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## The impact of the HDI on the association of psychosocial work demands with sickness absence and presenteeism

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**Background:** The purpose of this study was to determine whether psychosocial work demands have a different impact on sickness absence and presenteeism in countries with a high vs. countries with a low Human Development Index (HDI). **Methods:** This article is based on an analysis of the fifth European Working Conditions Survey. We investigated single items as well as complex constructs and indices. Sickness absence and presenteeism were measured as outcome variables. Following the model of Karasek and Theorell, we measured the HDI at the macro level and psychosocial job demands at the micro level as independent variables. **Results:** The multivariate multilevel analysis reveals a significant association between the HDI and the number of days recorded for sickness absence. In countries with a higher HDI, people report a lower number of days with sickness absence. Higher psychosocial job demands are associated with poorer health. There are significant cross-level interaction effects between psychosocial job demands and the HDI for these associations. Psychosocial job demands are stronger associated with sickness absence and presenteeism in high-HDI than in low-HDI countries. **Conclusions and implications for public health:** We argue that Public Health Actions that are connected to work characteristics need to take into consideration the level of HDI of the countries. In low- and high-HDI countries, different actions could be necessary to reach the needs of the working population.  
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## Introduction

### Purpose

The purpose of this study was to determine whether psychosocial work demands have a different impact on health in countries with a high compared with countries with a low Human Development Index (HDI). The HDI is a composite index that measures the years of schooling and expected years of schooling, life expectancy at birth and the gross national income per capita.<sup>1,2</sup> The HDI measures human progress and quality of life at the global level and is used for comparison of governmental policies, among others regarding health care and education.<sup>3</sup> Economic resources are known to be important determinants of health.<sup>4,5</sup> Additionally, a high level of economic and social development is known to be positively related to individual and collective health.<sup>6–9</sup> However, research has found differing results when considering associations between HDI and health. It has been reported that in regions with a low HDI compared with a high HDI, there is a higher prevalence

of major depressive episodes,<sup>10</sup> a higher occurrence of sleep complaints,<sup>11</sup> a higher rate of infant mortality<sup>12</sup> and a higher mortality to incidence rate in kidney cancer.<sup>13</sup> Shah presents a curvilinear relationship between HDI and elderly suicide rates, with low rates in very low-HDI and in very high-HDI countries.<sup>14</sup>

The demand/control model of Karasek and Theorell<sup>15</sup> assumes a negative impact on health from psychological and physical job demands, but a positive impact on health from decision latitude. Research supports these assumptions. Negative effects on health<sup>16,17</sup> have been attributed to psychosocial job demands, and associations between Karasek's job demands and psychological distress have been reported.<sup>18,19</sup> Haeusser et al. state that job demands and job control are mostly associated with psychological well-being.<sup>17</sup> There is contradictory evidence about the effect job strain—a combination of high job demands and low job control<sup>15</sup>—has on physical health and health behaviour. For example, no association was found between job strain and breast cancer, but women with a higher level of job strain showed a lower attendance of breast cancer screening.<sup>20</sup> It is thought that an interaction exists between job

demands and decision latitude, with high decision latitude buffering the impact of job demands on health. Research only partly supports this assumption of a buffering effect.<sup>17,21</sup>

The number of sickness absence days is known to be strongly associated with health, well-being and mortality,<sup>22,23</sup> and sickness absence has been reported to increase with higher job demands and other work-related demands.<sup>23</sup>

Generally speaking, presenteeism is defined as attending work despite being ill.<sup>24</sup> Presenteeism is also reported to be related to poor health<sup>24</sup> and to future health problems.<sup>25</sup> Merrill et al. found presenteeism to be most widespread among highly educated women and professionals.<sup>26</sup> Strong job demands, high stress and poor relations with co-workers are all predictive of presenteeism.<sup>27–30</sup> Studies that analyse associations between presenteeism or sickness absence on the one hand and job characteristics and their effects on health on the other hand are still rare. In addition, Leineweber et al. suggest that presenteeism is a complex phenomenon (and not just an alternative to sickness absence) that should be studied in more detail.<sup>31</sup> Therefore, sickness absence and presenteeism are considered to be important outcome variables in public health research studies, in particular when analysing associations with job demands and with the level of development in a certain country.

To our knowledge, no research has previously been carried out to establish whether the effects of psychosocial work demands on sickness absence and presenteeism differ according to the level of HDI. The aim of our study was to fill this research gap.

