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Measuring precarious employment in Sweden: Translation, adaptation and psychometric properties of the Employment Precariousness Scale (EPRES)

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ABSTRACT

Objectives: Precarious employment is a determinant of poor health and health inequality. However, the evidence of health consequences and mechanisms underlying the associations, are still limited due to a lack of a precise definition and measurement instrument. The Employment Precariousness Scale (EPRES) is a Spanish, multidimensional scale, developed to measure degree of precarious employment. This study aims to translate the EPRES-2010 into Swedish, adapt it to the Swedish context, and to assess the psychometric properties of the Swedish EPRES.

Method: EPRES was translated, adapted and implemented for data collection within the research project PREMIS. During 2016-2017, questionnaire data was collected from 483 non-standard employees in Stockholm, Sweden, sampled with web-based respondent-driven sampling. Analyses included item descriptive statistics, scale descriptive statistics and exploratory factor analysis.

Results: The final EPRES-Se consisted of six dimensions and 23 items. There was a high response rate to all items and response options. Global Cronbach's alpha was 0.83. Subscales 'vulnerability', 'rights' and 'exercise rights' had reliability coefficients between α= 0.78-0.89 and item-subscale correlations between r= 0.48-0.79. 'Temporariness' had poor reliability (α= -0.08) and inter-item correlation (r= -0.04), while 'disempowerment" showed acceptable psychometric properties (α= 0.5; r= 0.34). Exploratory factor analysis confirmed the original EPRES factor structure.

Conclusions: 'Vulnerability', 'wages' 'rights', 'exercise rights' and 'disempowerment' worked in the Swedish context; however 'temporariness' would need revising before

implementing the EPRES-Se in further research. Continued work and validation of EPRES-Se is encouraged. In order to enable international comparisons and multinational studies, similar studies in other European countries are also called for.

Strengths and limitations of this study:

- First translation and adaptation of the EPRES-2010 to Swedish and the Swedish context
- First assessment of the psychometric properties of the EPRES-Se
- Relatively small sample restricted to non-standard employees
- Limited generalizability of results

INTRODUCTION

Precarious employment (PE) is considered a social determinant of poor health and health inequality (1-3). PE is widespread in middle - and poor income countries but is becoming more common also in wealthy countries (4). However, evidence of the health consequences of precarious employment, and by which mechanisms PE harm workers' health, is still limited due to the lack of a precise definition and measurement instrument (5). This lack also brings about challenges in terms of capturing the size of the population in precarious employment, as well as conducting occupational health and safety surveillance (5, 6). The Employment Precariousness Scale (EPRES) is a Spanish questionnaire developed to measure six dimensions of precarious employment. EPRES has previously been validated in Spanish and Chilean populations (7-10), and also applied to the population of Catalonia (11), but as of yet there is no Swedish translation or adaptation.

Precarious Employment

Financial crises, deterioration of labor market conditions, increased trade competition, technological innovations and globalization has had a considerable impact on the dynamics of the labor market (12, 13). These impacts have resulted in a decline in attachment to employers, risk shifting from employer to employees, growth in perceived and actual job insecurity and work-based stress, and increasing unemployment and non-standard work (12). There has been a shift from standard contracts (i.e., open-ended full-time contracts) towards more atypical and flexible

contracts such as part-time work, temporary work, temporary agency work, zero hour contracts, "gig" work arrangements and self-employment (1, 4, 6, 13, 14). Non-standard work can also include holding multiple jobs (15). A comprehensive term used to describe forms of non-standard employment is "precarious employment" (16). These types of employments usually have a higher risk of insecurity – precariousness – , often characterized by low pay and lower levels of social security and rights as compared to standard contracts (3, 4, 13). However, these elements are not exclusively found in non-standard employments *per se*, but could also exist within a standard employment, meaning that employees in a standard employment also are at risk of experiencing precariousness (13, 17, 18). Thereby, it is important to move beyond a simplistic categorical grouping of employment, such as temporary vs. permanent, and instead work towards a multidimensional approach in order to better capture and understand precarious employment (15, 18). As of yet there is no universally accepted definition of precarious employment, although several definitions have been proposed. Commonly, definitions of precarious employment are multidimensional and include several aspects related to the employer-employee relation (2, 5, 19), such as temporariness/insecurity of the employment contract, vulnerability, wages and limited social protection and rights (3, 4, 13, 16, 20-23).

The Employment Precariousness Scale (EPRES)

EPRES is a Spanish, multidimensional scale, developed to measure degree of precarious employment among waged and salaried workers (7). EPRES is comprised of 22 items

and six subscales corresponding to six dimensions: 'temporariness' (contract duration; two items), 'wages' (low or insufficient; possible economic deprivation; three items), 'disempowerment' (level of negotiation of employment conditions; two items), 'vulnerability' (defenselessness to authoritarian treatment; five items), 'rights' (entitlement to workplace rights and social security benefits; four items) and 'exercise rights' (powerlessness, in practice, to exercise workplace rights; six items) (7, 8). EPRES items are scored on a 5-point or 3-point scale, depending on item, and all items taken together will give a global score ranging between 0 (least precarious) and 4 (most precarious) (19). EPRES has demonstrated good acceptability, good internal consistency and evidence of construct validity in Spanish and Chilean populations (7, 8). The original EPRES scale was revised in 2015 (hereafter known as EPRES-2010), which showed good metric properties and improved sensitivity to worker vulnerability and employment stability (9).

Precarious employment in Sweden

Reports show that the Swedish labor market is growing increasingly more insecure (24). Sweden has, according to some definitions, one of the smallest proportions of precarious employees in Europe (21). However, in the perspective of Nordic countries, Sweden has the highest proportion of precarious employed individuals (25) and the highest proportion of fixed-term employment contracts (26). The latter has been around 15-17% since the late 1990's. However, there has been a shift within this group where longer-term positions have been replaced by a higher proportion of on-demand

employees and day laborers, which are more precarious by nature (24, 27, 28). Especially women (19%, compared to 15% among men), 16-24 year olds (56%, compared to 21% among 25-34 year olds and 9% among 35-44 year olds), and foreign born (24%, compared to 15% among individuals born in Sweden) are likely of holding a temporary employment (28). Around 10% of the employees in Sweden are not covered by collective bargaining agreements and around 9% have multiple jobs. The latter has seen an increase with 1.5% since 2005 (27). According to a definition by the Swedish labor policy council, the group of atypical employees is constituted by those that fulfil one of the following: not being covered by a collective bargaining agreement, have a temporary employment, are employed by a temp agency or are self-employed, have their own company, hold multiple jobs or are working in the informal sector. This group of atypical workers is estimated to be around 35-39% of the Swedish workforce (27).

Thus, a translation and adaptation of EPRES to Swedish and the Swedish context is an important step in the direction to fully comprehend the distribution and health consequences of precarious employment in Swedish population.

Aim

The aim of this study was to translate the EPRES-2010 into Swedish, adapt it to the Swedish context, and to assess the psychometric properties of the Swedish EPRES.

METHOD

In order to fulfil the study aims, the EPRES-2010 was first translated into Swedish and subsequently adapted to suit the Swedish context (hereafter known as EPRES-Se). Thereafter, EPRES-Se was piloted and implemented as a part of the survey used in the research project Precarious Employment in Stockholm (PREMIS).

Translation and adaptation of EPRES

The translation and adaptation process of the EPRES-2010 consisted of five steps: 1. Translation from Spanish to Swedish; 2. Cultural adaptation to fit the Swedish context; 3. Back translation to Spanish and adjustments; 4. Pilot testing; 5. Final adaptations based on user feedback in pilot.

1. The Spanish version of the revised EPRES-2010 scale, which has been published elsewhere (9), was translated into Swedish. The translation was done by a bilingual member of the research team (TB) in close discussion with AV, a native Spanish speaker with previous experience of validation studies of EPRES.

2. Several adaptations of the questionnaire were implemented in order to fit Swedish labor market conditions. The questionnaire and its translation was discussed during workshops in the project team, which consisted of Swedish, Spanish and Chilean researchers within public - and occupational health, as well as within the reference group, which consisted of labor union members and workers with experience of precarious employment.

3. Several drafts of the Swedish questionnaire were translated back to Spanish during the adaptation process and discussed until the final translation was decided upon.

