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Validating the short measure of the Effort-Reward Imbalance Questionnaire in older workers in the context of New Zealand

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Abstract: Objectives: The objective of this study was to validate a short version of the Effort-Reward-Imbalance (ERI) questionnaire in the context of New Zealand among older full-time and part-time employees. **Methods:** Data were collected from 1694 adults aged 48-83 years (mean 60 years, 53% female) who reported being in full- or part-time paid employment in the 2010 wave of the New Zealand Health, Work and Retirement study. Scale reliability was evaluated by item-total correlations and Cronbach's alpha. Factorial validity was assessed using multi-group confirmatory factor analyses assessing nested models of configural, metric, scalar and strict invariance across full- and part-time employment groups. Logistic regressions estimated associations of effort-reward ratio and over-commitment with poor physical/mental health, and depressive symptoms. **Results:** Internal consistency of ERI scales was high across employment groups: effort 0.78-0.76; reward 0.81-0.77, and over-commitment 0.83-0.80. The three-factor model displayed acceptable fit in the overall sample (X^2/df = 10.31; CFI = 0.95; TLI = 0.94; RMSEA = 0.075), and decrements in model fit indices provided evidence for strict invariance of the three-factor ERI model across full-time and part-time employment groups. High effort-reward ratio scores were consistently associated with poor mental health and depressive symptoms for both employment groups. High over-commitment was associated with poor mental health and depressive symptoms in both groups and also with poor physical health in the full-time employment group. **Conclusions:** The short ERI questionnaire appears to be a valid instrument to assess adverse psychosocial work characteristics in old full-time and part-time employees in New Zealand.
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Key words: Effort reward imbalance, Full-time and part-time employees, New Zealand, Older workers, Validation

Introduction

Adverse psychosocial work conditions detract fundamentally from the well-being, performance, and health of employees. Effort-reward-imbalance (ERI) is a well-established and empirically widely supported model to assess psychosocial work characteristics. This theoretical model is based on the norm of social reciprocity in social exchange. Accordingly, adverse work conditions are characterized by high efforts and low, inadequate rewards (i.e., money, esteem, career opportunities, and job security). Such a constellation violates the norm of reciprocity and results in negative emotions and stress arousal[1)]. Ample evidence indicates that ERI constitutes a risk factor for negative health effects, in particular, depression and cardiovascular disease[2,3)]. In addition, people with excessive engagement and a desire for being in control (i.e., over-commitment) are seen to be at particular risk for negative effects of an imbalance between efforts and rewards[4)]. Furthermore, over-commitment, as a risky pattern of personal coping with work demands, generates independent health effects[1,4)]. Adverse psychosocial work conditions based on the ERI model can be assessed by a standardized self-report questionnaire, comprising three psychometric scales: effort, reward, and over-commitment[5)].

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There are two versions of the ERI questionnaire: the original, long version, consisting of 23 Likert-scaled items, and the short version with 16 items[6,7]. The shorter version pursues the idea to provide a generic measure for large epidemiological studies[6]. The validity of the short version has been demonstrated in different countries, including Germany[6,8], Sweden[9], Japan[10], China[11], and Italy[12]. In addition, agreement between different abbreviated measures and the original instrument has been demonstrated in 15 European cohort studies[13].

The perception and interpretation of adverse work characteristics may vary according to sociocultural contexts. This holds particularly true if social norms, such as the norm of reciprocity, are involved. Therefore, a validation of the measurement of this theoretical concept in countries and cultures other than those where the concept was developed is required. New Zealand is one such country. This country has a population of approximately 4.4 million people, with the major ethnic groups being European (77%), Māori (indigenous peoples, 15%), Asian (10%), and Pasifika (7%)[14]. In the past years, several instruments measuring psychosocial work characteristics have been applied in New Zealand, such as McLean's Stress-at-work Questionnaire[15], Cooper's Job Stress Questionnaire[16], and the Whitehall II Psychosocial Work Questionnaire[17]. Yet, to the best of our knowledge, there are no scientific reports on the ERI measure from this country. Another important feature of New Zealand workforce is an atypical employment pattern. According to data from the Organization for Economic Co-operation and Development (OECD)[18], the average part-time employment rate in 2015 was 16.8% among 34 OECD countries, 17.2% among 28 European countries, compared to 21.3% for New Zealand. Consequently, at a national level, part-time employment has been recommended to be added to the calculation of the New Zealand Socioeconomic Index of Occupational Status[19]. It has been suggested that part-time employment can produce significant effects on worker' health[20] and can even lead premature death[21]. The link between part-time employment and poor health appears to be mediated by adverse psychosocial work conditions[20,22]. However, research findings have been inconsistent. For instance, some studies have found no association between part-time employment and health[23,24]. Research on psychosocial work environment, in both full- and part-time employment, and health in New Zealand is lacking. In addition, with aging societies worldwide, a greater proportion of the labor market will be made up of older employees. The number of New Zealanders aged 65+ is projected to double over the next few decades, to reach a quarter of the population by 2040. As the proportion of older people in the New Zealand population grows, and that of younger workers decreases rapidly[25], the need for more older people to remain in the workforce for longer is highlighted. How to engage and retain older workers and how to maintain their health and productivity are crucial questions internationally[26]. Recent findings from a large cross-country study[27] on older workers underlines the potentially detrimental effects of effort-reward imbalance and highlights the need to utilize measures that are reliable and valid for the local context.

