Psychometric properties of the Effort-Reward Imbalance Questionnaire

Johannes Siegrist,* Jian Li,† Diego Montano‡

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*johannes.siegrist@med.uni-duesseldorf.de
†jian.li@uni-duesseldorf.de
‡diego.montano@med.uni-duesseldorf.de

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1 Introduction: Measurement of the effort-reward imbalance

In principle, different measurement approaches towards assessing ERI are feasible. To some extent, contextual information (e.g. job descriptions, level of salary, career mobility, job loss) can be used. However, core aspects of the model concern experiences and perceptions of working people. Therefore, self-report data are of core importance. These data can be acquired through qualitative interviews, ecological momentary assessments, standardized questionnaires or structured interviews. In large scale social epidemiological research an economic measure in terms of a psychometrically well justified standardized questionnaire has proven to be particularly useful.

In this tradition, the ERI model has been operationalized as a standardized self-report measure consisting of three psychometric scales: effort, reward, and overcommitment [1]. There are two versions of the ERI questionnaire: the original or long version, which consists of 22 Likert-scaled items, and the short version of 16 items. The shorter version of the original questionnaire is more easily applicable in large scale epidemiologic investigations.

2 Construction of scores

2.1 Long version

2.1.1 Effort scale

Effort is measured by five or six items respectively that refer to demanding aspects of the work environment: ERI1-ERI6. The 5-item version excluding physical load (item ERI5) has been found to be psychometrically appropriate in samples characterized predominantly by white collar jobs whereas the 6-item version was appropriate in blue collar samples and occupational groups with manual workers.

All questions refer to the present respectively last occupation and subjects are asked to indicate how far the items reflect their typical work situation. The rating procedure is defined as follows with higher ratings pointing to higher efforts (see table 1): (1) strongly disagree, (2) disagree, (3) agree, and (4) strongly agree.

Table 1: 4 point Likert scale answer format in the ERI-Questionnaires.

Strongly disagree	☐	(1)
Disagree	☐	(2)
Agree	☐	(3)
Strongly agree	☐	(4)

It should be noted that the Likert scale answer format has been changed from a

two-step procedure with five categories (see table 2) to a one-step procedure with only four categories (see table 1) as suggested by [2] (see also [3]). Psychometric analyses revealed no substantial differences between these two procedures, but response rates were substantially higher in the one-step procedure (e.g. [4]). We therefore recommend to use this latter approach. We are aware that the absolute scale scores are no longer strictly comparable between the scoring formats. In Section 4 we describe an adjustment procedure for comparing scores across studies and present some reference data.

Table 2: Former 5 point Likert scale answer format of the ERI-Questionnaires. Not recommended.

Disagree	☐	(1)
Agree, and I am not al all distressed	☐	(2)
Agree, and I am somewhat distressed	☐	(3)
Agree, and I am distressed	☐	(4)
Agree, and I am very distressed	☐	(5)

A sum score of the 4-point Likert ratings is computed as the unidimensionality of the effort scale has been documented (see table 3). A total score based on the five items measuring extrinsic effort varies between 5 and 20 (or 6 and 24 with 6 items). The higher the score, the more effort at work is assumed to be experienced by the subject.

2.1.2 Reward scale

Reward is measured by ten 4-point Likert scaled items (items ERI7-ERI16) coded as in table 1. We postulate a three-factorial structure of the construct of occupational reward as given in table 3. Therefore, a second-order factor analysis is expected to define a one-dimensional scale. The rating procedure is performed in analogy to the effort scale. Please be aware that the long version of the ERI-Questionnaire (ERI-L version 22.11.2012) has now only 16 items. In comparison with the previous version 29.08.07 of the ERI-Questionnaire we have merged the old items ERI7 ("I receive the respect I deserve from my superiors") and ERI8 ("I receive the respect I deserve from my collegues") into the new item ERI7 ("I receive the respect I deserve from my superior or a respective relevant person."). In this way, the long version of the ERI-Questionnaire can also be applied to self-employed or small proprietors using the same 4-point Likert scaled items. It should also be noted that the Likert scale answer format for the reward scale has also been changed from a two-step procedure with five categories (see table 2) to a one-step procedure with only four categories (see table 1).

After variable recoding procedures (see the coding of the ERI-Questionnaire Long Version in table 5 below), lower ratings point to lower rewards. A sum score of these ratings is computed which varies between 10 and 40. The lower the score, the fewer occupational rewards are supposed to be received by the person.

Table 3: ERI-Questionnaire. Long version. Construction of scores.

Scales	Items	Range
Effort scale	ERI1 to ERI6	6 to 24
Reward scale	ERI7 to ERI16	10 to 40
Overcommitment scale	OC1 to OC6	6 to 24
Subscales of the reward scale:		
Esteem	ERI7 to ERI9, ERI14	4 to 16
Promotion	ERI10, ERI13, ERI15 and ERI16.	4 to 16
Security	ERI11 and ERI12	2 to 8

Additional analyses using scores of the three sub-scales (esteem, promotion, and security) instead of the total reward score provide further meaningful information in theoretical and practical terms (see e.g. [5]).