4. A two-stage pilot testing was performed: first face-to-face with five volunteers from the reference group, and thereafter online with six volunteers who were currently working but without a permanent full-time employment. The latter were also asked to participate in an evaluation of the survey either via the phone or online.

5. With the input from the pilot, a few minor adaptions were made to the EPRES.

Further, in order to offer non-Swedish speaking participants an opportunity to participate in the PREMIS-study, the PREMIS-survey, including the Swedish version of EPRES, was translated into English by an external, professional, translator. After the translation, minor changes in terms of style and terminology was made by the research group. The English translation of the EPRES-Se was not validated in this study, nor has it been validated in any previous studies.

Implementation of the EPRES-Se

PREMIS is an ongoing, longitudinal, web-based study conducted in Stockholm county, Sweden, aiming at studying health outcomes of precarious employment. In 2016-2017, 483 non-standard employees were sampled with web-based respondent-driven sampling (webRDS). WebRDS uses peer-to-peer recruitment to build a sample from populations that are hard-to-reach and therefore lacks a sampling frame (29).

Questionnaire data was collected through an online survey tool specifically developed for RDS (30). The PREMIS-survey included all the items of the EPRES-Se, questions on employment type, occupational environment, health outcomes and background. The survey could be completed in Swedish or English. Inclusion criteria for participants were: living and/or working in Stockholm County, being aged 18-65 years, having and indicating a Swedish personal identification number, and having a current employment. Exclusion criteria were: having a fixed, full-time, employment, being voluntarily self-employed or being a student. Out of the 483 participants included in the sample, 68 participants were excluded due to being deemed ineligible after participation or due to suspected deception, giving a final sample of 415 participants. The full description of the sampling process for PREMIS has been described elsewhere (31).

Statistical analysis

Item descriptive statistics (mean, standard deviations, response frequencies, missing responses and Pearson item-subscale correlations) and scale descriptive statistics (mean, standard deviations, missing items, range, floor and ceiling effects, and reliability (Cronbach's alpha coefficient) were assessed for the entire sample. Participants answering "No answer" on the question on income (question three in EPRES-Se) were excluded from the analyses of this question due to the ambiguity of the response alternative. Exploratory factor analysis was conducted in order to determine the underlying factor structure of the data. Principal axis factoring, with varimax rotation, extracting eigenvalues >1 was used. Sub-analyses were conducted

without informal workers. Further, as the sample was recruited with respondent-driven sampling (RDS), weighted analyses were conducted in addition to the unweighted analyses. RDSII weights (32) were calculated in RDS Analyst 0.42 for Windows (Los Angeles, CA). The results from these analyses will be shown in full in the supplementary material. All analyses were performed using SPSS version 23 (IBM SPSS Statistics for Windows, Version 23. Armonk, NY:IBM Corp).

Ethical considerations

Permission from the Regional Ethics Committee of Stockholm was given for the study, with dnr: 2016/1291-31/5. Informed consent was attained from all participants by the respondent clicking "Yes" to the question "I understand the information given above and want to participate".

Results

Adaptations of EPRES-Se

The following adaptations were made to the EPRES-Se in comparison with EPRES-2010.

(1) The response alternatives in 'temporariness' were stated as categories of duration, as opposed to a free text value of number of days, months or years in EPRES-2010, in order to increase usability. Further, in the first question, response options "I do not have a contract" was added in order to capture informal work and "Do not know" was added in order to capture poor contractual relationship.

(2) In 'wages', the question of income was presented in local currency (SEK) and intervals were set to ~300 EUR as the 150-200 EUR intervals used in the EPRES-2010 version were perceived as too narrow. In EPRES-2010, intervals were 150 EUR - 200 EUR below a monthly income of 1200 EUR, and 300 EUR above an income of 1201 EUR.

(3) Items on 'disempowerment' were adapted to reflect Swedish collective bargaining agreements: The two response alternatives where working conditions were decided unilaterally by the employer were merged in the Swedish adaptation. As some workers, especially freelancers, are given a fixed budget with no hours specified, the response alternative "Not applicable. I work project-based" was added for the question on how salary was decided upon,

(4) One of the items in 'vulnerability', "afraid to demand better working conditions…", was taken from the original EPRES-scale (7) according to the recommendations made by Vives et al 2015 (9).

(5) In 'rights', the question on pension, which contained both pension due to old age and disability in EPRES-2010, was split in two as these are distinct systems unrelated to one another in the Swedish context. Retirement pension (i.e., pension due to old age) was kept in EPRES-Se and disability pension was removed. However, a new item assessing the right to sickness benefit was added in the subscale instead.

(6) In 'exercise of rights' the item on taking a day off for family reasons was clarified by adding "care of a sick child, care of a sick relative etc." within parentheses.

EPRES-Se

The final version of EPRES-Se consisted of a total of 23 items and six dimensions: 'temporariness' (two items), 'wages' (three items), 'disempowerment' (two items), 'vulnerability' (five items), 'rights' (five items) and 'exercise rights' (six items). As in the EPRES-2010, the response scales were 5-point ordinal scales for 'temporariness' and 'wages', 5-point frequency scales for 'vulnerability' and 'exercise rights', and 3-point categorical scales for 'disempowerment' and 'exercise rights'. See EPRES-Se in supplementary material A.

Coding of EPRES-Se

Similarly as EPRES-2010, subscale scores were computed as averages and transformed into a 0-4 scale. The global EPRES score is the average of the six subscales, ranging from 0-4, where 0 represent the lowest level of precariousness and 4 represent the highest level of precariousness.

For questions in 'temporariness', response options were coded slightly different compared to EPRES-2010 in order to accommodate the changes made in the Swedish version. For instance, in the question of duration of contract, response options "Do not have a contract" and "Do not know" were coded as 4 (most precarious), in comparison with the Spanish version where a contract length of less than six months was coded as 4. In the question on income, intervals were larger and consistent in size, as compared to the Spanish version. The cut-offs for income were based on the Swedish median net income for 2016, which was just above 18000 SEK for individuals 20-64 years of age

(33). The merging of items in 'disempowerment' did not affect coding. The coding of the individual items along with the English translation of EPRES-Se can be found in the supplementary material B.

Issues leading to recoding of 'temporariness' dimension

When conducting the data analyses it was revealed that 79% (n=139) of the respondents answering 'indefinitely' to the EPRES question on contract length ("How long is your current employment contract valid?") also answered that they were employed on demand/by the hour on a question assessing employment type included in the PREMIS-survey. We suspected that this combination could be a type of "zero hour" contract, in which the employer is not required to offer the employee any fixed number of hours of work at all per day, week or month (26). Thereby, this type of employment situation could be regarded as contingent with a high degree of precariousness. This was confirmed as the group indicating an indefinite contract length *and* on-demand/by the hour employment, were most similar (in terms of the other EPRES subscales) to employees with a contract lasting less than 1 month and least alike employees with a fixed-term contract >2 years. Consequently, we re-coded the group with an indefinite contract *and* on demand/by the hour-employment from 0 to 3 (i.e., the same coding as the response alternative <1 month contract). Those with any other employment type and an indefinite contract (n=36) remained coded as 0. See results of subscale-average comparisons in the supplementary material C.

Psychometric properties of EPRES-Se

The demographic characteristics of the sample is shown in Table 1. The sample consisted of a larger proportion 25-29-year olds (45%) compared to the other age-groups, and a larger proportion women (54%) as compared to men. Further, the sample was dominated by workers employed on demand/by the hour (59%).

Table 2 shows the item-descriptive statistics. There was a small proportion of missing values (below 5%). Item means were similar within subscales, with the greatest mean difference found within 'wages' (item mean difference = 1.4). All response options within the items were used by participants, although to a varying extent. Item-subscale correlations were around 0.6-0.8 in 'vulnerability' and 'exercise of rights'; and around 0.4-0.6 in 'wages' and 'rights'. There was a weak correlation between item and subscale in 'disempowerment' and no correlation between item and subscale in 'temporariness'. In the latter, all items correlated higher with their corresponding subscale compared to other subscales.