Therefore, the overall objective of this study was to validate a short version of the ERI measure in the New Zealand context. Specifically, we aimed to (i) examine the psychometric properties of the short ERI questionnaire and its association with indices of physical and mental health in a large sample of older employees in New Zealand, and (ii) compare the results for full-time and part-time workers. The purpose of these analyses was to establish the equivalence of the summated ERI scale scores across workers in full-time and part-time employment. As such, the fit of the three-factor model implied by the scoring routine was assessed over all participant data and the invariance of this model across full- and part-time employment groups assessed.

Methods

Study Sample

Data were obtained from participants responding to the 2010 wave of the New Zealand Health, Work and Retirement (HWR) Study[28], with respondents drawn from longitudinal cohorts recruited in 2006, 2009, and 2010. Cohorts were recruited from random samples of persons aged 55-70 (2006) and 48-82 (2009 and 2010) years drawn from the New Zealand electoral roll. An oversample of persons of Māori descent, the indigenous people of New Zealand, was drawn in 2006 and 2009 to facilitate adequate representation of this important population. In 2010, respondents were aged 48-83 years of age. A paper-based "omnibus" postal survey was employed for data collection. The questionnaire included a broad range of measurement domains including health, wellbeing, relationships, work, retirement, and demographic information. A copy of the questionnaire, a covering letter, and a prepaid return-addressed envelope were sent to the study participants. Of the n = 4358 questionnaires sent out, n = 3305 were returned (76% response rate). Of these respondents, n = 1066 reported being in full-time paid employment, n = 673 in part-time paid employment, n = 1114 retired, with the remainder represented by full-time homemakers (86), full-time students (14), those unemployed and seeking work (42), those unable to work due to a health or disability issue (150), and an "other" or missing employment status (160).

Self-reported full-time or part-time employment status was generally consistent with reported number of hours worked per week. Of the 95.9% of persons in paid employment who reported information on their number of hours worked, "full-time" workers reported working M =

43.30 hours per week (SD = 8.37; 97.1% worked 35 hours+ per week) and "part-time" workers reported working M = 20.45 hours per week (SD = 9.88; 94.0% worked less than 35 hours per week). Participants included in the current analyses were those who reported being in full-time or part-time paid employment and who provided any response to the ERI items: n = 1059 full-time (99.3%); n = 635 part-time (94.4%).

Ethical approval of the study was granted by the Massey University Human Ethics Committee: Palmerston North 05/90; Southern B 09/70 and 13/30. Informed consent was obtained from each participant.

Measures

Effort-reward imbalance (ERI): work-related effort, reward, and over-commitment were measured with a short version of the ERI questionnaire[6]. Effort was assessed with three items (example item: "I have constant time pressure due to a heavy work load"), reward with seven items (example item: "Considering all my efforts and achievements, my salary/income is adequate"), and over-commitment with six items (example item: "People close to me say I sacrifice too much for my job"). Each item had a four-point response option ranging from "strongly disagree" to "strongly agree." Summated scores were calculated for each scale (after appropriate reverse scoring of some items), such that higher scores reflected higher effort, reward, and over-commitment. Furthermore, an effort-reward ratio, the core indicator of the ERI model, was derived to quantify the amount of mismatch between effort and reward for each individual. According to a predefined algorithm and standard procedure[5,7], the ratio was calculated by dividing the effort by reward scale scores (weighted by the number of items). Scale and ratio scores were divided into tertiles for the regression analyses (see below).

