significant differences between assembly

workers and assistants (Sun *et al*, 2013). Age was measured in years; and concerning that Chinese culture usually treats 30 years old as a threshold of change from 'immature' to 'steadfast' (Xing and Hu, 2010), which might affect the individual perception of working conditions. We classified study samples into two groups as '1' for <30 years old and '2' for ≥30 years-old. Gender was categorized as '1' for Males and '2' for Females. Position was recorded as '1' for Assembly Workers and '2' for Assistants.

Occupational stress

The Effort-Reward Imbalance questionnaire (Chinese version) (Siegrist, 1996; Jonge *et al*, 2000; Dai *et al*, 2007) was used in the survey. The modified questionnaire includes 3 subscales: Job Effort (Items 1-to-6), Job Reward (Items 7-to-17), and Overcommitment (Items 18-to-22). All 22 items used the Likert 5-answer format, with a score of 1 meaning 'Not At All' and a score of 5 meaning 'Completely Agree' . The scale has been confirmed to have high reliability and validity (Li *et al*, 2005). Chrobach's alpha coefficients for Total Score, Job Effort, Job Reward, and Overcommitment were 0.934, 0.813, 0.925, and 0.690, respectively.

Insomnia

Insomnia was assessed by Self-administered Sleep Questionnaire (Nakata *et al*, 2002, 2004), which also used a 5-point rating format (1-to-5), and the total score ranged from 3-to-15. It included 3 Items covering 3 aspects of the sleep process: (a) 'difficulty in falling asleep': 'How long do you usually take to fall into deep sleeping state'? (1 '0-10 mins,' and 5 'more than 2 hours'; (b) difficulty in staying asleep: 'Are you easy to wake up at night, and hard to keep deep sleeping,' (1 'never' and 5 'more than 3 times a week'; and (c) wakeup early: 'Do you woke up early and cannot fall asleep again,' with the same answering format of (b) Chrobach's alpha coefficient was 0.705.

Well-being

The well-being of the study population was assessed by WHO Five Well-being Scale (Allgaier *et al*, 2013). Five statements presented ('I have felt cheerful and in good spirits,' 'I have felt calm and relaxed,' 'I have felt active and vigorous,' 'I have felt fresh and rested,' 'My daily life has been filled with things that interest me') were assessed on a 6-score scale (from 'Never' to 'Always'), with the possible total score varying from 0-to-25. Higher score refers to better well-being (Bech and Olsen, 2003). The Cronbach' alpha was 0.924 for this study.

Statistical analysis

Pearson test of correlation analysis was used to explore the relationships between ERI, insomnia, and well-being. For the inspection of the model of ERI-Insomnia-Well-being, the study used the structural equation model to perform confirmatory factor analysis (CFA). For the data fitting goodness indicator, the adjusted goodness of fit-index (AGFI), non-normed fit index (NNFI), incremental fit indicator (IFI), and root mean square error of approximation (RMSEA) were chosen.

The literature show that the model fit coefficient >0.9 and RMSEA<0.08 (Byrne, 2010), can be accepted as good global fitness indicator of model. According to our model (Fig 1), this study divided the working conditions into two latent variables as a whole; namely, the job effort and reward on the theoretical basis of ERI; over-commitment was included into the model as a mediation variable. The analysis of the mediating effect of structural equation model (Baron and Kenny,