Table 1. Demographic characteristics of the study population (frequencies and percentages), N=415

		N	%
Age	18-24	122	29
	25-29	185	45
	30-64	108	26
Sex	Male	190	46
	Female	225	54
Employment	Temporary employment	121	29
	Employed on demand/by the hour	243	59
	Self-employed (involuntary)	13	3
	Intern	2	1
	Part-time employed (involuntary)	36	9

Table 3 shows the scale descriptive statistics. The subscale mean scores ranged between 1.5 and 2.3, with a global average of 1.9. The proportion of participants with any missing values in the subscales were around 1%, except in the case of 'wages' where it was 2.2%. The latter also included participants answering "No answer" (n=9). Subscale scores ranged between 0-4, and global scale score ranged between 0.09-3.07. Both floor and ceiling effects were generally low (< 5%), with floor effects being highest for 'disempowerment' (9.2%) and 'vulnerability' (11.7%), and ceiling effects for 'rights' (18.0%). Cronbach's alpha coefficients were around 0.7 or higher for 'wages', 'vulnerability', 'rights' and 'exercise of rights'. Only 'temporariness' exhibited a Cronbach's alpha coefficient close to 0. The global alpha coefficient was 0.83.

The exploratory factor analysis extracted six factors with eigenvalues above 1 (eigenvalues = 5.3; 3.2; 2.3; 1.6; 1.3; 1.1). These factors were the same as in EPRES-2010, thereby confirming the original factor structure. Together, the six factors explained 64.1% of the variance. The six factors and their rotated factor loadings are shown in Table 4. All loadings were above 0.35, except in the case of "length of contract".

Sub-analyses were conducted in order to investigate the potential effect of including informal workers in the sample. Removing informal workers (n=35) had minor influence on the correlation (r=0.002, p=0.974) and reliability (0.003). However, in the factor analysis seven factors with eigenvalues >1 emerged (5.3; 3.2; 2.3; 1.6; 1.3; 1.1; 1.0), explaining 68.5% of the variance. The seventh factor was caused by a split of the temporariness dimension, grouping items on length of contract (duration) and time

working for employer (tenure) in separate factors, with factor loadings of 0.34 and 0.42 respectively.

The weighted population sample results remained virtually the same for item-subscale correlations, Cronbach's alpha coefficients, floor and ceiling effects, as well as factor loadings from the exploratory factor analysis of EPRES-Se, and did thereby not affect the interpretation of the results. See the weighted results in table 1-4 in Supplementary material D.

Table 2. Item descriptive statistics and Pearson item-subscale correlations of EPRES-Se

Item	Missing %[1]	Mean	SD[2]	Response value frequency (%)[3]					Pearson item subscale correlations[4]					
				0	1	2	3	4	T	W	D	V	R	ER
Temporariness[5]														
Length of contract	0.0	2.6	1.1	36 (8.7)	24 (5.8)	75 (18.1)	228 (54.9)	52 (12.5)	**-0.04**	0.04	0.09	0.06	0.08	0.04
Time working empl.	0.0	2.1	0.9	17 (4.1)	92 (22.2)	171 (41.2)	119 (28.7)	16 (3.9)	**-0.04**	0.06	0.10	-0.04	0.31	0.13
Wages														
Income monthly	2.2	2.4	1.2	43 (10.6)	45 (11.1)	87 (21.4)	171 (42.1)	60 (14.8)	0.09	**0.39**	0.13	-0.07	0.29	0.18
Cover basic need	1.0	0.8	0.9	175 (42.6)	171 (41.6)	44 (10.7)	14 (3.4)	7 (1.7)	-0.02	**0.60**	0.08	0.21	0.13	0.27
Cover unforeseen expen.	1.0	1.8	1.1	60 (14.6)	113 (27.5)	136 (33.1)	70 (17.0)	32 (7.8)	0.08	**0.55**	0.08	0.39	0.14	0.26
Disempowerment[5]														
Working hour settled	0.0	2.1	1.2	84 (20.2)	8 (1.9)	110 (26.5)	190 (45.8)	23 (5.5)	0.13	0.17	**0.34**	0.08	0.24	0.21
Salary settled	0.0	2.2	1.2	77 (18.6)	8 (1.9)	101 (24.3)	210 (50.6)	19 (4.6)	0.07	0.03	**0.34**	0.02	0.13	0.10
Vulnerability														
Demand work cond.	1.0	1.6	1.2	79 (19.2)	129 (31.4)	113 (27.5)	63 (15.3)	27 (6.6)	0.01	0.13	0.09	**0.75**	0.04	0.29
Unfair treatment	1.0	1.3	1.1	114 (27.7)	159 (38.7)	67 (16.3)	50 (12.2)	21 (5.1)	-0.03	0.12	0.08	**0.79**	-0.01	0.26
Afraid fired	1.0	1.5	1.2	106 (25.8)	130 (31.6)	81 (19.7)	60 (14.6)	34 (8.3)	0.06	0.20	0.10	**0.78**	0.04	0.35
Treated authoritarian	1.0	1.3	1.1	107 (26.0)	160 (38.9)	87 (21.2)	36 (8.8)	21 (5.1)	-0.04	0.20	-0.01	**0.63**	0.02	0.23
Easily replaced	1.0	1.6	1.3	91 (22.1)	124 (30.2)	92 (22.4)	55 (13.4)	49 (11.9)	0.06	0.22	0.01	**0.74**	0.04	0.27
Rights														
Right parental leave	1.2	1.2	0.8	100 (24.4)	130 (31.7)	180 (43.9)			0.18	0.16	0.25	0.05	**0.59**	0.16
Right retirement	1.2	1.2	0.8	107 (26.1)	113 (27.6)	190 (46.3)			0.26	0.22	0.22	0.07	**0.60**	0.16
Right unemployment	1.2	1.0	0.9	156 (38.0)	100 (24.4)	154 (37.6)			0.15	0.24	0.14	-0.01	**0.60**	0.09
Right severance pay	1.2	1.4	0.6	20 (4.9)	223 (54.4)	167 (40.7)			0.11	0.06	0.03	-0.02	**0.48**	0.03
Right sickness benefits	1.2	1.0	0.9	160 (39.0)	110 (26.8)	140 (34.1)			0.26	0.18	0.16	0.03	**0.53**	0.12
Exercise of rights														

Take weekend off	1.0	1.6	1.2	86 (20.9)	93 (22.6)	154 (37.5)	48 (11.7)	30 (7.3)	-0.01	0.23	0.16	0.18	0.10	**0.62**
Take vacation	1.2	1.9	1.1	50 (12.2)	88 (21.5)	163 (39.8)	77 (18.8)	32 (7.8)	0.14	0.22	0.19	0.30	0.15	**0.68**
Take day off	1.2	1.6	1.1	88 (21.5)	85 (20.7)	166 (40.5)	50 (12.2)	21 (5.1)	0.15	0.19	0.21	0.25	0.16	**0.75**
Take day off, pers.	1.0	1.9	1.2	63 (15.3)	78 (19.0)	159 (38.7)	69 (16.8)	42 (10.2)	0.11	0.21	0.06	0.36	0.07	**0.74**
Sick leave	1.2	1.6	1.2	98 (23.9)	74 (18.0)	163 (39.8)	50 (12.2)	25 (6.1)	0.06	0.22	0.19	0.26	0.12	**0.69**
Go to doctor	1.0	1.1	1.1	140 (34.1)	126 (30.7)	106 (25.8)	25 (6.1)	14 (3.4)	0.11	0.26	0.08	0.25	0.14	**0.64**

[1] Proportion of participants with any missing item; [2] SD=Standard Deviation; [3]Frequency (%) of participants indicating the specific response. 0 indicates the lowest precariousness score, 4 indicating the highest precariousness score. [4] Corrected for overlap, i.e., item is removed from the corresponding subscale. T=Temporariness; W=Wages; D=Disempowerment ;V=Vulnerability; R=Rights; ER=Exercise rights. [5]Inter-item correlations

Table 3. Scale descriptive statistics: range, mean, standard deviation (SD), floor and ceiling effects and Cronbach's alpha coefficient