Health functioning: Health was assessed using the SF-12 (version 2)[29] Australian and New Zealand form (example item: "During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities?"). The SF-12 has two summary components (physical health and mental health) which were scored using normative subscale scores for New Zealand population derived from the 2008 General Social Survey and factor score coefficients derived from the 2006/07 New Zealand Health Survey[30]. Higher scores reflect better health. In line with previous study[8], the scores for each dimension were categorized into tertiles, with poor health functioning defined by scores in the lowest tertile.

Depressive symptoms: A short-form version of the Center for Epidemiological Studies Depression Scale, the CESD-10[31], was used to screen for depressive symptoms. The 10-item scale included items concerning loneliness, fearfulness, and restless sleep (example item: "I was bothered by things that usually do not bother me"). Items were rated on four-point scales with response options ranging from "rarely or none of the time" to "all of the time," and respondents were asked to indicate how often they had felt that way during the past week. A sum score ranging from 0 to 30 was calculated (after appropriate reverse scoring of two items), with higher scores indicating greater severity of depressive symptoms. Depressive symptoms scores were dichotomized, with a score ≥10 defined as the cut-off for a high level of depressive symptoms[31].

In addition, information on age, gender, marital status, highest educational qualification, and annual personal net income was collected (see Table 1).

Statistical Analysis

Descriptive statistics, group comparisons, and logistic regression analyses were performed using SPSS Statistics 23.0 (IBM SPSS Inc, 2015). Internal reliability was evaluated by assessing internal consistency (Cronbach's alpha) and item-total correlations of the scales[32].

Assessments of factorial validity and group invariance were conducted using in Mplus 7.4. As ERI items were rated on a 4-point Likert-scale and inspection of the index of multivariate kurtosis revealed evidence of non-normality in the sample, data were treated as categorical and analyses were performed using the weighted least squares mean and variance adjusted (WLSMV) estimator[33]. Confirmatory factor analyses were conducted to assess whether a three-factor structure of the 16-item ERI provided an adequate fit to the observed data. Goodness of fit was assessed on the basis of multiple indices including the Root Mean Square Error of Approximation (RMSEA), the Tucker-Lewis index (TFI), and the Comparative Fit Index (CFI). Chi-square for the overall model is also reported. RMSEA values less than 0.06 are considered to indicate good fit and TLI/CFI values greater than.90 are considered to indicate acceptable fit to the data, with values greater than.95 indicating good fit[34,35]. Multi-group confirmatory factor analyses were conducted to assess the equivalence of the ERI measure over full-time and part-time employment groups, with increasingly restrictive nested models of configural (the same items are associated with the same factors), metric (item loadings onto the factors are the same), scalar (item thresholds are held to be the same across groups), and strict (unique variances of items are equal across groups) invariance assessed. The comparative fit of nested models was assessed in regard to differences in CFI and Gamma Hat indices, with differences less than 0.01 and.001, respectively, indicating that the more restrictive model could be confirmed[36].

Logistic regression analyses were used to assess associations between the ERI scales and poor health outcomes, namely physical health, mental health, and depres-

Table 1. Sample characteristics and comparison of full-time and part-time employment groups.

	N	Overall 1694	Full-time 1059	Part-time 635	χ2/F
Age in 2010 (range=48-83; M, SD)	1694	60.07 (6.09)	59.03 (5.53)	61.8 (6.58)	F (1, 1692)=86.30, p<.001
%48-53	316	18.7	20.9	15.0	
%54-59	451	26.6	30.7	19.8	
%60-65	630	37.2	38.0	35.9	χ^2 (4)=105.64, p<.001
%66-71	227	13.4	8.1	22.2	
%72+	70	4.1	2.4	7.1	
Gender					
%Male	800	47.2	55.1	34.0	χ^2 (1)=71.12, p<.001
%Female	894	52.8	44.9	66.0	
Ethnicity					
%European	1100	65.2	65.5	64.7	χ^2 (1) 70.11, p=.744
%Non-European	587	34.8	34.5	35.3	
Marital status					
%Married or *de facto*	1332	79.3	80.4	77.4	χ^2 (1)=2.12, p=.153
%Not married or *de facto*	348	20.7	19.6	22.6	
Highest Qualification					
%No qualifications	381	22.7	21.7	24.3	
%Secondary school	378	22.5	23.0	21.6	χ^2 (3)=8.23, p=.041
%Post-secondary/trade	575	34.2	32.7	36.7	
%Tertiary	347	20.6	22.5	17.5	
Annual income $NZD1000 (M, SD)	1632	48.36 (40.36)	58.9 (41.30)	35.3 (39.00)	F (1, 1630)=132.85, p<.001
Physical Health (M, SD)	1549	49.73 (8.18)	50.74 (7.88)	49.35 (8.08)	F (1, 1547)=13.80, p<.001
Mental Health (M, SD)	1549	50.33 (9.30)	50.03 (8.90)	51.20 (9.05)	F (1, 1547)=4.31, p=.038
CESD-10 (M, SD)	1678	5.95 (4.56)	5.56 (4.31)	6.05 (4.51)	F (1, 1676)=2.68, p=.102