## Methods

### Data

This article is based on an analysis of the fifth European Working Conditions Survey (EWCS). The fifth EWCS was carried out in 2010 by the European Foundation for the Improvement of Living and Working Conditions<sup>32</sup> and was implemented as a cross-sectional survey in the form of a face-to-face questionnaire interview by Gallup Europe. The multistage random sample included 43,816 workers from 34 countries (EU27, Norway, Croatia, the former Yugoslav Republic of Macedonia, Turkey, Albania, Montenegro and Kosovo), with a target number of 1000 interviews per country.

### Measures

We investigated single items as well as complex indices.

### Dependent variables

- Sickness absence: ‘Over the past 12 months, how many days in total were you absent from work for reasons of health problems?’ (a metric variable starting with 0).
- Presenteeism: ‘Over the past 12 months, did you ever go to work when you were sick?’ (1 = no, 2 = yes).

### Independent variables

We integrated the independent variables of two hierarchical levels of analysis into the model.

### Macro-level of analysis: HDI

As a macro-level (aggregate-level) variable, we used the value reached by the individual countries in the HDI.<sup>33</sup> The HDI was assessed independently of the survey data using United Nations data.<sup>33</sup> The HDI ranges between 0 and 1, with 1 signifying a very high development, and was used as a metric independent variable at the country level. It was standardized to values between 0 and 100. HDI values are available for all countries of the EWCS, except for

Kosovo, which reduces our sample size by 1018 individuals to a total sample size of 42 798 individuals.

### Micro-level (individual level) of analysis:

#### Variables of the demand/control model by Karasek

We constructed three indices (psychological job demands, physical demands at work and decision latitude) following Karasek and Theorell’s model of demands and control at work. The indices were constructed based on factors of the job demand and control model. Rather than using the values of the original job content questionnaire, we relied on approximation including variables of the EWCS. The indices were tested by means of factor analysis and were standardized to a range with a lowest possible value of 0 and a highest possible value of 100.

The scale ‘Psychological job demands’ consists of 10 variables ( $\alpha = 0.62$ , 100 = high psychological job demands). The scale includes items such as ‘Does your job involve working at very high speed?’.

‘Physical demands at work’ consists of 14 items ( $\alpha = 0.84$ , 100 = high physical demands at work). The scale includes items such as ‘Does your main job involve tiring or painful positions?’.

‘Decision Latitude’ consists of eight items ( $\alpha = 0.61$ , 100 = a high level of decision latitude). The scale includes items such as ‘Are you able to apply your own ideas in your work?’.

#### Socio-economic and socio-demographic status

The socio-economic and socio-demographic status was measured by:

- Education: ‘What is your highest level of education?’, with the categories ‘primary level (1)’, ‘low secondary’, ‘high secondary’ and ‘tertiary (4)’
- Sex (1 = male, 2 = female)
- Age in years

### Statistical analysis

We calculated multilevel regression models to analyse the associations between individual-level outcome variables on the one hand and individual-level and macro-level independent variables on the other hand (as described earlier). We posed sickness absence and presenteeism as dependent variables, and HDI (macro-level) and psychosocial work conditions (micro-level) as independent variables. In addition, we investigated whether the HDI modifies the association between work conditions and sickness absence/presenteeism. In addition, we calculated an interaction term between psychological demands and decision latitude on the micro-level of analysis.

We took the hierarchical structure of the data into account and controlled for the level of the independent variables (micro-level or macro-level). Therefore, the SPSS Mixed Model procedure was used to calculate linear random intercept and random slope multilevel regression models using Residual Maximum Likelihood Estimation as the estimation type. On a nominal level, the nominal country identification variable was used as subject identification. For our analysis, we compared the countries according to their values reached in the HDI.

To avoid problems of multicollinearity, centered variables were used.<sup>34</sup> We used the following formula for centering the variables:  $X_i - \text{Mean Score of } X$ .

## Results

The mean value of sickness absence was 5.97 (SD = 19.42, N = 41 791), and 57.3% reported presenteeism (N = 37 883). The mean value of psychological job demands was 30.36 (SD = 16.02,

N = 40 156), the mean value of physical demands at work was 20.60 (SD = 15.72, N = 42 473) and mean decision latitude was 42.06 (SD = 19.19, N = 41 123). Individuals in the sample were, on average, 41.68 years old (SD = 12.16, N = 43 625), 52% of the interviewed were male (N 100% = 43 816). 6.3% had primary education, 19.2% had low secondary education, 45.0% had high secondary education and 29.5% had tertiary education (N 100% = 43 695). At the macro-level of analysis, the mean HDI was 85.54 (range: 69.9–94.3, N = 42 798).

### Multilevel multivariate results

Table 1 shows the results for the two multilevel linear regression models with different health outcome variables, controlled for sex, age and level of education.