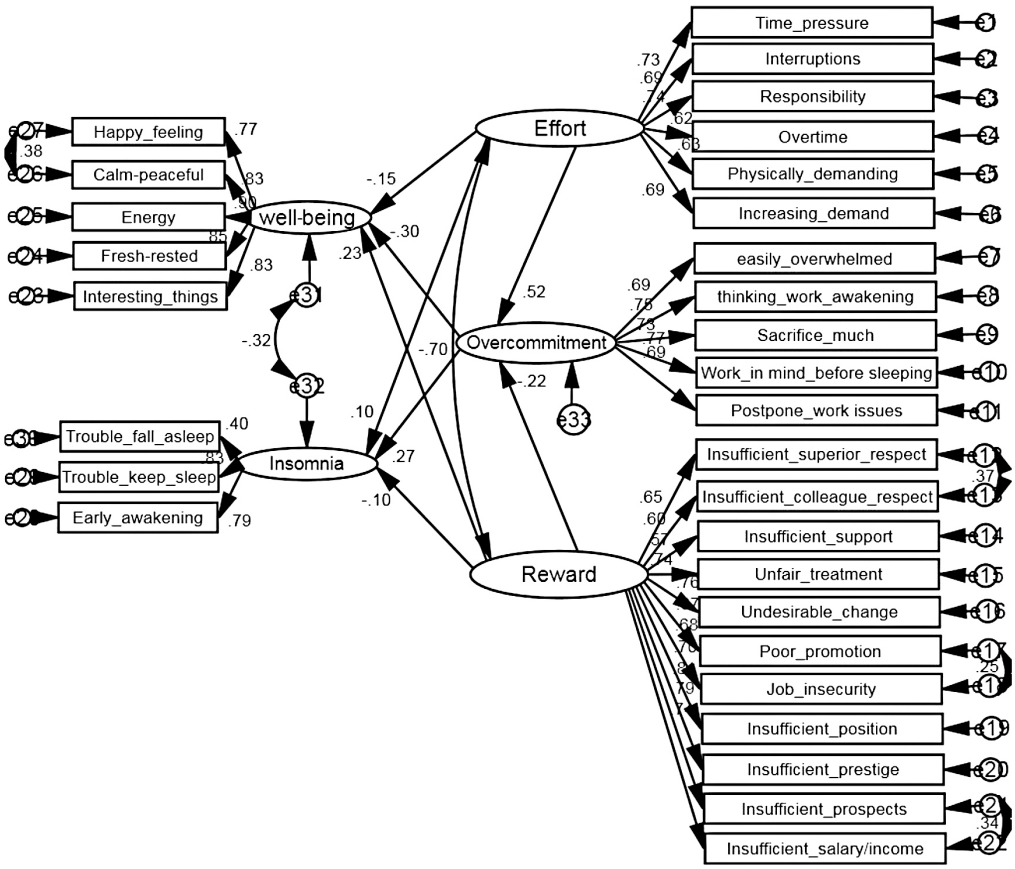

Fig 1–ERI-Insomnia-Well-being Model with standardized path coefficients.

1986) was conducted simultaneously by using bootstrap method. The resampling number was set as 5,000 according to the research of Hayes (Preacher and Hayes, 2010); taking the bias correction interval as the confidence interval of mediating effect. Epidata® (version 3.1; EpiData Association: Odense, Denmark) was used for data entry, and SPSS Statistics® (version 19.0; IBM, Armonk, NY) was used for statistical analysis and SPSS Amos® version 21.0 (IBM, Armonk, NY) for CFA. The variable α took 0.05 with two tails.

Ethical considerations

The Medical Ethics Committee of the Institute of Occupational Health and Poison Control of Chinese Center for Disease Control and Prevention approved this study (Ref No. 201502; 2015 Feb 28).

RESULTS

One thousand eight hundred questionnaires were issued; 1,618 questionnaires were recovered, and the effective recovery rate was 89.9%, with 835 males (51.6%), and 783 females (48.4%); the average age was 28.84 ± 6.37 years old, and the proportions of <30 year-old age group and ≥30 year-old age group were 66.4% and 33.6%, respectively. There were 768 workers on the assembly line (47.5%) and 850 workers were as the assistant (52.5%).

Table 1
Analysis of correlation and internal consistency of each dimension.