sive symptoms. All ERI scales were included in the same regression models to assess the independent effects of each scale, and adjustments were made for age, gender, marital status, education, and personal income.

Results

Table 1 shows respondent characteristics and a comparison of characteristics by employment group. Those in part-time employment group were older, more likely to be female, have a lower level of education, and a lower annual income than those in the full-time employment group. There were no differences between groups in terms of ethnicity or marital status. The part-time group displayed poorer physical health and better mental health than the full-time group. Groups did not differ on frequency of depressive symptoms.

Item scores and internal consistency of the ERI questionnaire

Proportion of missing item data, means, SDs, corrected item-total correlations for ERI items and overall Cronbach's alpha coefficients for scales are presented in Table 2. There was a generally low level of missing data across all items, suggesting a high level of item acceptability. Highest levels of missing values for both the full-time and part-time groups were observed for items related to potential for job promotion (ERI5 and ERI9). Corrected item-total correlations varied between 0.45 and 0.72 indicating acceptable consistency of all items with their respective overall scale scores. All scales showed reasonable internal consistency both overall, and within full-time (effort = 0.78; reward = 0.81; over-commitment = 0.83) and part-time (effort = 0.76; reward = 0.77; over-commitment = 0.80) employment groups.

Factorial validity

Assessments of factorial validity were restricted to respondents who provided data for at least 14 of the 16 ERI items: n = 1033 (97.6%) full-time; n = 610 part-time (96.1%). Confirmatory analyses were conducted to assess how well the three hypothesized scales represented the data. Results suggest that model fit to the data was less than ideal (M1). Inspection of modification indices suggested that the model fit would be improved by acknowledging a correlation of ERI7 with ERI6 and ERI8 with ERI4, corresponding to the "esteem" and "job security" factors indicated in the theoretical model of the ERI. The

Table 2. Means, SDs, corrected item-total correlations for ERI items.

		Overall (n=1694)				Full-time (n=1059)				Part-time (n=635)			
		N	Mean	SD	Corrected item-total correlation	% missing	Mean	SD	Corrected item-total correlation	% missing	Mean	SD	Corrected item-total correlation
Effort (*overall* α=0.78)													
ERI1	Have constant time pressure	1683	2.33	0.86	0.63	0.4	2.55	0.84	0.63	1.1	1.96	0.76	0.61
ERI2	Have many interruptions	1685	2.50	0.80	0.59	0.3	2.68	0.77	0.59	0.9	2.22	0.76	0.58
ERI3	Job has become more demanding	1685	2.57	0.83	0.63	0.6	2.73	0.80	0.63	0.5	2.30	0.80	0.57
Reward (*overall* α=0.81)													
ERI4	Receive respect I deserve	1656	3.10	0.68	0.54	2.0	3.08	0.70	0.54	2.7	3.12	0.66	0.51
ERI5	Job promotion prospects are poor (R)	1615	2.40	0.83	0.49	4.0	2.46	0.83	0.49	5.8	2.31	0.82	0.38
ERI6	Have experienced undesirable change (R)	1657	2.90	0.78	0.54	1.7	2.86	0.80	0.54	3.0	2.97	0.73	0.45
ERI7	Job security is poor (R)	1662	3.05	0.73	0.53	1.4	3.10	0.73	0.53	2.7	2.97	0.72	0.49
ERI8	Receive respect and prestige I deserve	1658	3.03	0.66	0.64	1.8	3.01	0.68	0.64	2.7	3.05	0.63	0.59
ERI9	Job promotion prospects are adequate	1599	2.71	0.69	0.57	4.5	2.71	0.71	0.57	7.4	2.72	0.66	0.54
ERI10	Salary/income is adequate	1678	2.66	0.75	0.47	0.6	2.64	0.76	0.47	1.6	2.68	0.73	0.47
Over-commitment (*overall* α=0.83)													
OC1	Get easily overwhelmed by time pressures	1679	1.96	0.63	0.49	0.5	1.99	0.64	0.49	1.6	1.90	0.61	0.48
OC2	Soon as get up start thinking about work	1673	2.20	0.75	0.66	0.8	2.31	0.76	0.66	2.05	2.02	0.71	0.57
OC3	Can easily relax and switch off (R)	1681	2.09	0.74	0.65	0.6	2.15	0.76	0.65	1.10	2.00	0.71	0.54
OC4	Sacrifice too much for my job	1662	2.26	0.76	0.47	1.7	2.35	0.77	0.47	2.20	2.11	0.72	0.45
OC5	Work rarely lets me go	1681	2.11	0.76	0.73	0.5	2.22	0.77	0.73	1.26	1.93	0.72	0.71
OC6	If postpone will have trouble sleeping	1677	2.12	0.75	0.57	0.8	2.13	0.74	0.57	1.42	2.10	0.76	0.62