### HDI and sickness absence

The multilevel analysis revealed that in countries with a higher HDI, people report a lower number of days of sickness absence.

### Psychosocial work demands and health

Leaving cross-level interactions aside, higher psychological and higher physical job demands are significantly associated with more sickness absence and with more presenteeism.

More decision latitude is significantly associated with less sickness absence and more presenteeism.

### Interaction effects between psychosocial work demands and health

Higher decision latitude significantly reduces the association between psychological demands and sickness absence or presenteeism.

### Socio-economic and socio-demographic status and health

Men report significantly less sickness absence and less presenteeism than women.

Higher age is significantly associated with more sickness absence and less presenteeism.

The level of education is significantly associated with both sickness absence and presenteeism. Individuals with low education have significantly more sickness absence and less presenteeism than individuals with tertiary education.

### Cross-level interactions HDI\* psychosocial work demands and health

Table 1 and figure 1 show cross-level interactions between the HDI and psychosocial work demands in their associations with sickness absence and with presenteeism. The interaction lines are presented (for quartiles of the HDI) and differentiate between very low (699–805), low (806–840), high (841–884) and very high (885–943) HDI (standardized HDI values). For the calculation of the predicted values (Y) shown in the graphs, the following formula was used:

$$Y = [B(\text{psychological demands (for respective HDI group)}) * \text{psychological demands} + d (= \text{Intercept HDI})].$$

The regression coefficients are used as B values. The same formula applies for physical demands and for decision latitude.

There are significant cross-level interactions between psychological demands and the HDI as well as between physical demands and HDI for the number of sickness absence days taken. Figure 1 demonstrates a steeper slope of the regression line for high-HDI than for low-HDI countries. This indicates that psychological job demands are more strongly related to a higher number of days of sickness absence in high-HDI than in low-HDI countries. By contrast, in countries with a low HDI, the associations between physical demands and sickness absence are more strongly positive than in countries with a high HDI.

There are significant cross-level interactions for presenteeism, namely, between physical demands and the HDI and decision latitude and the HDI. In countries with a high HDI, there is a stronger positive association between physical demands and presenteeism than in countries with a low HDI. The same pattern is observed for decision latitude.

## Discussion

To our knowledge, this is the first study ever analysing cross-level interactions to determine how psychosocial work demands differ in their impact on sickness absence and presenteeism according to a country's HDI based on the new EWCS 2010 data. Therefore, we argue that this analysis presents new knowledge and contributes to advances in the field. Former studies<sup>6,23</sup> found country differences in the prevalence of psychosocial work demands, poor well-being and other health-related items, as well as associations between district unemployment rates and subjective health. Others report that a

**Table 1** The results of the linear multilevel regression analyses

	1: Sickness absence Regression coefficient B (95% CI min/max)	2: Presenteeism Regression coefficient B (95% CI min/max)
Intercept	2.443 (1.379 to 3.507)	51.651 (47.434 to 55.869)
[Sex = male]	−1.509 (−1.932 to −1.087)	−5.270 (−6.341 to −4.199)
[Sex = female]	Category of reference	Category of reference
[Education = primary]	0.998 (−0.026 to 2.023)	−7.594 (−10.241 to −4.946)
[Education = 2.00]	0.880 (0.221 to 1.538)	−7.199 (−8.884 to −5.513)
[Education = 3.00]	0.093 (−0.421 to 0.606)	−3.469 (−4.778 to −2.161)
[Education = tertiary]	Category of reference	Category of reference
Age	0.098 (0.080 to 0.116)	−0.063 (−0.109 to −0.018)
Psychological demands	0.044 (0.025 to 0.063)	0.452 (0.381 to 0.523)
Physical demands	0.109 (0.082 to 0.135)	0.210 (0.145 to 0.275)
Decision latitude	−0.034 (−0.061 to −0.006)	0.168 (0.116 to 0.221)
HDI	0.194 (0.075 to 0.313)	0.082 (−0.563 to 0.727)
Psychological demands * HDI	0.006 (0.003 to 0.010)	0.006 (−0.007 to 0.018)
Physical demands * HDI	0.008 (0.003 to 0.012)	0.012 (0.001 to 0.023)
Decision latitude * HDI	−0.001 (−0.005 to 0.004)	0.014 (0.005 to 0.023)
Decision latitude * psychological demands	−0.001 (−0.002 to 0.000)	0.002 (0.000 to 0.004)