2.1.3 Overcommitment scale

Overcommitment is measured by six items (items OC1-OC6) derived from an earlier test containing 29 items ([1]). Items range from 1 (low) to 4 (high overcommitment) (see table 4).

Table 4: 4 point Likert-scaled items for the "overcommitment" dimension.

OC1: I get easily overwhelmed by time pressures at work		
Strongly disagree	☐	(1)
Disagree	☐	(2)
Agree	☐	(3)
Strongly agree	☐	(4)

Note that item OC3 has to be reversed (see table 5). The scale score is computed by adding item values. Although the six overcommitment items load usually on a single factor, some studies report a stronger loading of OC1 on the effort factor (e.g. [6, 7]).

Table 5: ERI-Questionnaire. Long version. Item coding.

		Strongly disagree (1)	Disagree (2)	Agree (3)	Strongly agree (4)
ERI1	I have constant time pressure due to a heavy work load.	☐	☐	☐	☐
ERI2	I have many interruptions and disturbances while performing my job.	☐	☐	☐	☐
ERI3	I have a lot of responsibility in my job.	☐	☐	☐	☐
ERI4	I am often pressured to work overtime.	☐	☐	☐	☐
ERI5	My job is physically demanding.	☐	☐	☐	☐
ERI6	Over the past few years, my job has become more and more demanding.	☐	☐	☐	☐
ERI7	I receive the respect I deserve from my superior or a respective relevant person.	☐	☐	☐	☐
ERI8	I experience adequate support in difficult situations.	☐	☐	☐	☐
ERI9	I am treated unfairly at work. Reverse coding	☐	☐	☐	☐
ERI10	My job promotion prospects are poor. Reverse coding	☐	☐	☐	☐
ERI11	I have experienced or I expect to experience an undesirable change in my work situation. Reverse coding	☐	☐	☐	☐
ERI12	My employment security is poor. Reverse coding	☐	☐	☐	☐
ERI13	My current occupational position adequately reflects my education and training.	☐	☐	☐	☐
ERI14	Considering all my efforts and achievements, I receive the respect and prestige I deserve at work.	☐	☐	☐	☐
ERI15	Considering all my efforts and achievements, my job promotion prospects are adequate.	☐	☐	☐	☐
ERI16	Considering all my efforts and achievements, my salary / income is adequate.	☐	☐	☐	☐

2.2 Short version

2.2.1 Effort scale

Effort is measured by three 4-point Likert scaled items (ERI 1-3) coded as in table 7. To facilitate the measurement in future studies we recommend a consistent 4-point Likert scale (strongly disagree, disagree, agree, strongly agree) for all components of the questionnaire. A total score based on the three items measuring effort varies between 3 and 12 (see table 6).

Table 6: ERI-Questionnaire. Short version. Construction of scores.

Scales	Items	Range
Effort scale	ERI1 to ERI3	3 to 12
Reward scale	ERI4 to ERI10	7 to 28
Overcommitment scale	OC1 to OC6	6 to 24
Subscales of the reward scale:		
Esteem	ERI4 and ERI8	2 to 8
Promotion	ERI5, ERI9, and ERI10	3 to 12
Security	ERI6 and ERI7	2 to 8

2.2.2 Reward scale

Reward is measured by seven items (ERI4-ERI10). A sum score of these items varies between 7 and 28. The score coding for the reward scale is reproduced in table 7. The lower the score, the fewer occupational rewards are supposed to be received by the person.

2.2.3 Overcommitment scale

Because the overcommitment questionnaire was already the result of a previous psychometrically validated reduction capturing the essence of this personal pattern of coping with work, it was included without further change into the short version.

2.3 ER-ratio

The established procedure of data analysis consists in estimating the association of single scales, and eventually their interaction, with outcomes of interest. In this context and in accordance with a core theoretical assumption, it was proposed that the interaction of

Table 7: ERI-Questionnaire. Short version. Item coding.

		Strongly disagree	Disagree	Agree	Strongly agree
		(1)	(2)	(3)	(4)
ERI1	I have constant time pressure due to a heavy work load.	☐	☐	☐	☐
ERI2	I have many interruptions and disturbances while performing my job.	☐	☐	☐	☐
ERI3	Over the past few years, my job has become more and more demanding.	☐	☐	☐	☐
ERI4	I receive the respect I deserve from my superior or a respective relevant person.	☐	☐	☐	☐
ERI5	My job promotion prospects are poor. Reverse coding	☐	☐	☐	☐
ERI6	I have experienced or I expect to experience an undesirable change in my work situation. Reverse coding	☐	☐	☐	☐
ERI7	My job security is poor. Reverse coding	☐	☐	☐	☐
ERI8	Considering all my efforts and achievements, I receive the respect and prestige I deserve at work.	☐	☐	☐	☐
ERI9	Considering all my efforts and achievements, my job promotion prospects are adequate.	☐	☐	☐	☐
ERI10	Considering all my efforts and achievements, my salary / income is adequate.	☐	☐	☐	☐
OC1	I get easily overwhelmed by time pressures at work.	☐	☐	☐	☐
OC2	As soon as I get up in the morning I start thinking about work problems.	☐	☐	☐	☐
OC3	When I get home, I can easily relax and 'switch off' work. Reverse coding	☐	☐	☐	☐
OC4	People close to me say I sacrifice too much for my job.	☐	☐	☐	☐
OC5	Work rarely lets me go, it is still on my mind when I go to bed.	☐	☐	☐	☐
OC6	If I postpone something that I was supposed to do today I'll have trouble sleeping at night.	☐	☐	☐	☐

