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Peer reviewed

## Re: Siegrist J, Dragano N, Nyberg ST et al. validating abbreviated measures of effort-reward imbalance at work in European cohort studies: the IPD-Work consortium

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Dear Editor,

We read with interest the paper by Siegrist et al. (2013) about the validation of short partial or proxy versions of the effort-reward imbalance (ERI) scales in 10 cohorts of the IPD-Work consortium. The validation was conducted using 5 IPD-Work consortium cohorts with original ERI scales. Due to serious methodological problems in the validation procedures, we disagree with the conclusion of the authors that the short partial or proxy versions of ERI scales in the 10 cohorts were validated, or can be used to assess ERI.

First of all, the authors reported that there was “a relatively high degree of heterogeneity of the partial versions of the ERI scales in terms of wording of items and their response format” in the IPD-Work cohorts. They did not explicitly report to what extent the wording of items was different in the 10 cohorts with incomplete ERI scales (BELSTRESS, COPSOQ-2, DWECS, IPAQ, PUMA, FPS, NWCS, POLS, Whitehall II, and WOLF-S) from those in the 5 cohorts with original ERI scales (HNR, SOEP, SLOSH, GAZEL, and WOLF-F). Furthermore, it was

implied in Siegrist et al. (2013) that the wording of 2 items for extrinsic effort and 3 items for reward used in the Whitehall II Study (Kuper et al. 2002) was the same as that in the 5 cohorts with original ERI scales. However, Table 1 below shows that the ERI items used in the Whitehall II Study are substantially different from the original ERI items in terms of wording. If a significantly different wording of ERI items was used for partial ERI scales in the 10 cohorts, the validity of the partial versions cannot be assessed appropriately by statistical analyses with the 5 cohort data in which original ERI items (not the partial versions) were used.

Likewise, if a different response format (e.g., four-point Likert style, strongly disagree to strongly agree) was used for partial or proxy ERI scales, the validity of the partial versions cannot be tested with the 5 cohort data in which original ERI scales with the five-point two-step response format were available [i.e., (1) does not apply; (2) does apply, but subject does not consider herself or himself distressed; (3) does apply and subject considers herself or himself somewhat distressed; (4) does apply and subject considers her or himself distressed; and (5) does apply and subject considers herself and himself very distressed] (Siegrist et al. 2004). One cannot assume that the responses of survey participants to ERI items on a different response format (e.g., four-point Likert scale) will be the same as the responses on the original five-point response scale. More importantly, response item format is theoretically related to what the ERI scales are intended to measure. ERI scales based on the original item response set are intended to assess a combination of the existence of a work stressor and the degree of perceived stress from the work stressor, while ERI scales based on a different response set (e.g., four-point Likert style) are intended to assess only the existence of a work stressor without including the extent of

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**Table 1** The ERI items for extrinsic effort and reward used in the Whitehall II study according to the two sources: the original paper from the Whitehall II study (Kuper et al. 2002) and the IPD-Work paper (Siegrist et al. 2013)

Items	According to the paper by Kuper et al. (2002)	According to the IPD-Work paper by Siegrist et al. (2013)
Extrinsic effort	Do you have to work very fast?	I have constant time pressure due to a heavy work load (ERI 1)
	Do you have to work very intensively?	Over the past few years, my job has become more and more demanding (ERI 6)
	Do you have enough time to do everything?	
	Does your work demand a high level of skill and expertise?	
	Does your job require you to take the initiative?	
	Do you ever get praised for your work?	I receive the respect I deserve from my superiors (ERI 7)
	Does your job provide you with a variety of interesting things?	My job promotion prospects are poor (ERI 11)
Reward	Do you consider your job very important?	Considering all my efforts and achievements, my salary/income is adequate (ERI 17)
	Do your colleagues consider your job very important?	
	How often do you get help and support from your colleagues?	
	How often do you get help and support from your immediate superior?	
	How satisfied are you with your usual take home pay?	
	How satisfied are you with your work prospects?	
	How satisfied are you with the way your abilities are used?	
	How satisfied are you with the interest and skill involved in your job?	

perceived stress. It is illogical to assume that partial versions of ERI scales based on a different item response format and original versions of ERI scales based on the original response format are measuring the same construct.

In addition, the content validity of the partial or proxy versions of ERI scales (particularly, the “reward” scale) in the 10 cohorts is generally weak. This cannot be overcome or improved through statistical analyses. We found that only 2 (reward A and reward E) out of the 7 partial ERI reward scales in the 10 cohorts were built on at least one item for each of the three theoretical dimensions of reward (promotion/financial reward, esteem reward, and job security reward) (Siegrist 1996; Siegrist et al. 2004). The partial version of the reward scale (reward G) was built on ERI items for only one theoretical dimension of reward (promotion). Furthermore, the sensitivities for the ERI ratios based on partial scales (effort A/reward E; and effort B/reward C) against complete scales were low, i.e., less than on average, 0.70 (in other words, false negatives >30 %). It seems inappropriate to call these low sensitivities “acceptable agreements” in the paper by Siegrist et al. (2013). We think that if all partial versions of ERI scales from the 10 cohorts are included in future individual meta-analyses of the IPD-Work consortium, the true associations between effort, reward, and ERI and health outcomes (including “hard” outcomes such as cardiovascular disease) would likely be significantly underestimated in the future analyses.

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