Subscale	Items	Mean	SD	Missing (%)[1]	Obs. range	Floor %[2]	Ceiling %[2]	Cronbach's alpha
Temporariness	2	2.3	0.7	0.0	0-4	0.5	1.0	-0.08
Wages	3	1.6	0.8	3.1	0-4	4.2	0.7	0.69
Disempowerment	2	2.2	1.0	0.0	0-4	9.2	1.4	0.50
Vulnerability	5	1.5	1.0	1.0	0-4	11.7	1.9	0.89
Rights	5	2.3	1.2	1.2	0-4	2.9	18.0	0.78
Exercise of rights	6	1.6	0.9	1.2	0-4	6.8	1.0	0.88
EPRES-se	23	1.9	0.5	3.4	0.09-3.07	0.2	0.2	0.83

[1] Proportion of participants with any missing item

[2] Proportion of participants with lowest (floor) and highest (ceiling) EPRES-Se scores

Table 4. Factor loadings from exploratory factor analysis of the EPRES-Se

	Factor					
	Exercise rights	Vulnerability	Rights	Wages	Disempowerment	Temporariness
Temporariness						
Length of contract						**0.13**
Time working empl.	0.12		0.35			**-0.37**
Wages						
Income monthly	0.15	-0.16	0.24	**0.49**		0.35
Cover basic need	0.18	0.13		**0.71**		
Cover unforseen expen.	0.12	0.32		**0.79**		-0.11
Disempowerment						
Working hour settled	0.15		0.19		**0.54**	0.16
Salary settled					**0.58**	
Vulnerability						
Demand work cond.	0.14	**0.80**				
Unfair treatment	0.11	**0.84**				
Afraid fired	0.20	**0.80**				
Treated authoritarian	0.11	**0.66**		0.12		0.13
Easily replaced	0.12	**0.77**		0.15		
Rights						
Right parental leave			**0.67**		0.22	
Right retirement			**0.69**		0.16	
Right unemployment			**0.70**	0.11		0.28
Right severance pay			**0.55**		-0.11	
Right sickness benefits			**0.59**		0.12	
Exercise rights						

Take weekend off	**0.65**			0.11		0.14
Take vacation	**0.70**	0.18			0.13	-0.13
Take day off	**0.80**	0.10	0.10		0.13	-0.13
Take day off, pers.	**0.78**	0.24				-0.11
Sick leave	**0.72**	0.11			0.12	0.14
Go to doctor	**0.66**	0.11		0.13		

Table showing factor loadings >0.1

DISCUSSION

Key findings and summary

The scale generally performed well, with a small proportion of missing values across all subscales, usage of all response options and good global reliability. The factor structure established in the Spanish EPRES-2010 (9) was confirmed. The subscales 'vulnerability', 'wages', 'rights' and 'exercise of rights' generally worked well in the Swedish context, with high item-subscale correlations, subscale reliability and factor loadings. However, 'temporariness' did not perform as expected and would need revision. In addition, although 'disempowerment' showed acceptable psychometric properties, the subscale might benefit from additional adaptation.

'Temporariness'

This subscale proved problematic due to several reasons: in terms of factor loading for the item assessing contractual length, the zero item-subscale correlations and negative Cronbach's alpha coefficient. On the basis of these results, we argue that the temporariness dimension should be redesigned. There are multiple reasons for this argument:

First, the very poor psychometric properties indicate that the subscale does not function in the current context. This was further highlighted when removing informal workers, a mere number of 35 participants, splitting the items in 'temporariness' in two – showing greater factor loadings and explained variance. Thus, neither the adapted version nor the version without informal workers were acceptable.

Second, we found that the type of employment in combination with duration of contract was associated with the precariousness of the employee. This in addition to the previous results, highlight that the duration-item is inadequate both on its own and together with the tenure-item, in assessing temporariness. Combining duration and type of employment in an item could be an alternative to capture temporariness. However, the continuous flexibilization of the labor market challenge the standard employment relationship (5), moving towards a future in which the permanent full-time employment situation might no longer represent the norm and the "gold standard". Therefore, incorporating an item on employment type might not be feasible and as its rating and quantification might prove (increasingly) difficult.

Third, it is not necessarily so that the relationship between tenure and temporariness is linear, i.e., that the shorter the tenure the greater the temporariness. In the current context, the Swedish legislation (the Employment Protection Act SFS 1982:80) prevents an employer to hire an employee for more than two years during a five-year period (consecutive or in shorter repeated contracts) (34). Thereby, an employee with an 18-month tenure might be worse off than an employee with a 3-

month tenure in the experience of temporariness. Further, approximately 50% of temporary employees in Sweden has had repeated contracts with the same employer (28). This is likely to contribute to the non-linear association between tenure and duration of contract. In order to adapt EPRES-Se further to the Swedish context, we suggest that further work with the EPRES-Se consider whether the tenure-item could be combined with an item assessing the number of repeated contracts with the same employer or an item assessing how often during a specific time interval the employment contract is up for renewal. It could also be explored whether the tenure-item could be replaced with an item assessing the remaining duration of the contract.

On the basis of this discussion, we suggest that a future development of EPRES-Se takes a novel outlook on the 'temporariness' dimension and includes an evaluation of a number of new items in a population of both standard and non-standard employees.

'Wages'

The income-item showed a factor loading of 0.49, and a correlation of 0.39 with the items assessing how well the income covers basic needs and unforeseen expenses. Previous studies report similar findings for this item (7-9). One explanation to these results is the quantitative nature of the income-item compared to the other items. The majority, 57%, of the participants scored a precariousness level of 3 or 4 on income, which is not surprising as the sample is constituted by young non-standard employees. However, only 5% and 25% of the sample scored a precariousness level of 3 or 4 on

the other two items respectively. How well one can cover basic needs and unforeseen expenses could depend on more than income, such as family support. Approximately 24% of adults aged 20-27 years in Sweden still live at home. This figure is more than 50% in the majority of municipalities in large city regions. About half of those living at home pay nothing in rent (35). As 74% of the sample is between 18-29 years old, it is likely that some of the participants still live at home and receive help from their parents. A more diverse sample in terms of employment could potentially have increased the item-subscale correlation as we would expect more participants with higher income.

Aside from the income-item, the other item-subscale correlations and the subscale reliability were acceptable and only a fraction of the sample did not provide an answer to the item on income (2.2%). Therefore, as in the other EPRES scales, we believe the subscale can be used in its current form in future studies.

'Disempowerment'

The items in 'disempowerment' had acceptable item-subscale correlations and reliability. However, some response options ("my working hours/salary was decided within my working team" and "do not know") were hardly used at all in, indicating that these options might not be appropriate for the current population in the Swedish context. Further, the remaining response options were also inadequate from an adaptational point of view. For example, the working hours/salary being in line with collective bargaining agreements does not imply that the working hours/salary was not set by the employer; these options are not mutually exclusive. In a revised EPRES-Se,

the disempowerment-items would benefit from revision and clarification. Combining response options not mutually exclusive could be considered as one way of improving the subscale, such as "my working hours/salary are in accordance with Swedish law and the collective agreement, decided by my employer" and "my working hours/salary are not in accordance with Swedish law and the collective agreement, decided by my employer".

'Rights'

The new item assessing sickness benefit had an acceptable item-subscale correlation and factor loading, similar to the other item-subscale correlations and factor loadings in the subscale, Further, the subscale reliability was good. Taken together, these results point towards that the new item worked well in the subscale.

Limitations and generalizability

This study finds strength in the fact that it is the first study translating and adapting EPRES-2010 to the Swedish context. It is the first study to use EPRES to collect data in Sweden. In addition, this work provides context-specific recommendations for future research using EPRES-Se. This study is, however, not without limitations.

One of the main limitations is the sample. The sample was restricted to employees with a non-standard employment and the sample was skewed towards on-demand/by the hour employees. EPRES, however, is developed to measure precariousness independent of the type of employment (7). By only sampling non-

standard employees the scale properties cannot be directly compared to similar studies as the heterogeneity of the sample is limited. A sample with greater diversity could have provided better insights as to how the scale behaved. However, as the majority of non-standard contracts in Sweden are on-demand (27) it is not unlikely that the distribution would have been similar if conducting the study again, using the same inclusion criteria. Further, being a convenience sample limits the generalizability of the results.