Table 3. Fit indices for the three factor ERI model to data from older New Zealand adults in paid employment (*n*=1643).

Model	χ^2	*df*	*p*	RMSEA	90% CI	CFI	TLI
M1. Three correlated ERI factors	1328.28	101	<.001	0.086	.082-.090	0.939	0.927
M2. Three correlated ERI factors with one error covariance (ERI4 with ERI8)	1148.41	100	<.001	0.080	.076-.084	0.947	0.937
M3. Three correlated ERI factors with two error covariance (ERI6 with ERI7)	1021.24	99	<.001	0.075	.071-.080	0.954	0.944
3 [A] *Full-time*	700.650	99	<.001	0.077	.071-.082	0.953	0.943
3 [B] *Part-time*	447.774	99	<.001	0.076	.069-.083	0.946	0.935

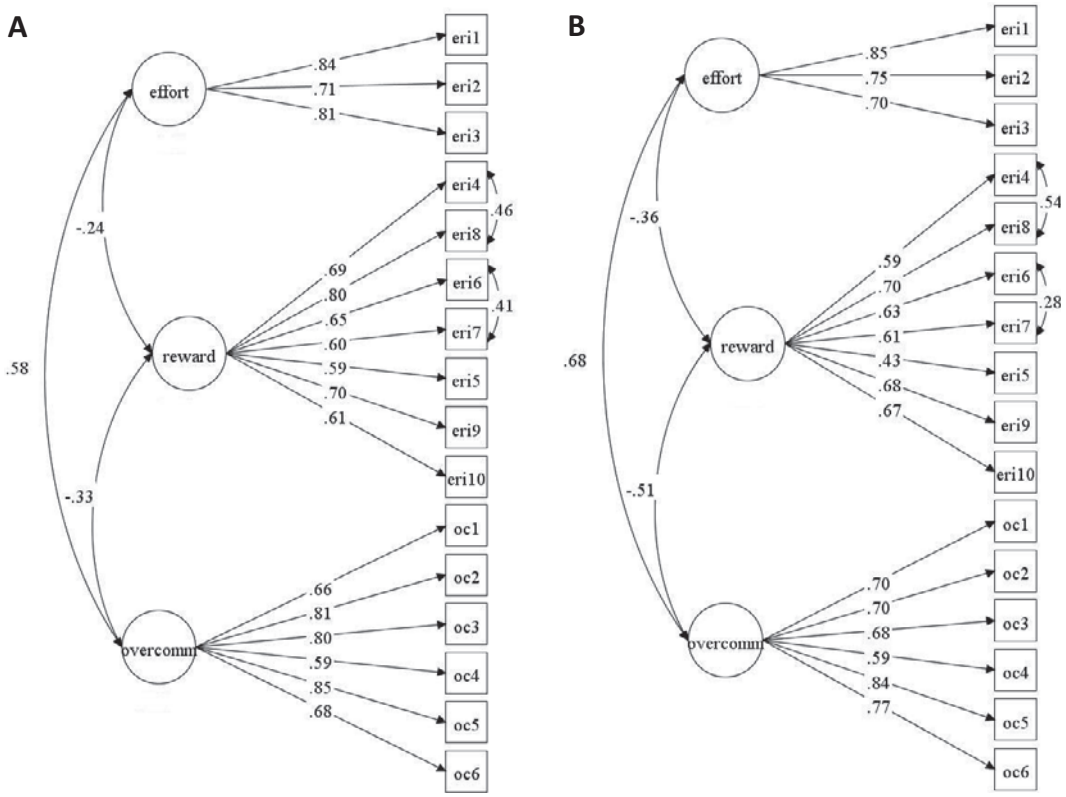

Fig. 1. Standardized coefficients for confirmatory model (model 3) of the Effort-Reward Imbalance Questionnaire for older persons in [A] full-time (n=1033) and [B] part-time (n=610) employment.