the effort and reward scales in terms of a ratio may capture the imbalance between efforts and rewards at the individual level. The quantification of imbalance at the individual level provides important additional information with a single indicator. This procedure is comparable to the use of synthetic measures in epidemiological studies (e.g. Body Mass Index, see [8, 9] for methodological discussion).

To compute the ER-ratio, the effort score is put in the enumerator and the reward score in the denominator:

$$ER = k\frac{E}{R} \tag{2.1}$$

where E is the effort score, R the reward score, and k a correction factor that may be used to adjust for the unequal number of items of the effort and reward scores. Assuming that one effort item is equivalent to one reward item, we can define the correction factor k as follows:

$$k = \frac{\text{Number of reward items}}{\text{Number of effort items}}. \tag{2.2}$$

With this formulation of k, the interpretation of the ER-ratio is facilitated for descriptive purposes. For $ER = 1$, the person reports one effort for one reward, for $ER < 1$, there are less efforts for each reward, and for $ER > 1$, the person reports more efforts for each reward. In the short version $k = 7/3$, and in the long version either $k = 10/6$ or $k = 10/5$ depending on the number of items used for the effort scale. Please be aware that the cut-off point of $ER = 1$ does not represent a clinically validated threshold. We propose to use the ER-ratio either as continuous variable or as categorical variable based on the quantiles of the distribution (e.g. quartiles, see for example [10, 11]).

3 Psychometric information

3.1 Original version

3.1.1 Scale reliability

Published data document satisfactory internal consistency in terms of Cronbach's α (usually $\alpha > 0.70$) of the three scales of effort, reward and overcommitment. Test-retest-reliability has been analysed in several studies so far with satisfactory results [6, 12, 13]. More recently, multiple assessment of scales has been conducted, using 'Ecological Momentary Assessment' technique documenting a strong correlation between the summary estimate based on the self-administered questionnaire and the momentary estimate based on EMA technique (see table 2 in [14]).

3.1.2 Factorial structure

Exploratory and confirmatory factor analyses were conducted with satisfactory results. In particular, confirmatory factor analyses based on data from five international samples resulted in a good model fit for the unidimensional "effort" and "overcommitment" scales and the three factorial structure of the "reward" scale. Goodness of fit was

assessed by the GFI- and the AGFI-index, in addition to Chi-square and root-mean square residual. For details see [1]. These results were replicated and further validated in several third order confirmatory factor analyses (e.g. [15, 4, 6]). Figure 1) demonstrates the theoretically postulated structure of scales for the short version.

3.1.3 Convergent validity

Several studies have documented the independent explanatory power of the ER scales compared to the scales of the demand-control-model [16] despite the fact that the scales 'demand' and 'effort' show modest to strong correlations (ranging between r = 0.30 and r = 0.60; [17, 18], among others). Independent explanatory power of the ER scales was also demonstrated in case of the model of organizational injustice [19].

3.1.4 Discriminant validity

Significant differences in mean scores of effort, reward and overcommitment according to gender, age, socio-economic status, and other socio-demographic characteristics were observed in a large number of studies. We cannot give here a comprehensive review but, as an example, Wahrendorf et al. (2012) point to the social gradient of effort-reward imbalance (ERI) [20].

3.1.5 Criterion validity

See 'Selected publications on research evidence' on our website http://www.uniklinik-duesseldorf.de/med-soziologie.

3.1.6 Sensitivity to change over time

Importantly, several studies reported convincing sensitivity of the scales to indicate real changes over time [21, 6, 13].