Conclusion

The study found that the global reliability of the scale was good, that all response options were used for all items and that there were few missing values. Five out of six subscales worked well, considering this being the first translation and adaptation, while one subscale, 'temporariness', did not work at all and would need revision before implementing the scale in further research. As employment precariousness is an emergent determinant of health it is important that PE can be properly measured. The EPRES-Se is an important step in this direction. The researchers therefore encourage others to continue working with EPRES-Se and to validate it further in populations of both standard and non-standard employees. In order to enable international comparisons and multinational studies, similar studies in other European countries are also called for.

STATEMENTS

Author contributions: The study was conceived by TB and GJ. All authors contributed to the design of the study. TB translated and back-translated the EPRES, AV supported the translation process and examined the back translation. JJ collected the data with support from TB and GJ. JJ and TB conducted the analyses. JJ wrote the draft(s) of the manuscript. All authors reviewed the drafts and provided feedback on its content.

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SUPPLEMENTARY MATERIAL

Supplementary material A. EPRES-Se

TEMPORALITET	
1. Hur länge gäller ditt nuvarande kontrakt? Om du har flera arbetsgivare anger du den arbetsgivare du arbetar för flest timmar en genomsnittlig månad.	- Tillsvidare - 2 år eller mer - 1 år eller mer - 6 månader eller mer - 3 månader eller mer - 1 månad eller mer - Kortare än 1 månad - Har inget kontrakt - Vet ej
2. Hur länge har du jobbat för samma arbetsgivare/uppdragsgivare? Om du har flera arbetsgivare anger du den arbetsgivare du arbetar för flest timmar en genomsnittlig månad.	- Mindre än 1 månad - 1 månad till mindre än 3 månader - 3 månader till mindre än 6 månader - 6 månader till mindre än 1 år - 1 år till mindre än 2 år - 2 år till mindre än 5 år - 5 år eller mer
LÖN	
3. Ungefär hur mycket tjänar du per månad netto (efter skatt)? Lägg ihop summan för din vita lön efter skatt + svart lön + eventuell dricks, en genomsnittlig månad.	- 3 000 kr eller mindre - Mellan 3 001 och 6 000 kr - Mellan 6 001 och 9 000 kr - Mellan 9 001 och 12 000 kr - Mellan 12 001 och 15 000 kr - Mellan 15 001 och 18 000 kr - Mellan 18 001 och 21 000 kr - Mellan 21 001 och 24 000 kr - Mellan 24 001 och 27 000 kr - Mellan 27 001 och 30 000 kr - Mer än 30 000 kr - Inget svar
Hur ofta tillåter din nuvarande lön dig att... **4. Täcka dina dagliga grundläggande behov?** **5. Täcka oförutsedda utgifter av betydelse?**	- Alltid - Ofta - Ibland - Sällan - Aldrig

MAKTLÖSHET

6. Hur bestämdes arbetstiderna för ditt nuvarande arbete?
Välj det alternativ som stämmer bäst in på dig. Om du har flera arbetsgivare anger du den arbetsgivare du arbetar för flest timmar en genomsnittlig månad.

- De följer lag och kollektivavtalet
- De bestämdes av arbetsgivaren
- De var en överenskommelse mellan mig och min chef
- De var en överenskommelse i mitt arbetslag
- Vet ej
- Ej relevant, arbetar uppdragsbaserat

7. Hur bestämdes lönen för ditt nuvarande arbete?
Välj det alternativ som stämmer bäst in på dig. Om du har flera arbetsgivare anger du den arbetsgivare du arbetar för flest timmar en genomsnittlig månad.

- Den följer kollektivavtalet
- Den bestämdes av arbetsgivaren
- Den var en överenskommelse mellan mig och min chef
- Den var en överenskommelse i mitt arbetslag
- Vet ej

SÅRBARHET

Ange hur ofta hos din arbetsgivare som...
Om du har flera arbetsgivare anger du den arbetsgivare du arbetar för flest timmar en genomsnittlig månad.

Var god besvara alla frågor.

8. Du är rädd för att kräva bättre arbetsvillkor

9. Du är försvarslös mot orättvis behandling från överordnande

10. Du är rädd för att få sparken om du inte gör allt arbetsgivaren ber om

11. Du blir behandlad auktoritärt

12. De får dig att känna dig lätt utbytbar

- Alltid
- Ofta
- Ibland
- Sällan
- Aldrig

RÄTTIGHETER

Har du rätt till något av följande?
Var god besvara alla frågor.

13. Föräldraledighet

14. Ålderspension

15. A-kassa

16. Avgångsvederlag vid uppsägning

17. Sjukersättning/sjukpenning

- Ja
- Nej
- Vet ej

UTÖVANDE AV RÄTTIGHETER

Hur ofta i den organisation där du arbetar kan du utöva följande rättigheter?
Om du har flera arbetsgivare anger du den arbetsgivare du arbetar för flest timmar en genomsnittlig månad.

Var god besvara alla frågor.

18. Ta helg/veckovila utan problem

19. Ta semesterdagar utan problem

20. Ta en ledig dag av familjeskäl utan problem (vård av sjukt barn, vård av sjuk anhörig etc.)

21. Ta en ledig dag av personliga skäl utan problem

22. Sjukskriva dig utan problem

23. Gå till läkare när du behöver

- Alltid
- Ofta
- Ibland
- Sällan
- Aldrig

Supplementary material B. English translation of EPRES-Se with coding

TEMPORARINESS			Coding
1. How long is your current employment contract valid? If you have more than one employer, please indicate the employer you work the most hours for during an average month.	-	Indefinitely	0
	-	2 years or more	1
	-	1 year or more	1
	-	6 months or more	2
	-	3 months or more	3
	-	1 month or more	3
	-	Less than 1 month	3
	-	Do not have a contract	4
	-	Do not know	4
2. How long have you been working for the same employer? If you have more than one employer, please indicate the employer you work the most hours for during an average month.	-	Less than 1 month	4
	-	1 month to less than 3 months	3
	-	3 months to less than 6 months	3
	-	6 months to less than 1 year	2
	-	1 year to less than 2 years	2
	-	2 years to less than 5 years	1
	-	5 years or more	0
WAGES			
3. Approximately how much do you earn per month after taxes? Add the amount for your salary after tax deductions + salary for illicit work + any tips, during an average month.	-	3000 SEK or less	4
	-	Between 3001 and 6000 SEK	4
	-	Between 6001 and 9000 SEK	3
	-	Between 9001 and 12 000 SEK	3
	-	Between 12 001 and 15 000 SEK	2
	-	Between 15 001 and 18 000 SEK	2
	-	Between 18 001 and 21 000 SEK	1
	-	Between 21 001 and 24 000 SEK	1
	-	Between 24 001 and 27 000 SEK	0
	-	Between 27 001 and 30 000 SEK	0
	-	More than 30 000 SEK	0
	-	No answer	-
How often does your current salary allow you to... **4. Cover you daily basic needs?** **5. Cover unforeseen expenses of significance?**	-	Always	0
	-	Often	1
	-	Sometimes	2
	-	Rarely	3
	-	Never	4

DISEMPOWERMENT

6. How were your working hours settled for your current job? Indicate the alternative that fits you best. If you have more than one employer, please indicate the employer you work the most hours for during an average month.	- My working hours are in accordance with Swedish law and the collective agreement - My employer decided my working hours - My working hours are the result of an agreement between me and my manager - My working hours are the result of an agreement within my work team - Do not know - Not applicable. I work project-based	0 3 2 1 4 2
7. How was the salary settled for your current job? Indicate the alternative that fits you best. If you have more than one employer, please indicate the employer you work the most hours for during an average month.	- My salary is accordance with the collective agreement - My salary was set by my employer - My salary is the result of an agreement between me and my manager - My salary is the result of an agreement in my work team - Do not know	0 3 2 1 4

VULNERABILITY

Indicate how often, at your employer...
If you have more than one employer, please indicate the employer you work the most hours for during an average month.

Please indicate an answer to all of the questions.

8. You feel afraid to demand better working conditions	- Always - Often - Sometimes - Rarely - Never	4 3 2 1 0
9. You are defenceless towards unfair treatment by your superiors		
10. You feel afraid of being fired if you do not comply with everything your employer asks of you		
11. You are treated in an authoritarian manner		

12. You are made to feel easily replaceable

RIGHTS

Do you have the right to any of the following?
Please indicate an answer to all of the questions.