final model (M3) provided an acceptable fit to the data. Model fit for the full-time and part-time employment groups is noted in Table 3, with standardized coefficients for each group presented in Fig. 1.

Group invariance

Multi-group confirmatory factor analyses, assessing the relative fit of nested configural, metric, scalar, and strict invariance models of the ERI across groups, were performed to assess whether ERI scales could be meaningfully compared across the full-time and part-time employment groups. Decrements in model fit observed suggest that the ERI displayed strict invariance across groups (Table 4).

Scale scores of the ERI questionnaire

Table 5 details the observed ERI scale scores and ranges definition the low, intermediate, and high tertiles for the effort-reward ratio and over-commitment scores. The proportions of persons in each tertile by the employment group are also presented. Differences in mean scale scores were compared when controlling for age, gender, marital status, education, and annual income. Those in part-time employment reported lower effort, lower over-commitment, and a lower effort-reward ratio than those in full-time employment. There were no differences between groups on reward.

Table 4. Invariance of three correlated factors with two correlated error variances across full-time (n=1033) and part-time (n=610) groups.

Model	χ^2	df	p	RMSEA	90% CI	CFI	GH	ΔCFI	ΔGH
1. Configural	1149.769	198	<.001	0.076	.072-.081	0.951	0.933	.	.
2. Metric	1134.964	211	<.001	0.073	.069-.077	0.952	0.934	.001	.001
3. Scalar	1263.438	240	<.001	0.072	.068-.076	0.947	0.928	.005	.006
4. Strict	1278.873	256	<.001	0.070	.066-.074	0.947	0.927	.000	.003

Note: RMSEA, Root Mean Square Error of Approximation; CFI, Comparative Fit Index; GH, Gamma-hat.

Table 5. descriptive statics and Cronbach's alpha coefficients for ERI scales.

	Overall		Full-time		Part-time		β
	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	
Effort (range 3-12)	1673	7.40 (2.10)	1048	7.96 (2.01)	625	6.46 (1.90)	–.31**
Reward (range 7-28)	1553	19.80 (3.40)	982	19.83 (3.53)	571	19.76 (3.16)	.01 ns
Effort-reward ratio (range 0.25-4.00)	1541	0.92 (0.37)	974	0.99 (0.38)	567	0.80 (0.31)	–.15**
%Low (*0.25-0.74*)	*481*	*31.2*	*367*	*37.7*	*114*	*20.1*	
%Intermediate (*0.75-1.00*)	*541*	*35.1*	*380*	*39.0*	*161*	*28.4*	
%High (*1.01-4.00*)	*519*	*33.7*	*227*	*23.3*	*292*	*51.5*	
Over-commitment (range 6-24)	1639	12.72 (3.20)	1030	13.13 (3.25)	609	12.02 (2.99)	–.26**
%Low (*6-11*)	*607*	*37.0*	*436*	*42.3*	*171*	*28.1*	
%Intermediate (*12-13*)	*552*	*33.7*	*327*	*31.7*	*225*	*36.9*	
%High (*14-24*)	*480*	*29.3*	*267*	*25.9*	*213*	*35.0*	

Note: **p<.001; *ns* p>.05

Regression Analyses

Results of the logistic regression analyses assessing the association of intermediate and high scores on the effort-reward ratio and over-commitment scores with poor health outcomes (relative to lowest tertile scores) are shown in Table 6 for full-time and part-time employment. ERI scales explained a similar proportion of variance in poor health outcomes across the full- and part-time employment groups.

Among full-time employees, the high effort-reward ratio was associated with increased likelihood of poor mental health and depressive symptoms relative to those with a low effort-reward ratio. High over-commitment was associated with an increased likelihood of poor physical health, poor mental health, and depressive symptoms relative to those with low over-commitment. Intermediate over-commitment scores were also associated with an increased likelihood of poor mental health and depressive symptoms; however, the association with poor mental health was attenuated when adjusting for demographic factors. Among part-time employees, the high effort-reward ratio was associated with increased likelihood of poor mental health and depressive symptoms relative to those with low effort-reward imbalance. Intermediate effort-reward imbalance scores were also associated with increased likelihood of poor mental health; however, this association was attenuated when adjusting for demographic factors. High over-commitment was associated with an increased likelihood of poor mental health and depressive symptoms relative to those with low over-commitment.