3.2 Short version

3.2.1 Scale reliability

In a study by Leineweber et. al. (2010) all Cronbach's α coefficients are equal to or higher than 0.80 (effort =0.80, reward = 0.84, overcommitment=0.85), indicating a satisfying internal consistency. Item-total correlations varied between 0.55 (0.42 for corrected item-total correlation) and 0.86 (0.78 for corrected item-total correlation) and were all above the threshold of 0.30. In another study [3] all Cronbach's α coefficients were higher than 0.70, suggesting satisfactory internal consistency (Cronbach's alpha of 0.74 for "effort", 0.79 for "reward", and 0.79 for "overcommitment"). Further, all item-total correlation coeffcients were above the threshold of 0.30, indicating considerable consistency of items defining respective scales (see also [22]).
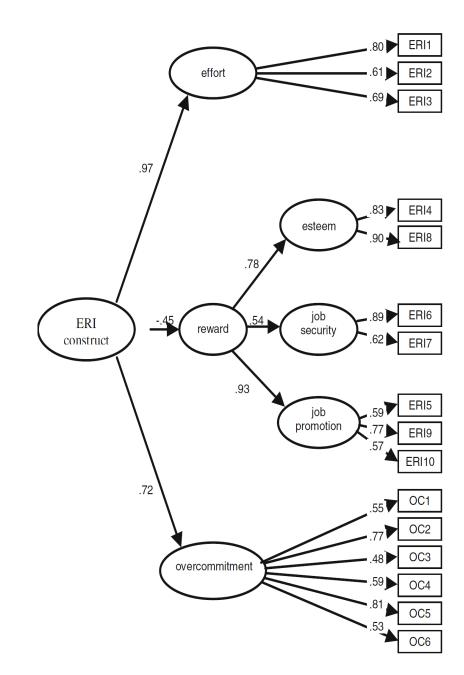
Figure 1: Factorial structure of the effort-reward imbalance model. Source: [3].

3.2.2 Factorial Structure

The ER scales were tested with confirmatory factor analysis (see Figure 1 which represents the second-order model testing the theoretical structure, RMSEA = 95% CI 0.057 - 0.060). This factorial structure was replicated in other studies (e.g. [23]).

3.2.3 Discriminant validity

Again, as indicated for the long version (see Section 3.1.4), the short version scales demonstrated discriminant validity in several studies published so far (e.g. [23, 22, 24, 3]).

3.2.4 Criterion validity

Published studies so far document criterion validity of the short scales with regard to several health measures (see 'Selected publications on research evidence' on our website http://www.uniklinik-duesseldorf.de/med-soziologie).

4 Means of the ER scores from epidemiological studies

In this section we have tabulated the means of the effort, reward, overcommitment, and ER-ratio scores of several epidemiological studies using the original or a slightly modified long version. The range of the scales is heterogeneous and depends on (i) the number ot items and (ii) the range of each Likert item. Moreover, substantial socio-cultural differences are expected. In order to compare the scores across studies it is necessary to transform the original scores into a common scale. The adjusted scores are obtained by applying a linear transformation mapping the original score in the range 0-100. The procedure is as follows. Let x_i be any original scores for person i (i.e. effort, reward or overcommitment scores), $\bar{x}$ the sample mean of the original scores, and σ_x^2 the original sample variance. The adjusted scores y_i for person i are defined by:

$$y_i = a + bx_i \tag{4.1}$$

$$\text{with} \quad a = -\frac{100}{\dfrac{m_u}{m_l} - 1}, \quad b = \frac{100}{m_u - m_l}, \tag{4.2}$$

where $m_l > 0$ and m_u are the minimum and maximum possible score values in the original scores, respectively. Taking into account the definitions of expectation and variance, we can obtain from Equation 4.1 estimates of the adjusted sample mean $\bar{y}$ and variance σ_y^2:

$$\bar{y} = \frac{1}{n} \sum_i y_i = a + b\bar{x} \tag{4.3}$$

$$\sigma_y^2 = \frac{1}{n-1} \sum_i (y_i - \bar{y})^2 = b^2 \sigma_x^2. \tag{4.4}$$

The following section describes the estimation formulae of the adjusted ER-ratios for those who are interested in the exact procedure. Since the comparability of the ER-ratio scores is also limited by the differences in range and number of items in each study, the adjusted scores may be used in this case to obtain the adjusted means and variances of the ER-ratios. If individual data is missing, we can approximate the adjusted mean ER-ratio $\overline{ER}_a$ from the adjusted means and variances of the efforts and rewards by using a normal approximation. Let $N(\mu, \sigma^2)$ denote a normal distribution with expectation μ and variance σ^2. Using Equations 4.3 and 4.4 let $\bar{e}_a$ and σ_e^2 be the adjusted mean and variance of the effort scores, and $\bar{r}_a, \sigma_r^2$ the adjusted mean and variance of the reward scores. From Equation 2.1 we can estimate the adjusted mean of the ER-ratio scores $\overline{ER}_a$ as follows. First, we assume that $\bar{e}_a, \sigma_e^2$, and $\bar{r}_a, \sigma_r^2$ result from normally distributed variables. We can sample in that case n elements from the normal distributions $N(\bar{e}_a, \sigma_e^2)$ and $N(\bar{r}_a, \sigma_r^2) > 0$ and estimate the mean of the n sampled elements:

$$ER_i = k \frac{N_i(\bar{e}_a, \sigma_e^2)}{N_i(\bar{r}_a, \sigma_r^2)}, \quad i = 1, \ldots, n \tag{4.5}$$

$$\overline{ER}_a = \frac{1}{n} \sum_i^n ER_i. \tag{4.6}$$

$$\tag{4.7}$$

Note that the elements sampled from the distributions $N_i(\bar{e}_a, \sigma_e^2)$ and $N_i(\bar{r}_a, \sigma_r^2) > 0$ are taken only in the ranges $[0, 100]$ and $(0, 100]$, respectively. A rough approximation of the adjusted variance of the ER-ratio scores $\widehat{Var}(ER)_a$ becomes thus:

$$\widehat{Var}(ER)_a = \frac{1}{n-1} \sum_i^n (ER_i - \overline{ER}_a)^2 \tag{4.8}$$