13. Parental leave	- Yes	0
	- No	1
14. Retirement due to old age	- Do not know	2

15. Unemployment insurance fund (A-kassa)

16. Severance pay in the event of termination

17. Sickness benefit

EXERCISE OF RIGHTS

How often, in the organisation where you work, are you able to exercise the following rights?
If you have more than one employer, please indicate the employer you work the most hours for during an average month.

Please indicate an answer to all of the questions.

18. Take the weekend off/ weekly rest without problem	- Always	0
	- Often	1
19. Take vacation days without problem	- Sometimes	2
	- Rarely	3
20. Take a day off for family reasons without problem (care of a sick child, care of a sick relative etc.)	- Never	4

21. Take a day off for personal reasons without problem

22. Go on sick leave without problem

23. Go to the doctor when needed

Supplementary material C. Comparison of subscale means for recoding of participants with an indefinite contract and on demand/by the hour employment

Crosstabulation of type of employment and contractual length

Table showing crosstabulation of type of employment and contractual length (EPRES-Se item 1)

	Type of employment			
Contractual length	**Temporary employment**	**Employed on demand/by the hour**	**Self-employed (involuntary), intern, part-time**	**Total**
Indefinitely	16[a]	139[b]	20[a]	175
2 years or more	3	3	1	7
1 year or more	9	7	1	17
6 months or more	34	32	9	75
3 months or more	24	19	6	49
1 month or more	16	6	2	24
Less than 1 month	11	5	0	16
I do not have a contract	2	21	12	35
Do not know	6	11	0	17
Total	121	243	51	415

[a] Used in comparison 2
[b] Used in comparison 1

1. Comparison of subscale means for employees with an indefinite contractual length and on demand/by the hour employment

Table showing subscale averages for employees with an indefinite contractual length and an on demand/by the hour employment

Subscale	N	Minimum	Maximum	Mean	Std. Deviation
Wages	135	0.00	3.67	1.76	0.72
Disempowerment	139	0.00	4.00	2.22	0.97
Vulnerability	137	0.00	4.00	1.35	0.94
Rights	136	0.00	4.00	2.35	1.06
Exercise of rights	136	0.00	3.50	1.74	0.71
Valid N	134				

Table showing least sum of squares-differences between subscale averages for employees with an on demand/by the hour employment, comparing employees with an indefinite contractual length vs. employees wth any other contractual length

	EPRES-Se item 1. How long is your current employment valid?							
Subscales	**2 y**	**1y**	**6m**	**3m**	**1m**	**<1m**	**No contract**	**I don't know**
Wages	0.014	0.652	0.320	0,100	0.348	0.096	0.142	0.025
Disempowerment	0.386	0.291	0.063	0,360	0.303	0.119	0.053	0.189
Vulnerability	1.216	0.092	0.320	0,004	0.518	0.251	0.461	0.658
Rights	2.086	0.467	0.053	0,659	0.180	0.113	0.123	0.338
Exercise of rights	0.185	0.764	0.135	0,191	0.315	0.040	0.046	0.558
Sum	3.887	2.266	0.891	1.313	1.664	**0.620**	0.824	1.769

2. Comparison of subscale means for employees with an indefinite contractual length and any other type of employment (excluding on demand/by the hour)

Table showing subscale averages for employees with an indefinite contract length and any other type of employment

Subscales	N	Minimum	Maximum	Mean	Std. Deviation
Wages	35	0.33	4.00	1.819	0.919
Disempowerment	36	0.00	4.00	2.194	1.104
Vulnerability	36	0.00	4.00	1.167	0.966
Rights	36	0.00	4.00	2.356	1.182
Exercise of rights	36	0.00	4.00	1.690	0.876
Valid N	35				

Table showing least sum of squares-differences between subscale averages for employees with any other employment (excluding on demand/by the hour employees), comparing employees with an indefinite contractual length vs. employees with any other contractual length

EPRES-Se item 1. How long is your current employment valid?

Subscales	2 y	1y	6m	3m	1m	<1m	No contract	I don't know
Wages	1.402	0.486	0.510	0.624	0.504	0.819	0.264	0.459
Disempowerment	0.569	0.244	0.218	0.094	0.083	0.058	0.377	0.028
Vulnerability	0.533	0.233	0.517	0.667	0.500	0.258	0.276	0.633
Rights	1.456	0.836	0.132	0.276	0.378	0.792	0.298	0.422
Exercise of rights	0.357	0.957	0.252	0.179	0.227	0.311	0.404	0.032
Sum	4.317	2.756	1.629	1.839	1.692	2.238	1.619	1.575

Supplementary material D. Weighted results, table 1-4

Table 1. Weighted demographic characteristics of the study population (percentages), N=415

		%
Age	18-24	34%
	25-29	43%
	30-64	23%
Sex	Male	50%
	Female	50%
Employment	Temporary employment	21%
	Employed on demand/by the hour	64%
	Self-employed (involuntary)	3%
	Intern	1%
	Part-time employed (involuntary)	10%

Table 2. Weighted item descriptive statistics and Pearson item-subscale correlations of EPRES-Se

Item	Missing %[1]	Mean	SD[2]	Response frequency[3]					Pearson item subscale correlations[4]					
				0	1	2	3	4	T	W	D	V	R	ER
Temporariness														
Length of contract[5]	0.0	2.5	1.1	9.5	5.8	17.9	56.0	10.9	**-0.05**	0.03	-0.02	0.06	0.06	0.05
Time working empl.[5]	0.0	2.1	0.9	2.8	22.1	43.8	27.8	3.5	**-0.05**	0.15	0.16	0.05	0.36	0.21
Wages														
Income monthly	3.5	2.6	1.1	6.9	6.6	23.3	47.0	16.1	0.13	**0.40**	0.05	-0.00	0.28	0.24
Cover basic need	1.3	0.8	0.9	40.2	44.2	11.4	2.5	1.7	0.01	**0.62**	0.05	0.27	0.13	0.28
Cover unforeseen expen.	1.3	1.8	1.1	13.3	28.7	34.3	15.6	8.1	0.13	**0.57**	0.08	0.43	0.17	0.22
Disempowerment														
Working hour settled[5]	0.0	2.2	1.2	18.7	0.7	26.3	47.8	6.5	0.08	0.14	**0.33**	0.08	0.19	0.15
Salary settled[5]	0.0	2.2	1.2	19.3	2.1	19.3	54.1	5.2	0.07	-0.03	**0.33**	0.00	0.10	0.12
Vulnerability														
Demand work cond.	1.3	1.5	1.1	21.8	33.0	28.4	11.4	5.4	0.04	0.20	0.09	**0.76**	0.09	0.26
Unfair treatment	1.3	1.2	1.1	28.5	39.2	18.4	9.9	4.0	0.04	0.20	0.08	**0.80**	0.11	0.26
Afraid fired	1.3	1.4	1.2	28.4	30.9	21.4	13.3	6.0	0.09	0.31	0.10	**0.79**	0.17	0.38
Treated authoritarian	1.3	1.2	1.1	28.4	38.1	19.1	9.9	4.5	0.03	0.22	-0.04	**0.64**	0.12	0.23
Easily replaced	1.3	1.6	1.3	21.6	33.2	22.7	11.5	11.1	0.13	0.30	-0.02	**0.74**	0.15	0.24
Rights														
Right parental leave	1.3	1.2	0.8	23.0	33.7	43.3			0.19	0.20	0.22	0.12	**0.59**	0.22
Right retirement	1.3	1.2	0.8	24.4	29.8	45.8			0.29	0.20	0.23	0.17	**0.59**	0.28
Right unemployment	1.3	1.0	0.9	36.7	24.7	38.6			0.13	0.17	0.05	0.07	**0.61**	0.12
Right severance pay	1.3	1.4	0.6	6.0	53.2	40.8			0.14	0.11	0.04	0.05	**0.50**	0.05
Right sickness benefits	1.3	1.0	0.9	38.7	26.8	34.5			0.28	0.15	0.10	0.13	**0.53**	0.15
Exercise of rights														
Take weekend off	1.3	1.7	1.1	19.9	17.4	44.6	11.5	6.5	0.07	0.23	0.14	0.21	0.13	**0.67**
Take vacation	1.3	1.9	1.0	12.3	20.1	43.4	18.3	6.0	0.15	0.25	0.18	0.27	0.19	**0.71**
Take day off	1.3	1.7	1.1	21.4	17.8	41.4	13.6	5.8	0.18	0.22	0.19	0.25	0.20	**0.77**
Take day off, pers.	1.3	1.9	1.1	13.7	19.1	41.8	16.4	9.0	0.12	0.23	0.05	0.37	0.19	**0.71**
Sick leave	1.3	1.6	1.1	21.7	19.1	42.9	12.1	4.1	0.11	0.22	0.15	0.23	0.19	**0.71**
Go to doctor	1.3	1.2	1.1	34.3	27.1	28.2	7.2	3.2	0.19	0.28	0.07	0.24	0.19	**0.68**