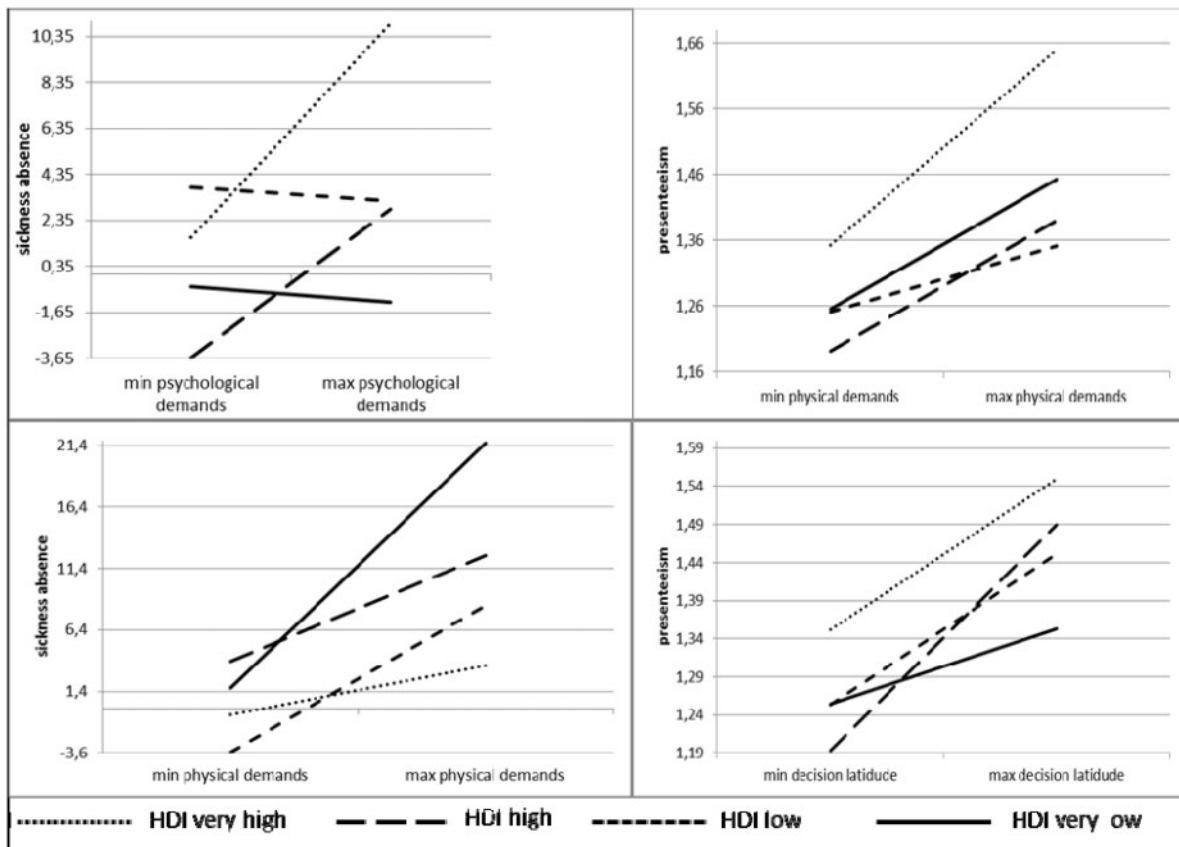


Figure 1 Cross-level interactions

more equal distribution of economic resources weakens the tie between wealth and health.<sup>8</sup>

At the macro-level, we used the HDI to compare the tie between psychosocial work demands and health within different countries.

In accordance with previous research,<sup>6–9</sup> a higher HDI is associated with a lower number of days in sickness absence. One explanation might be better working and living conditions in higher-HDI countries. In line with Niedhammer<sup>23</sup> and Karasek's hypotheses—without taking cross-country interactions into account—our analysis generally shows a higher number of psychological demands to be significantly associated with more sickness absence. The cross-level interaction shows that this applies only to countries with a high HDI, whereas in countries with a low HDI, higher psychological demands are associated with less sickness absence. These results suggest that Karasek's hypotheses about psychological job demands having sickness absence as a health outcome might only be valid for higher-developed countries but might have to be rejected for lower-developed countries. In high-HDI countries, job demands seem to produce more stress for workers than in low-HDI countries. As Wilkinson explains, inequality is a stressor to health.<sup>9</sup> Possibly, workers in higher-HDI countries, who experience high job demands, feel more strongly disadvantaged than those in low-HDI countries when comparing themselves with their colleagues in the same working environment. Another explanation for the cross-level interaction could be that in low-HDI countries, pressure is greater, such that persons with higher psychological demands do not dare to stay at home on sickness absence for fear of losing their jobs. Additionally, we assume that regulations and legislations for sickness absence differ between countries, in particular regarding psychological strain and psychological health problems. The latter might be acceptable for sickness absence only in higher-HDI countries. In addition, in high-HDI countries,

psychological complaints might be more accepted and, thus, individuals experiencing high psychological demands might be more prepared to take sickness absence.