In order to estimate more accurately the sample variance of the adjusted ER-ratios, we calibrated the variances in Equation 4.8 with the standard deviations of the ER-ratios reported in the original publications. We were able to obtain better approximations of the sample variances of the adjusted ER-ratios by adding 1 to the adjusted standard deviations, that is, we sampled from the normal distributions given above with variance $\sigma_e^2 + 1$ and $\sigma_r^2 + 1$, respectively. In table 11 we report the results of the calibrated estimates of the original means of the ER-ratios together with the adjusted means. In order to obtain more realistic results, we set $n = 500$ for all studies. The correction factor k in the adjusted ER-ratios is always 1, since the ranges of the adjusted effort and reward scales are expressed in the same range.

Table 8: Means of the effort scores from various epidemiological studies. Standard deviation in parentheses. NA = Not available.

Reference	Country, year	Occupation	Sample size	Items	Likert-scale	Original score	Adjusted mean score
[1]	France, 2004	GAZEL (French National Electric and Gas Company)	6447 men	5	5	11.57 (4.28)	32.85 (21.4)
[1]	France, 2004	GAZEL (French National Electric and Gas Company)	2454 women	5	5	11.34 (4.27)	31.7 (21.35)
[1]	UK, 2004	Whitehall II Study (civil servants)	2783 men	4	5	8.24 (2.8)	26.5 (17.5)
[1]	UK, 2004	Whitehall II Study (civil servants)	914 women	4	5	8.54 (3.12)	28.37 (19.5)
[1]	Sweden, 2004	WOLF (several companies representing different sectors in the Northern region of Sweden, Norrland)	738 men	5	5	13.31 (4.87)	41.55 (24.35)
[1]	Sweden, 2004	WOLF (several companies representing different sectors in the Northern region of Sweden, Norrland)	222 women	5	5	12.31 (4.97)	36.55 (24.85)
[1]	Germany, 2004	Public Transport Employees	256 men	5	5	12.65 (3.93)	38.25 (19.65)
[1]	Germany, 2004	Public Transport Employees	46 women	5	5	11.7 (3.89)	33.5 (19.45)
[1]	Belgium, 2004	Somstress Study (4 companies across Belgium)	2045 men	5	4	14.42 (2.52)	62.8 (16.8)
[1]	Belgium, 2004	Somstress Study (4 companies across Belgium)	1724 women	5	4	14.19 (2.78)	61.27 (18.53)
[25]	The Netherlands, 2000	Blue- and white-collar workers from four companies	775, 82% men, 18% women	6	4	10.9 (3.0)	27.22 (NA)

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Table 8: Means of the effort scores from various epidemiological studies. Standard deviation in parentheses. NA = Not available.

Reference	Country, year	Occupation	Sample size	Items	Likert-scale	Original score	Adjusted mean score
[26]	Spain, 2003	Hospital workers	84 men	6	5	15.75 (4.4)	40.62 (18.33)
[26]	Spain, 2003	Hospital workers	214 women	6	5	16.42 (4.26)	43.42 (17.75)
[27]	Norway, 2008	Municipality employees	1803 men and women	5	5	11.7 (4.2)	33.5 (21)
[28]	Germany, 2007	Teachers	949 men and women	6	5	18.2 (4.24)	50.83 (17.67)
[4]	Greece, 2012	Health professionals	456 men and women	6	4	18 (3.2)	66.67 (17.78)
[29]	Germany, 2013	Gutenberg Health Study: population-based sample	1342 men and women	6	5	13.58 (4.29)	31.58 (17.88)
[30]	Belgium, 2011	NEXT study: Hospital nurses	527 women	6	5	15.2 (4.4)	38.33 (18.33)
[30]	Germany, 2011	NEXT study: Hospital nurses	1054 women	6	5	17.17 (4.06)	46.54 (16.92)
[30]	France, 2011	NEXT study: Hospital nurses	773 women	6	5	15.39 (4.16)	39.12 (17.33)
[30]	Italy, 2011	NEXT study: Hospital nurses	1652 women	6	5	15.53 (4.62)	39.71 (19.25)
[30]	The Netherlands, 2011	NEXT study: Hospital nurses	646 women	6	5	11.55 (3.06)	23.13 (12.75)
[30]	Poland, 2011	NEXT study: Hospital nurses	1281 women	6	5	15.95 (4.48)	41.46 (18.67)
[30]	Slovakia, 2011	NEXT study: Hospital nurses	536 women	6	5	14.93 (4.15)	37.21 (17.29)
[31]	USA, 2010	Hotel room cleaners	827 men and women	5	5	16.3 (4.9)	56.5 (24.5)

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Table 8: Means of the effort scores from various epidemiological studies. Standard deviation in parentheses. NA = Not available.