Discussion

The aim of the present study was to determine the psychometric properties of a short version of the ERI scale in older workers from New Zealand. The results demonstrate a good internal consistency, structural validity, and criterion validity across both full-time and part-time employment groups.

The properties of the short ERI measurement in New Zealand are in line with findings from validation studies in other countries. Reported Cronbach's alpha coefficients are comparable to short ERI versions in Germany[6,8], Sweden[9], and Japan[10], and are higher than in China[11] and Italy[12]. Likewise, the factorial structure is comparable to the theoretical structure and the data defining the short version[6]. In addition, criterion validity was tested with poor mental and physical health as well as with depressive symptoms, known correlates of the adverse psychosocial work environment measured by the ERI model[8,37], as well as the comprehensive evidence in-

Table 6. Associations between work stress and poor health for full- and part-time workers (odds ratios and 95% confidence intervals).

Full-time		Poor Physical Health		Poor Mental Health		Depressive symptoms	
		Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
Full time workers	*n*	886	861	886	861	954	927
Effort-Reward Ratio	Low	1	1	1	1	1	1
	Intermediate	0.93 (0.62, 1.39)	0.98 (0.65, 1.48)	1.28 (0.84, 1.94)	1.37 (0.89, 2.11)	1.18 (0.69, 2.02)	1.37 (0.77, 2.44)
	High	1.26 (0.84, 1.90)	1.38 (0.90, 2.11)	2.87 (1.89, 4.37)***	3.05 (1.97, 4.73)***	1.80 (1.06, 3.06)*	1.93 (1.09, 3.41)*
Over-commitment	Low	1	1	1	1	1	1
	Intermediate	1.31 (0.88, 1.96)	1.21 (0.80, 1.83)	1.56 (1.03, 2.35)*	1.50 (0.98, 2.28)	3.36 (1.73, 6.51)***	3.25 (1.63, 6.49)***
	High	1.53 (1.03, 2.27)*	1.52 (1.01, 2.28)*	2.31 (1.56, 3.43)***	2.38 (1.58, 3.58)***	5.57 (2.94, 10.54)***	6.06 (3.11, 11.82)***
	R^2	0.02	0.06	0.11	0.14	0.10	0.13
Part-time		Poor Physical Health		Poor Mental Health		Depressive symptoms	
		Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
Part time workers	*n*	515	488	515	488	554	527
Effort-Reward Ratio	Low	1	1	1	1	1	1
	Intermediate	0.93 (0.61, 1.44)	1.11 (0.70, 1.76)	1.66 (1.04, 2.64)*	1.61 (0.98, 2.63)	1.56 (0.91, 2.66)	1.58 (0.90, 2.76)
	High	1.27 (0.76, 2.10)	1.55 (0.90, 2.66)	2.06 (1.21, 3.52)**	2.06 (1.17, 3.61)*	2.04 (1.14, 3.65)*	2.16 (1.18, 3.95)*
Over-commitment	Low	1	1	1	1	1	1
	Intermediate	1.42 (0.92, 2.19)	1.35 (0.86, 2.12)	1.29 (0.79, 2.11)	1.39 (0.83, 2.33)	1.24 (0.69, 2.26)	1.23 (0.67, 2.26)
	High	1.44 (0.88, 2.36)	1.54 (0.92, 2.59)	2.27 (1.34, 3.84)**	2.41 (1.38, 4.20)**	2.78 (1.53, 5.06)***	2.86 (1.55, 5.28)***
	R^2	0.01	0.08	0.08	0.14	0.09	0.13

Note: *p<0.05; **p<0.01; ***p<0.001; 'Unadjusted' models include tertriles of effort-reward ratio and over-commitment as model predictors; 'Adjusted' models include both ERI scores as well as age, gender, marital status, education, and annual income.

dicated by two recent meta-analyses[38,39].