In line with other research (Niedhammer et al., 2012), no significant associations between decision latitude and sickness absence were found in our study.

Concerning the association between physical demands and sickness absence, our results are in line with Karasek's model. The association shows a similar pattern across all HDI levels: high physical demands are associated with more sickness absence. Nevertheless, cross-level interaction effects show a stronger association in low-HDI countries than in high-HDI countries, even though there is, in general, less sickness absence in high-HDI countries. This might be explained by poorer general health and more severe illnesses in low-HDI countries. In the event of additional stress from physical demands at work, the physical health of workers might be even poorer and they might, therefore, be forced to take more sickness absence.

Higher decision latitude is associated with more presenteeism. This might be explained by the nature of decision latitude, which is often associated with higher levels of responsibility, such that persons with high decision latitude feel the pressure to finish all tasks at work. This argument is in line with other research reporting that for a majority of employees, the pressure to attend work when sick comes from themselves.<sup>29</sup> In addition, subjective job insecurity has been reported to be related to presenteeism,<sup>35</sup> as presenteeism can be seen as a means of addressing an individual's own concerns about his/her job security. Another explanation might be that decision latitude is often associated with work adjustment latitude. Possibly, workers who experience high decision latitude have better chances to adjust their working conditions to possible health problems or complaints.<sup>36</sup>



The association between decision latitude and presenteeism is stronger in high-HDI countries. In our view, workers in low-HDI countries might experience less work adjustment latitude even when reporting higher decision latitude. As a consequence, this might prevent them from going to work, even if they would prefer to do so. In line with previous research,<sup>17</sup> decision latitude seems to buffer the negative effects of high psychological demands, meaning that individuals with high decision latitude seem to be less affected by psychological job demands when referring to the days of sickness absence.

Several limitations of our study have to be considered. First of all there is still a need for further interpretations of interactions effects. Another limitation concerns the measurement of the dimensions of Karasek's and Theorell's model. As the questionnaires did not include the original Karasek items, we had to use an approximative approach. In this context, the rather low Cronbach's alphas of the scales should be mentioned. We assume this is due to the fact that we did not use the original items. The results of the factor analysis did not indicate that the scales included different constructs [which has been argued before<sup>37</sup>], therefore we argue that the constructs measured were valid. Furthermore, a number of previous publications<sup>23</sup> have already used EWCS data to construct scales following Karasek, so we argue this to be a legitimate approach.

A strength of this study is the use of the HDI as a metric macro-level variable to show cross-level interaction effects between the HDI and psychosocial work demands. Another major strength of the study is that it is based on a cross-national data set, but this strength is also a limitation. When interpreting the results of our study, we must be aware that the labour market, professions and job demands differ between the countries. As differing professions and job demands are associated with the level of education, we controlled for education and argue that our results are valid even when taking cross-national differences into account. The cross-sectional data do not allow us to reach any conclusion regarding causality; therefore, the direction of the associations can only be argued based on theoretical assumptions and on previous research.

We would like to mention that the sheer nature of self-reported data bears the risk of some of the associations being confounded by third variables. To minimize this risk of confounding, we controlled for socio-economic status, a very common approach in social epidemiology.<sup>9,38</sup> The HDI was assessed independently of the survey. Therefore, no common method bias is to be expected concerning the associations between self-reported data and the HDI.

## Conclusions and implications for public health

In summary, we can state that psychosocial job demands seem to be more strongly associated with sickness absence and with presenteeism in high-HDI than in low-HDI countries. Therefore, we argue that Public Health programmes concerning work characteristics should consider the level of HDI of the countries. In low- and high-HDI countries, different actions seem to be necessary to cover the needs of the working population. In low-HDI countries, these actions should aim, in particular, at reducing physical work stressors. In contrast, in high-HDI countries, public health actions should aim at reducing psychological job demands and enforcing decision latitude.

Finally, we have to state that the nature of cross-country interactions is still difficult to explain and should thus be further investigated.

*Conflicts of interest:* None declared.

## Key points

- In higher-HDI countries, a lower number of days in sickness absence is reported.
- Higher psychosocial job demands are associated with poorer health.
- Job stress is stronger related to sickness absence and to presenteeism in high-HDI countries compared with low-HDI countries.
- Therefore public health programmes concerning work characteristics should consider the level of HDI prevailing in the relevant countries.
- In low-HDI countries, these actions should, in particular, consider to reduce physical work stressors. In high-HDI countries, in turn, public health actions should consider to reduce psychological job demands.

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