Variable	Mean	SD	1	2	3	4	5	6	7
Covariates									
1. Gender	–	–	1.00						
2. Age	28.84	6.36	0.21[b]	1.00					
3. Position	–	–	-0.09[b]	0.07[b]	1.00				
ERI									
4. Efforts	2.42	0.83	-0.12[b]	-0.09[b]	-0.16[b]	1.00			
5. Rewards	3.91	0.86	0.01	0.06[a]	0.26[b]	-0.62[b]	1.00		
Mediator									
6. OC	2.48	0.82	-0.01	-0.07[b]	-0.18[b]	0.57[b]	-0.52[b]	1.00	
Outcomes									
7. Insomnia	2.51	0.89	-0.05[a]	-0.05[a]	-0.11[b]	0.29[b]	-0.29[b]	0.33[b]	1.00
8. Well-being	3.10	1.22	0.04	0.13[b]	0.20[b]	-0.45[b]	0.47[b]	-0.48[b]	-0.42[b]

[a]$p<0.05$; [b]$p<0.01$; ERI, effort reward imbalance; OC, overcommitment.

Correlationship between study variables

Single factor correlation analysis shows that the correlation coefficients of the three dimensions of ERI are of statistical significance; these are -0.62, 0.57, and -0.52, respectively. Higher job effort, lower reward, and higher overcommitment are associated with higher insomnia, and these correlation coefficients are 0.29, -0.29, and 0.33, respectively. To the contrary, higher job effort, lower reward, and higher overcommitment are associated with lower well-being status; these coefficients are -0.45, 0.47, and -0.48, respectively, which have statistical significance. Insomnia and well-being correlate negatively with coefficients of -0.42 ($p<0.05$). Covariates of gender, age, and position associate with insomnia and status of well-being significantly, except the relationship between gender and well-being (Table 1).

Global fitness of ERI-insomnia-well-being structural model

We used the structural equation model to conduct data fitting and optimization for model hypotheses, and then finally tested whether the hypotheses have been confirmed. First, we conducted the analysis of structural equation model to the two basic dimensions of job effort-reward model. The results showed that model goodness of fit was acceptable after optimization (CMIN/DF=5.77, AGFI=0.936, NNFI=0.953, IFI=0.960, RMSEA=0.054), which all reach the standards of the goodness of fit. Then overcommitment was added into M2, and the model also achieves high global goodness of fit.

On the basis of M2, we added the latent variable of insomnia as the common outcome variables of three dimensions, while the interactive paths between three dimensions were not added. It indicated that the goodness of fit of the model was relatively poor (CMIN/DF=9.98, AGFI=0.857, NNFI=0.860, IFI=0.875, RMSEA=0.075). Similarly, when three dimensions were added to the one-way path of well-being, the model fit was also unacceptable.

Then, we added the corresponding paths between three dimensions on the

Table 2
The process of model fitting and the global goodness of fit of validated models.

Dimension/Model[a]	χ^2	df	χ^2/df	AGFI	NNFI	IFI	RMSEA
M1	663.91	115	5.77	0.936	0.953	0.960	0.054
M2	1113.90	203	5.49	0.924	0.942	0.949	0.053
M3	2683.25	269	9.98	0.857	0.860	0.875	0.075
M4	2903.96	317	9.16	0.858	0.884	0.895	0.071
M5	1214.51	266	4.57	0.929	0.944	0.951	0.047
M6	1431.55	314	4.56	0.923	0.949	0.955	0.047
M7	1676.15	392	4.28	0.920	0.946	0.951	0.045
M8	1561.12	391	3.99	0.926	0.950	0.956	0.043

[a]The M1 model only includes the job effort and reward; M2, add overcommitment dimension and related path on the basis of M1; M3, include the three dimensions of job effort, reward, overcommitment personality and insomnia, and add dimension to the insomnia path; M4, include the three dimensions of job effort, reward, overcommitment personality and well-being, and add the three dimensions to the well-being path; M5, add the relation path of three dimensions of job effort, reward, overcommitment personality on the basis of M3; M6, add the interaction path of three dimensions of job effort, reward, overcommitment personality on the basis of M4; M7, combine M5 with M6; M8, add the interaction paths of insomnia and well-being variables on the basis of M7.
AGFI, adjusted goodness of fit index; NNFI, non-normed fit index; IFI, incremental fit indicator, RMSEA, root mean square error of approximation.

basis of M3, and the results suggested that the goodness of fit reached a higher level (CMIN/DF=4.57, AGFI=0.929, NNFI=0.944, IFI=0.951, RMSEA=0.047). M6 also showed similar results.