Reference	Country, year	Occupation	Sample size	Items	Likert-scale	Original score	Adjusted mean score
[32]	China, 2005	Healthcare workers	800 men and women	6	5	15.63 (4.8)	40.13 (20)
[33]	South Korea, 2007	Workers from a a petro-chemical company	908 men	6	5	11.71 (3.39)	23.79 (14.13)
[34]	Thailand, 2008	Garment workers	823 men and women	6	5	11.53 (3.81)	23.04 (15.88)
[35]	Mongolia, 2011	Doctors and nurses	362 men and women	6	5	12.38 (3.82)	26.58 (15.92)
[36]	Iran, 2013	Employees from a synthetic fibre factory	227 men	6	5	10.43 (3.5)	18.46 (14.58)
[37]	Brazil, 2009	Nurses	1509 men and women	6	5	12.8 (NA)	28.33 (NA)
[38]	Jordan, 2013	High school staff	126 men and women	6	5	15.3 (4.4)	38.75 (18.33)

Table 9: Means of the reward scores from various epidemiological studies. Standard deviations in parentheses. NA = Not available.

Reference	Country, year	Occupation	Sample size	Items	Likert-scale	Original score	Adjusted mean score
[1]	France, 2004	GAZEL (French National Electric and Gas Company)	6447 men	11	5	46.71 (7.86)	81.16 (17.86)
[1]	France, 2004	GAZEL (French National Electric and Gas Company)	2454 women	11	5	46.65 (8.24)	81.02 (18.73)
[1]	UK, 2004	Whitehall II Study (civil servants)	2783 men	9	5	34.48 (5.6)	70.78 (15.56)
[1]	UK, 2004	Whitehall II Study (civil servants)	914 women	9	5	33.91 (6.09)	69.19 (16.92)
[1]	Sweden, 2004	WOLF (several companies representing different sectors in the Northern region of Sweden, Norrland)	738 men	11	5	46.4 (7.7)	80.45 (17.5)
[1]	Sweden, 2004	WOLF (several companies representing different sectors in the Northern region of Sweden, Norrland)	222 women	11	5	45.19 (7.1)	77.7 (16.14)
[1]	Germany, 2004	Public Transport Employees	248 men	11	5	41.52 (8.93)	69.36 (20.3)
[1]	Germany, 2004	Public Transport Employees	42 women	11	5	42.79 (9.01)	72.25 (20.48)
[1]	Belgium, 2004	Somstress Study (4 companies across Belgium)	2012 men	11	4	28.86 (4.82)	54.12 (14.61)
[1]	Belgium, 2004	Somstress Study (4 companies across Belgium)	1671 women	11	4	29.17 (4.88)	55.06 (14.79)
[26]	Spain, 2003	Hospital workers	84 men	11	5	37.51 (8.7)	60.25 (19.77)
[26]	Spain, 2003	Hospital workers	214 women	11	5	38.55 (8.46)	62.61 (19.23)

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Table 9: Means of the reward scores from various epidemiological studies. Standard deviations in parentheses. NA = Not available.

Reference	Country, year	Occupation	Sample size	Items	Likert-scale	Original score	Adjusted mean score
[27]	Norway, 2008	Municipality employees	1803 men and women	11	5	47.8 (6.5)	83.64 (14.77)
[28]	Germany, 2007	Teachers	949 men and women	11	5	43.5 (7.04)	73.86 (16)
[4]	Greece, 2012	Health professionals	456 men and women	11	4	26.4 (4.9)	46.67 (14.85)
[29]	Germany, 2013	Gutenberg Health Study: population-based sample	1342 men and women	11	5	48.25 (6.75)	84.66 (15.34)
[30]	Belgium, 2011	NEXT study: Hospital nurses	527 women	11	5	48.36 (5.61)	84.91 (12.75)
[30]	Germany, 2011	NEXT study: Hospital nurses	1054 women	11	5	44.64 (6.47)	76.45 (14.7)
[30]	France, 2011	NEXT study: Hospital nurses	773 women	11	5	47.23 (6.34)	82.34 (14.41)
[30]	Italy, 2011	NEXT study: Hospital nurses	1652 women	11	5	44.19 (7.38)	75.43 (16.77)
[30]	The Netherlands, 2011	NEXT study: Hospital nurses	646 women	11	5	50.39 (4.11)	89.52 (9.34)
[30]	Poland, 2011	NEXT study: Hospital nurses	1281 women	11	5	40.8 (8.03)	67.73 (18.25)
[30]	Slovakia, 2011	NEXT study: Hospital nurses	536 women	11	5	43.42 (7.52)	73.68 (17.09)
[31]	USA, 2010	Hotel room cleaners	827 men and women	11	5	36.2 (12.1)	57.27 (27.5)
[32]	China, 2005	Healthcare workers	800 men and women	11	5	46.28 (7.28)	80.18 (16.55)
[24]	China, 2012	Community-based sample	1916 men and women	7	4	18.88 (2.59)	56.57 (12.33)

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Table 9: Means of the reward scores from various epidemiological studies. Standard deviations in parentheses. NA = Not available.