[1] Proportion of participants with any missing item; [2] SD=Standard Deviation; [3]Frequency (%) of participants indicating the specific response. 0 indicates the lowest precariousness score, 4 indicating the highest precariousness score. [4] Corrected for overlap, i.e., item is removed from the corresponding subscale. T=Temporariness; W=Wages; D=Disempowerment ;V=Vulnerability; R=Rights; ER=Exercise rights. [5]Inter-item correlations

Table 3. Weighted scale descriptive statistics: range, mean, standard deviation (SD), floor and ceiling effects and Cronbach's alpha coefficient

Subscale	Items	Mean	SD	Missing (%)[1]	Obs. range	Floor %[2]	Ceiling %[2]	Cronbach's alpha
Temporariness	2	2.3	0.7	0.0	0-4	0.3	1.3	-0.10
Wages	3	1.7	0.8	4.7	0-4	2.9	0.9	0.70
Disempowerment	2	2.2	1.0	0.0	0-4	8.7	2.4	0.49
Vulnerability	5	1.4	1.0	1.2	0-4	14.1	2.0	0.90
Rights	5	2.3	1.2	1.3	0-4	3.8	17.7	0.78
Exercise of rights	6	1.6	0.9	1.3	0-4	7.2	1.0	0.89
EPRES-se	23	1.9	0.5	4.8	0.09-3.07	0.2	0.6	0.84

[1] Proportion of participants with any missing item

[2] Proportion of participants with lowest (floor) and highest (ceiling) EPRES-Se scores

Table 4. Weighted factor loadings from exploratory factor analysis of the EPRES-Se

	Factor					
	Exercise rights	**Vulnerability**	**Rights**	**Wages**	**Disempowerment**	**Temporariness**
Temporariness						
Length of contract						**-0.21**
Time working empl.	0.17		0.37		0.14	**-0.39**
Wages						
Income monthly	0.20	-0.11	0.25	**0.49**		-0.24
Cover basic need	0.20	0.19		**0.66**		
Cover unforeseen expen.		0.35		**0.84**		0.18
Disempowerment						
Working hour settled			0.13		**0.43**	
Salary settled					**0.69**	0.16
Vulnerability						
Demand work cond.	0.11	**0.81**				
Unfair treatment		**0.86**				
Afraid fired	0.24	**0.78**		0.12	0.13	-0.11
Treated authoritarian	0.11	**0.68**			-0.14	
Easily replaced		**0.76**		0.17		
Rights						
Right parental leave	0.15		**0.69**		0.20	
Right retirement	0.17		**0.68**		0.24	-0.12
Right unemployment			**0.70**			-0.17
Right severance pay			**0.56**			
Right sickness benefits			**0.60**			0.14
Exercise rights						
Take weekend off	**0.69**			0.11		-0.11
Take vacation	**0.74**	0.12			0.10	
Take day off	**0.82**	0.11				0.14
Take day off, pers.	**0.73**	0.26			-0.10	0.10
Sick leave	**0.74**				0.15	-0.15
Go to doctor	**0.69**		0.11	0.15		

Table showing factor loadings >0.1

The weighted exploratory factor analysis extracted six factor with eigenvalues >1 (eigenvalues: 5.6; 3.0; 2.5; 1.5; 1.4; 1.1). These factors were the same as in EPRES-2010, thereby confirming the EPRES-2010 scale structure. Together, the six factor explained 65.4% of the variance.

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
Outcome data	15*	Report numbers of outcome events or summary measures
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses

Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Measuring precarious employment in Sweden: Translation, adaptation and psychometric properties of the Employment Precariousness Scale (EPRES)

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Measuring precarious employment in Sweden: Translation, adaptation and psychometric properties of the Employment Precariousness Scale (EPRES)

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ABSTRACT

Objectives: Precarious employment is a determinant of poor health and health inequality. However, the evidence of health consequences and mechanisms underlying the associations, are still limited due to a lack of a comprehensive multidimensional definition and measurement instrument. The Employment Precariousness Scale (EPRES) is a Spanish, multidimensional scale, developed to measure degree of precarious employment. The aim of this study was to translate the EPRES-2010 into Swedish, adapt it to the Swedish context, and to assess the psychometric properties of the Swedish EPRES.

Method: EPRES was translated, adapted and implemented for data collection within the research project PREMIS. During 2016-2017, questionnaire data was collected from 483 non-standard employees in Stockholm, Sweden, sampled with web-based respondent-driven sampling. Analyses included item descriptive statistics, scale descriptive statistics and exploratory factor analysis.

Results: The final EPRES-Se consisted of six dimensions and 23 items. There was a high response rate to all items and response options. Global Cronbach's alpha was 0.83. Subscales 'vulnerability', 'rights' and 'exercise rights' had reliability coefficients between α= 0.78-0.89 and item-subscale correlations between r= 0.48-0.78. 'Temporariness' had poor reliability (α= -0.08) and inter-item correlation (r= -0.04), while 'disempowerment" showed acceptable psychometric properties (α= 0.5; r= 0.34). Exploratory factor analysis confirmed the original EPRES factor structure.

Conclusions: 'Vulnerability', 'wages' 'rights', 'exercise rights' and 'disempowerment'

worked in the Swedish context; however 'temporariness' would need revising before implementing the EPRES-Se in further research. Continued work and validation of EPRES-Se is encouraged. In order to enable international comparisons and multinational studies, similar studies in other European countries are also called for.

Strengths and limitations of this study:

- First translation and adaptation of the EPRES-2010 to Swedish and the Swedish context
- First assessment of the psychometric properties of the EPRES-Se
- Relatively small sample restricted to non-standard employees
- Limited generalizability of results

INTRODUCTION

Precarious employment (PE) is considered a social determinant of poor health and health inequality (1-3). PE is present in both developing as well as developed countries (4, 5). However, evidence of the health consequences of precarious employment, and by which mechanisms PE harm workers' health, is still limited due to the lack of a comprehensive multidimensional definition and measurement instrument (6). This lack also brings about challenges in terms of capturing the size of the population in precarious employment, conducting occupational health and safety surveillance (6, 7), as well as cross-country comparisons. The Employment Precariousness Scale (EPRES) is a Spanish questionnaire developed to measure six dimensions of precarious employment. EPRES has previously been validated in Spanish and Chilean populations (8-11), and also applied to the population of Catalonia (12), but as of yet there is no Swedish translation or adaptation.

Precarious Employment

During the past decades, neoliberal economics and policies together with increased globalization, trade competition, technological innovation and financial crises, has had a considerable impact on the dynamics of the labour market (5, 13, 14). These impacts have had several implications, including an increase in privatization, downsizing, outsourcing, a weakening of union input and collective regulation, and a more competitive and uncertain context for workers, with increases in flexible work, unemployment and non-standard employment arrangements (5, 13, 14). Furthermore,

there has been a decline in attachment to employers, risk shifting from employer to employees, growth in perceived and actual job insecurity and work-based stress, as well as diminished bargaining power and rights (13, 14).

Non-standard arrangements, in comparison with standard employment contracts (i.e., open-ended full-time contracts), includes part-time work (underemployment), temporary work, temporary agency work, zero hour contracts, "gig" work arrangements and self-employment (1, 4, 7, 14, 15). Non-standard work can also include holding multiple jobs (16). A comprehensive term used to describe forms of non-standard employment is "precarious employment" (17). Precarious employment does not, however, solely refer to the type of employment, but also to unfavorable employment conditions, such as vulnerability, low pay, low levels of social security and rights (3, 4, 14, 17-21). As these elements are not exclusively found in non-standard employments *per se*, employees in a standard employment also are at risk of experiencing precariousness (14, 22, 23). Thereby, it is important to move beyond a simplistic categorical grouping of employment, such as temporary vs. permanent, and instead work towards a comprehensive multidimensional approach that enables a better understanding of precarious employment (16, 23). Today, several proposals and attempts to create multidimensional constructs capturing precarious employment exist (e.g., (10, 21, 24-26)), but as of yet there is no universally accepted definition.