In M7, we combined M5 and M6, that is, insomnia and well-being are included into the model simultaneously with the corresponding paths between three dimensions at the same time, and the goodness of model fit reached a higher degree (CMIN/DF=4.28, AGFI=0.920, NNFI=0.946, IFI=0.951, RMSEA=0.045).

In the final M8 model, we further added the correlation path of insomnia and well-being, and the final fitting model results had satisfactory goodness of fit (CMIN/DF=3.99, AGFI=0.926, NNFI=0.950, IFI=0.956, RMSEA=0.043), and the coefficients of each path were of statistical significance, respectively (Table 2).

Path coefficient of structural equation model

The validated model showed a high degree of goodness of fit to the occupational population of electronic manufacturing industry. The paths of measurement model had acceptable loadings, among which the minimum standardized regression weight occurs on the path from ''trouble fall asleep'' to ''insomnia''(0.40), and the loadings of other measurement paths were all above 0.50; the correlation coefficient of structural model between the latent variable job effort and reward was -0.70; the standardized regression weight from latent variable effort to insomnia and well-being were 0.10 (p=0.07) and -0.15 (p<0.05), respectively, that is,

once the job effort increases by an unit, insomnia increased by 0.10 unit, and well-being decreased by 0.15 unit.

Similarly, the standardized path loadings between reward and the two aspects were -0.10 and 0.23, respectively. With the increase of reward, the insomnia decreased and the well-being increased gradually. With respect to overcommitment, the standardized path loadings to insomnia and well-being were 0.27 and -0.30. The relationship between insomnia and well-being was negative, and the standardized covariance was -0.32 (Fig 1).

Direct and indirect effects of the structural model

In order to further confirm the study hypotheses 1 and 2, and to explore association between ERI and health outcomes, we carried out the mediating effect analysis of structural equation model. The results suggested that the direct effects of job effort on over-commitment, insomnia and well-being were 0.52 (0.43, 0.60), 0.10 (-0.01, 0.22), and -0.16 (-0.25, -0.06), respectively, and the indirect effects were 0.14 (0.09, 0.20) and -0.15 (-0.20, -0.11) through overcommitment.

The direct effect of effort- insomnia showed no statistical significance for the total sample. Similarly, direct effects of reward to overcommitment, insomnia, and well-being were -0.22 (-0.30, -0.12), -0.11 (-0.20, -0.01), and 0.23 (0.16, 0.31) respectively; and the indirect effects through over-commitment were -0.02 (-0.03, -0.01) and 0.03 (0.01, 0.06), respectively. At the same time, over-commitment also has direct effect on insomnia and well-being (Table 3).

Moderating role of covariates on direct and indirect effects of the structural model

In order to explore the different structural association of individual characteristics, we used the hierarchical method of structural equation modeling. We adopted the method of Nested Model Comparisons to discuss the influences of different characteristics on the model goodness of fit, and then analyzed the path coefficients of the model to different characteristics.

In general, results were quite comparable with those for the total sample. However, there were some differences regarding the direct and indirect effect of specific working conditions on the latent factors for each group. For example, in respect to covariate as age and position, effort showed significant direct association with insomnia in ≥30 years age group (0.19; 0.01, 0.40) and assembly line workers (0.16; 0.01, 0.30), while it showed no significance in <30 years age group (0.06; -0.07, 0.22) and assistant workers (0.05; -0.12, 0.24).

Gender also buffers the direct relationship between job effort and well-being. A similar situation occurred in the direct relationship between reward and insomnia in term of different gender, age and position (Table 3).

DISCUSSION

The present study proposes that the ERI-Insomnia-Well-being Model, by which 3 hypotheses have been analyzed: 1) Working conditions of ERI associated directly with insomnia and well-being directly; 2) Such relationships could be mediated by overcommitment; 3) Sociodemographic factors, such as gender, age, and position have moderating effects on direct and indirect association between ERI and occupational health outcomes.