Reference	Country, year	Occupation	Sample size	Items	Likert-scale	Original score	Adjusted mean score
[33]	South Korea, 2007	Workers from a a petro-chemical company	908 men	11	5	47.96 (7.26)	84 (16.5)
[34]	Thailand, 2008	Garment workers	822 men and women	11	5	48.41 (5.46)	85.02 (12.41)
[35]	Mongolia, 2011	Doctors and nurses	362 men and women	11	5	46.7 (5.94)	81.14 (13.5)
[36]	Iran, 2013	Employees from a synthetic fibre factory	227 men	11	5	40.66 (8.9)	67.41 (20.23)
[37]	Brazil, 2009	Nurses	1509 men and women	11	5	45.2 (NA)	77.73 (NA)
[38]	Jordan, 2013	High school staff	126 men and women	11	5	21.3 (8.7)	23.41 (19.77)

Table 10: Means of the overcommitment scores from various epidemiological studies. Standard deviations in parentheses. NA = Not available.

Reference	Country, year	Occupation	Sample size	Items	Likert-scale	Original score	Adjusted mean score
[1]	France, 2004	GAZEL (French National Electric and Gas Company)	6289 men	6	4	2.51 (0.61)	50.33 (20.33)
[1]	France, 2004	GAZEL (French National Electric and Gas Company)	2404 women	6	4	2.57 (0.63)	52.33 (21)
[1]	UK, 2004	Whitehall II Study (civil servants)	2783 men	5	4	2.02 (0.76)	34 (25.33)
[1]	UK, 2004	Whitehall II Study (civil servants)	914 women	5	4	2.06 (0.78)	35.33 (26)
[1]	Sweden, 2004	WOLF (several companies representing different sectors in the Northern region of Sweden, Norrland)	738 men	6	4	1.79 (0.61)	26.33 (20.33)
[1]	Sweden, 2004	WOLF (several companies representing different sectors in the Northern region of Sweden, Norrland)	222 women	6	4	1.85 (0.61)	28.33 (20.33)
[1]	Germany, 2004	Public Transport Employees	256 men	6	4	2.04 (0.63)	34.67 (21)
[1]	Germany, 2004	Public Transport Employees	48 women	6	4	2.1 (0.61)	36.67 (20.33)
[1]	Belgium, 2004	Somstress Study (4 companies across Belgium)	2056 men	6	4	2.57 (0.6)	52.33 (20)
[1]	Belgium, 2004	Somstress Study (4 companies across Belgium)	1740 women	6	4	2.53 (0.59)	51 (19.67)
[25]	The Netherlands, 2000	Blue- and white-collar workers from four companies	775, 82% men, 18% women	9	2	2.4 (2.5)	26.67 (NA)

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Table 10: Means of the overcommitment scores from various epidemiological studies. Standard deviations in parentheses. NA = Not available.

Reference	Country, year	Occupation	Sample size	Items	Likert-scale	Original score	Adjusted mean score
[26]	Spain, 2003	Hospital workers	84 men	6	4	2.48 (0.59)	49.33 (19.67)
[26]	Spain, 2003	Hospital workers	214 women	6	4	2.63 (0.62)	54.33 (20.67)
[27]	Norway, 2008	Municipality employees	1803 men and women	6	4	12.1 (3.4)	33.89 (18.89)
[4]	Greece, 2012	Health professionals	456 men and women	6	4	14.5 (3.2)	47.22 (17.78)
[29]	Germany, 2013	Gutenberg Health Study: population-based sample	1342 men and women	6	4	13.07 (3.75)	39.28 (20.83)
[30]	Belgium, 2011	NEXT study: Hospital nurses	527 women	6	4	13.57 (3.31)	42.06 (18.39)
[30]	Germany, 2011	NEXT study: Hospital nurses	1054 women	6	4	13.8 (3.53)	43.33 (19.61)
[30]	France, 2011	NEXT study: Hospital nurses	773 women	6	4	13.99 (3.44)	44.39 (19.11)
[30]	Italy, 2011	NEXT study: Hospital nurses	1652 women	6	4	14.22 (3.22)	45.67 (17.89)
[30]	The Netherlands, 2011	NEXT study: Hospital nurses	646 women	6	4	11.79 (2.54)	32.17 (14.11)
[30]	Poland, 2011	NEXT study: Hospital nurses	1281 women	6	4	14.19 (3.23)	45.5 (17.94)
[30]	Slovakia, 2011	NEXT study: Hospital nurses	536 women	6	4	14.98 (2.78)	49.89 (15.44)
[32]	China, 2005	Healthcare workers	800 men and women	6	4	15.95 (2.95)	55.28 (16.39)

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Table 10: Means of the overcommitment scores from various epidemiological studies. Standard deviations in parentheses. NA = Not available.