Although internal consistency and structural validity of the short ERI were quite similar among the two groups in full-time and part-time employment, some differences between these groups were found in the present study. Employees in full-time employment had higher effort and similar levels of reward, resulting in a somewhat unfavorable effort-reward ratio, compared to employees in part-time employment. This pattern is the same as that observed in another two studies, among younger teachers[40] and older workers from Germany[41]. Regarding the concurrent associations with poor health functioning and depressive symptoms, in line with earlier evidence of positive[20,22] or null[23,24] associations, the findings based on data from New Zealand older workers are mixed. Particularly, we did not find any significant effects of effort-reward ratio on physical health in both full-time and part-time groups. At this point, we could only speculate about some possible causes of these differential effects, for example, additional influence and differing impact of other stressors not assessed in this study. The overall pattern of our results reveals consistent associations of the short ERI with mental health including depressive symptoms, in accordance with a large number of studies worldwide in the past decades[38,39]. Also, stronger effects of over-commitment were found to be related with health outcomes in our study. Conceptually, over-commitment, the intrinsic component of the ERI model which is a specific pattern of coping with demanding situations characterized by excessive engagement and a desire of being in control, could generate independent effects on health[1], although the direct explanatory role of over-commitment in explaining workers' health has been confirmed by a majority of studies, as suggested by a recent review[4].

Concerning implications for the psychosocial work environment, health, and engagement in labor participation among older workers, multicomponent interventions are suggested, according to few available research findings[42]. In view of cross-country perspectives, beneficial effects on psychosocial stress and well-being among older workers have been found under active labor policies and reliable social protection measures[43]. Therefore, at the national policy level of New Zealand, given its second highest employment rate of older workers aged 55 to 64 years among the OECD countries and the fourth highest in the 65 to 69 age group[44], policy settings that encourage older adults to remain in the workforce have contributed to high labor force participation rates for older New Zealanders. These polices include, on one hand, goals around income and employment opportunities, emphasizing the benefits of prolonging workforce participation in terms of productivity for society and health for the individual[45]; on the other hand, removal of a compulsory retirement age, the introduction of legislation to support anti-age discrimination in the workplace, and most importantly, universal superannuation (a government-funded pension available from age 65 years)[45]. The universality of the pension means workers do not need to exit the workforce at 65 years of age in order to receive it, and it is neither income nor asset tested. This provides a clear incentive for remaining in the workforce beyond the traditional retirement age of 65 years[46]. At the organizational level, reducing the nonreciprocity of older workers' career experience shall be of primary interest. This may particularly be effective through re-design of workload and simultaneous improvement of reward at work. Specifically to older workers, overtime work and shift work should be limited; meanwhile respective measures should focus on improved career prospects, particularly providing nonmaterial rewards, such as recognition of older employees' valuable work experience, positive feedback and support to their contribution. Though such intervention programs among older workers are quite sparse[47], some observational evidence did indicate that effort-reward imbalance was significantly associated with ill health, and both factors predicted exit from paid employment due to retirement, unemployment, or disability among older worker from 11 European countries[48]; previous findings from New Zealand also showed that workers intending to retire later reported better health, lower stress level at work, and that they rated the availability of challenging work and the recognition of experience and knowledge more highly compared to those workers intending to retire at age of pension eligibility[49]. As for the full-time and part-time employment, the major reasons for older workers to choose part-time employment are flexible engagement into labor market and/or massive incorporation of family obligations[22]. A study in German older workers revealed that a mediating role of work-family conflict in the association between effort-reward imbalance and depressive symptoms was found in full- and part-time employed women, but only among men in full-time positions[41]. As a result, improving work-family balance would be another organizational measure to promote workers' wellbeing[50]. At the individual level, interventions that strengthen workers' coping ability with stressful work are also needed, considering the strong effects produced by over-commitment in this study. In this regard, some studies reported beneficial effects of becoming psychologically detached from work (i.e., recovery intervention) on workers' well-being[51,52].

Our study has several limitations to address. First, this study drew on cross-sectional data, where longitudinal stability and test-retest reliability could not be determined. Second, a selection bias might have occurred whereby employees with the highest stress or the worst health might have left employment, thus producing a "healthy worker effect." Furthermore, the study population mainly comprised older employees, and therefore, generalization to younger employees cannot be made. As

revealed in a previous study, the perception of effort-reward imbalance could vary with an increase in age, that is, the ratio between effort and reward was higher in the middle-aged compared to the older and the younger age groups[6].

In conclusion, the short ERI represents a valid tool to study adverse psychosocial work characteristics in New Zealand. Moreover, this study confirms good psychometric properties for both full-time and part-time employees.

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