Hypothesis 1, that job effort and reward can directly associate with insomnia and well-being, was largely supported by our results. The correla-

Table 3
Direct and indirect effects of the SEM in the model of ERI- insomnia-well-being for the whole sample and for the moderating covariates.

Effect	Mediator (95%CI)	Outcomes (95%CI)	
	Overcommitment	Insomnia	Well-being
Direct effect			
Job effort			
Total sample	0.52 (0.43, 0.60)	0.10 (-0.01, 0.22)[a]	-0.16 (-0.25, -0.06)
Gender			
Male	0.56 (0.45, 0.67)	0.09 (-0.06, 0.26)[a]	-0.13 (-0.26, 0.01)[a]
Female	0.49 (0.35, 0.64)	0.10 (-0.08, 0.29)[a]	-0.17 (-0.32, -0.03)
Age (years)			
<30	0.50 (0.39, 0.60)	0.06 (-0.07, 0.22)[a]	-0.14 (-0.26, -0.03)
≥30	0.56 (0.41, 0.70)	0.19 (0.01, 0.40)	-0.17 (-0.35, -0.01)
Position			
Assembly line	0.40 (0.26, 0.53)	0.16 (0.01, 0.30)	-0.13 (-0.27, -0.01)
Assistant	0.61 (0.50, 0.73)	0.05 (-0.12, 0.24)[a]	-0.18 (-0.33, -0.05)
Reward			
Total sample	-0.22 (-0.30, -0.12)	-0.11 (-0.20, -0.01)	0.23 (0.16, 0.31)
Gender			
Male	-0.19 (-0.30, -0.06)	-0.13 (-0.25, -0.01)	0.23 (0.14, 0.34)
Female	-0.24 (-0.38, -0.09)	-0.08 (-0.22, 0.07)[a]	0.22 (0.10, 0.34)
Age (years)			
<30	-0.24 (-0.34, -0.12)	-0.16 (-0.27, -0.03)	0.25 (0.16, 0.34)
≥30	-0.18 (-0.33, -0.04)	0.01 (-0.14, 0.15)[a]	0.18 (0.06, 0.29)
Position			
Assembly line	-0.27 (-0.39, -0.13)	-0.04 (-0.17, 0.09)[a]	0.18 (0.06, 0.29)
Assistant	-0.15 (-0.26, -0.02)	-0.14 (-0.26, -0.01)	0.24 (0.14, 0.33)
Overcommitment			
Total sample	—	0.27 (0.18, 0.37)	-0.30 (-0.37, -0.21)
Gender			
Male	—	0.26 (0.12, 0.40)	-0.33 (-0.45, -0.21)
Female	—	0.30 (0.15, 0.42)	-0.27 (-0.38, -0.16)
Age (years)			
<30	—	0.30 (0.18, 0.41)	-0.29 (-0.39, -0.19)
≥30	—	0.21 (0.04, 0.38)	-0.30 (-0.43, -0.15)
Position			
Assembly line	—	0.26 (0.14, 0.38)	-0.24 (-0.35, -0.12)
Assistant	—	0.29 (0.13, 0.43)	-0.33 (-0.44, -0.20)
Indirect effect			
Job effort			
Total sample	—	0.14 (0.09, 0.20)	-0.15 (-0.20, -0.11)
Gender			
Male	—	0.15 (0.07, 0.24)	-0.19 (-0.27, -0.12)
Female	—	0.15 (0.07, 0.24)	-0.13 (-0.21, -0.07)
Age (years)			
<30	—	0.15 (0.09, 0.23)	-0.15 (-0.21, -0.09)
≥30	—	0.12 (0.03, 0.24)	-0.17 (-0.28, -0.09)
Position			
Assembly line	—	0.10 (0.05, 0.18)	-0.09 (-0.16, -0.05)
Assistant	—	0.18 (0.08, 0.28)	-0.20 (-0.28, -0.12)

Table 3 (Continued).