Reference	Country, year	Occupation	Sample size	Items	Likert-scale	Original score	Adjusted mean score
[24]	China, 2012	Community-based sample	1916 men and women	6	4	15.32 (2.38)	51.78 (13.22)
[33]	South Korea, 2007	Workers from a a petro-chemical company	908 men	6	4	13.58 (2.29)	42.11 (12.72)
[34]	Thailand, 2008	Garment workers	825 men and women	6	4	14.15 (2.48)	45.28 (13.78)
[35]	Mongolia, 2011	Doctors and nurses	362 men and women	6	4	14.36 (3.54)	46.44 (19.67)
[36]	Iran, 2013	Employees from a synthetic fibre factory	227 men	6	4	14.05 (2.7)	44.72 (15)
[37]	Brazil, 2009	Nurses	1509 men and women	6	4	13.6 (NA)	42.22 (NA)
[38]	Jordan, 2013	High school staff	126 men and women	6	4	13.7 (3.5)	42.78 (19.44)

Table 11: Means of the ER-ratio scores from various epidemiological studies. Standard deviations in parentheses. The calibrated values denote the estimates of the original values by using Equation 4.8 and adding 1 standard deviation unit. For the adjusted values the correction factor is $k = 1$.

Reference	Country, year	Occupation	Sample size	k	Original ER-score	Calibrated values	Adjusted ER-ratios
[27]	Norway, 2008	Municipality employees	1803 men and women	2.2	0.6 (0.3)	0.61 (0.24)	0.43 (0.26)
[28]	Germany, 2007	Teachers	949 men and women	1.83	0.81 (0.3)	0.82 (0.27)	0.79 (0.42)
[4]	Greece, 2012	Health professionals	456 men and women	1.83	1.32 (0.41)	1.27 (0.45)	1.63 (1.13)
[29]	Germany, 2013	Gutenberg Health Study: population-based sample	1342 men and women	1.83	0.55 (0.23)	0.59 (0.22)	0.42 (0.24)
[30]	Belgium, 2011	NEXT study: Hospital nurses	527 women	1.83	0.6 (0.23)	0.63 (0.21)	0.52 (0.24)
[30]	France, 2011	NEXT study: Hospital nurses	773 women	1.83	0.62 (0.23)	0.65 (0.23)	0.55 (0.24)
[30]	Germany, 2011	NEXT study: Hospital nurses	1054 women	1.83	0.74 (0.27)	0.76 (0.25)	0.64 (0.28)
[30]	Italy, 2011	NEXT study: Hospital nurses	1652 women	1.83	0.68 (0.33)	0.7 (0.28)	0.58 (0.36)
[30]	Poland, 2011	NEXT study: Hospital nurses	1281 women	1.83	0.78 (0.38)	0.77 (0.35)	0.71 (0.38)
[30]	Slovakia, 2011	NEXT study: Hospital nurses	536 women	1.83	0.67 (0.3)	0.71 (0.27)	0.56 (0.31)
[30]	The Netherlands, 2011	NEXT study: Hospital nurses	646 women	1.83	0.43 (0.13)	0.45 (0.14)	0.29 (0.15)
[31]	USA, 2010	Hotel room cleaners	823 men and women	2.2	1.3 (0.9)	1.1 (0.58)	1.32 (5.29)

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Table 11: Means of the ER-ratio scores from various epidemiological studies. Standard deviations in parentheses. The calibrated values denote the estimates of the original values by using Equation 4.8 and adding 1 standard deviation unit. For the adjusted values the correction factor is $k = 1$.

Reference	Country, year	Occupation	Sample size	k	Original ER-score	Calibrated values	Adjusted ER-ratios
[32]	China, 2005	Healthcare workers	800 men and women	1.83	0.66 (0.34)	0.69 (0.26)	0.57 (0.29)
[24]	China, 2012	Community-based sample	1916 men and women	2.33	0.97 (0.26)	0.96 (0.35)	0.96 (0.49)
[33]	South Korea, 2007	Workers from a a petro-chemical company	908 men	1.83	0.48 (0.26)	0.52 (0.17)	0.34 (0.21)
[35]	Mongolia, 2011	Doctors and nurses	362 men and women	1.83	0.61 (0.28)	0.55 (0.19)	0.36 (0.2)
[36]	Iran, 2013	Employees from a synthetic fibre factory	227 men	1.83	0.54 (0.4)	0.59 (0.25)	0.39 (0.56)

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