Effect	Mediator (95%CI)	Outcomes (95%CI)	
	Overcommitment	Insomnia	Well-being
Reward			
Total sample	—	-0.06 (-0.09, -0.03)	0.07 (0.03, 0.10)
Gender			
Male	—	-0.05 (-0.10, -0.02)	0.06 (0.02, 0.12)
Female	—	-0.07 (-0.13, -0.03)	0.06 (0.02, 0.12)
Age (years)			
<30	—	-0.07 (-0.12, -0.03)	0.07 (0.03, 0.12)
≥30	—	-0.04 (-0.10, -0.01)	0.06 (0.01, 0.12)
Position			
Assembly line	—	-0.07 (-0.12, -0.03)	0.07 (0.03, 0.12)
Assistant	—	-0.04 (-0.09, -0.01)	0.05 (0.01, 0.10)

95%CI, 95% confidence interval; [a]$p>0.05$.

tion analysis showed that the job effort was positively correlated to insomnia. Namely, higher effort directly associates with greater insomnia and lower well-being. Similarly, the decrease of reward can significantly relate to the risk of insomnia, and increased well-being, which is in line with previous studies (Tsutsumi and Kawakami 2004; Lunau *et al*, 2013,). Effort and reward could also indirectly correlate with insomnia and well-being through overcommitment. The indirect effect varies from different variables of which job effort loads stronger indirect effects than reward which is probably due to a more close association between effort and over-commitment. In other words, job effort makes more influence on over-commitment to affect the occupational outcomes indirectly.

Conversely, reward showed a greater direct association with health outcomes. This finding is largely in line with some previous studies (Karasek, 1979; Demerouti, 2007). As Bakker *et al* (2010) indicated, job resources are not only essential to deal with job demands, but they also have influencing effects on their own right (Demerouti, 2007). In other words, job rewards either play an intrinsic motivational role because they promote employees' growth, learning, and development, or they play an extrinsic motivational role because they are helpful in achieving work goals, indicating that work task with adequate rewards will probably be obtained and completed (Karasek, 2012).

Hypothesis 2 proposed that overcommitment may mediate the relationship between ERI and health outcomes and it is supported by present results. Mediation analysis shows that in addition to the direct association with health outcomes, overcommitment could also mediate the relationship between effort, reward, and health outcomes.

Results of present study also indicate that, over-commitment, being as the direct embodiment of working conditions emotionally (Chen *et al*, 2016), might be more positively affected by job efforts or demands rather than rewards or controls. Then it will probably load more effect on occupational health outcomes from

job efforts, which can be supported by previous studies (Feldt *et al*, 2013; du Prel *et al*, 2015). Feldt *et al* (2013) indicated that participants with low over-commitment, as a certain personal characteristic with a set of attitudes reflecting excessive striving combined with a strong desire for approval (du Prel *et al*, 2015), tend to score higher in well-being. Overcommitment, like exaggerating their efforts beyond levels or exposing high demands at work too often, might diminish the potential to recover from job demands and increase the susceptibility to frustration (Siegrist, 1996).

The analysis of multi-group SEM shows that gender, age and position load significantly different coefficient of the path from job effort to insomnia and well-being. In terms of covariates as age and position, effort significantly associate with insomnia in ≥30 years age group and assembly line workers directly, while it shows no significance in <30 years age group and assistant workers. And gender also moderates the direct relationship between job effort and well-being. Similar situation occurs in the direct relationship between reward and insomnia in term of different gender, age and position. It is in line with previous indication that such variables perform moderating effects on the association between abovementioned aspects (Peter *et al*, 2006; Ota *et al*, 2014). In other words, assistant employees with lower age might have weakened health effects of insomnia by job effort. Male workers might show an insensitive reaction on well-being under certain job effort. Similarly, male assistant employees in the lower age group show more sensibility to insomnia when rewards change accordingly.

The present study was based on self-report questionnaires, which might lead to the subjective bias of the information. Nevertheless, the consistency of our findings under the theory, together with the acceptable sample size, suggests that common-method bias is not a major drawback of our study. Moreover, because of the limited availability of the study samples, we only collected information from employees of electronic manufacturing service industry in Hunan Province, which restricts the generalizability of our results. The theoretical model should be gradually revised in the future studies.

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