By the means of a cross-national multidimensional definition and measurement instrument of precarious employment, comparative and more precise estimations of health effects are made possible. Previously, PE has been linked to an array of health

issues including mental and physical health (2, 27) and occupational injuries (28). Previous research on related concepts such as job insecurity and temporary employment also show consistent associations with various health outcomes (29-32). Mechanisms linking precarious employment and health are not yet fully understood but pathways that have been suggested include more harmful working conditions, limited control over one's professional and personal lives, feelings of insecurity and incomes below the subsistence level, which consequently can affect other social determinants of health such as housing quality, lifestyles and so on (33).

The Employment Precariousness Scale (EPRES)

EPRES is a Spanish, multidimensional theory-based scale, developed to measure degree of precarious employment among waged and salaried workers (8). EPRES is comprised of 22 items and six subscales corresponding to six dimensions: 'temporariness' (contract duration; two items), 'wages' (low or insufficient; possible economic deprivation; three items), 'disempowerment' (level of negotiation of employment conditions; two items), 'vulnerability' (defenselessness to authoritarian treatment; five items), 'rights' (entitlement to workplace rights and social security benefits; four items) and 'exercise rights' (powerlessness, in practice, to exercise workplace rights; six items) (8, 9). EPRES items are scored on a 5-point or 3-point scale, depending on item, and all items taken together will give a global score ranging between 0 (least precarious) and 4 (most precarious) (34). EPRES has demonstrated good acceptability, good internal consistency and evidence of construct validity in

Spanish and Chilean populations (8, 9). The original EPRES scale was revised in 2015 (hereafter known as EPRES-2010), which showed good metric properties and improved sensitivity to worker vulnerability and employment stability (10).

Precarious employment in Sweden

It is challenging to put Sweden in a comparative context of precarious employment as there is no consensus on its operationalization. Sweden has, according to some definitions (as defined by a typological approach of 11 indicators), one of the smallest proportions of precarious employees among the Scandinavian countries (19). However, in other measures (defined by involuntary part-time work, temporary employment and fear of job-loss) Sweden has the highest proportion of precarious employed individuals (25) and the highest proportion of fixed-term employment contracts (35) in the same context. Reports show that the Swedish labour market is growing increasingly more insecure, especially for temporary employees (36, 37). The proportion of temporary employees has been stable around 15-17% since the late 1990's (37, 38). There has, however, been reports on a shift within this group where longer-term positions have been replaced by a higher proportion of on-demand employees and day laborers, which are more precarious by nature (36, 37, 39). Especially women (19%, compared to 15% among men), 16-24 year-olds (56%, compared to 21% among 25-34 year-olds and 9% among 35-44 year-olds), and foreign born (24%, compared to 15% among individuals born in Sweden) are likely of holding a temporary employment (37). These are groups that reportedly are exposed to high employment precariousness (19).

Further, around 10% of the employees in Sweden are not covered by collective bargaining agreements and around 9% have multiple jobs. The latter has seen an increase with 1.5% percentage points since 2005 (39). According to a definition by the Swedish Labour Policy Council, the group of atypical employees is constituted by those that fulfil one of the following: not being covered by a collective bargaining agreement, have a temporary employment, are employed by a temp agency or are self-employed, have their own company, hold multiple jobs or are working in the informal sector. This group of atypical workers is estimated to be around 35-39% of the Swedish workforce (39), and likely of experiencing precariousness.

Thereby, despite the stabile levels of temporary employment in Sweden, it could be assumed that the level of precariousness has increased on the Swedish labour market. A study from Finland, however, indicate that the precariat (as defined by atypical employment, previous unemployment, fear of job-loss, poor prospects of employment and low earnings) has not seen an increase the past couple of decades (40). Without longitudinal studies assessing changes in precarious employment over time, evidence in Sweden remains inconclusive.

A translation and adaptation of EPRES to Swedish and the Swedish context is thus an important step in the direction to fully comprehend the distribution and trends of precarious employment in the Swedish population, as well as to allow for cross-country comparisons. Such an instrument would also enable well-needed studies on the health outcomes of precarious employment.

Aim

The aim of this study was to translate the EPRES-2010 into Swedish, adapt it to the Swedish context, and to assess the psychometric properties of the Swedish EPRES.

METHOD

In order to fulfil the study aims, the EPRES-2010 was first translated into Swedish and subsequently adapted to suit the Swedish context (hereafter known as EPRES-Se). Thereafter, EPRES-Se was piloted and implemented as a part of the survey used in the research project Precarious Employment in Stockholm (PREMIS).

Translation and adaptation of EPRES

The translation and adaptation process of the EPRES-2010 consisted of five steps: 1. Translation from Spanish to Swedish; 2. Cultural adaptation to fit the Swedish context; 3. Back translation to Spanish and adjustments; 4. Pilot testing; 5. Final adaptations based on user feedback in pilot.

1. The Spanish version of the revised EPRES-2010 scale, which has been published elsewhere (10), was translated into Swedish. The translation was done by a bilingual member of the research team (TB) in close discussion with AV, a native Spanish speaker with previous experience of validation studies of EPRES.

2. Several adaptations of the questionnaire were implemented in order to fit Swedish labour market conditions. The questionnaire and its translation was discussed during workshops in the project team, which consisted of Swedish, Spanish and Chilean

researchers within public - and occupational health, as well as within the reference group involved in PREMIS, which consisted of labour union members and workers with experience of precarious employment.

3. Several drafts of the Swedish questionnaire were translated back to Spanish during the adaptation process and discussed until the final translation was decided upon.

4. A two-stage pilot testing was performed: first face-to-face with five volunteers from the reference group, and thereafter online with six volunteers who were currently working but without a permanent full-time employment. The latter were also asked to participate in an evaluation of the survey either via the phone or online.

5. With the input from the pilot, a few minor adaptations were made to the EPRES.

Further, in order to offer non-Swedish speaking participants an opportunity to participate in the PREMIS-study, the PREMIS-survey, including the Swedish version of EPRES, was translated into English by an external, professional, translator. After the translation, minor changes in terms of style and terminology was made by the research group. The English translation of the EPRES-Se was not validated in this study, nor has it been validated in any previous studies.

Implementation of the EPRES-Se

PREMIS is an ongoing, longitudinal, web-based study conducted in Stockholm county,

Sweden. PREMIS aims at methodological development in terms of sampling strategies and assessment of precarious employment, as well as at studying health outcomes of precarious employment. In 2016-2017, 483 non-standard employees were sampled with web-based respondent-driven sampling (webRDS). WebRDS uses peer-to-peer recruitment to build a sample from populations that are hard-to-reach and therefore lacks a sampling frame (41). Questionnaire data was collected through an online survey tool specifically developed for RDS (42). The PREMIS-survey included all the items of the EPRES-Se, as well as questions on employment type, occupational environment, health outcomes and background. The survey could be completed in Swedish or English.

As one of the aims of PREMIS was to sample precarious employees with webRDS, a process which has been described elsewhere (43), participation in the study was restricted to individuals considered particularly vulnerable to precarious employment conditions, such as individuals with temporary employment, on-demand employment, involuntary part-time employment and involuntary self-employment. The inclusion criteria for participants were: living and/or working in Stockholm County, being aged 18-65 years, having and indicating a Swedish personal identification number, and having a current employment. Exclusion criteria were: having a fixed, full-time, employment, being voluntarily self-employed or being a student. Out of the 483 participants included in the sample, 68 participants were excluded due to not matching criteria of county (n=6), re-using or giving an incorrect personal number (n = 8 and n=17, respectively), being underage (n = 1) or suspected cheating (i.e., systematic

repeated participation; n=36), giving a final sample of 415 participants.

Statistical analysis

Item descriptive statistics (mean, standard deviations, response frequencies, missing responses and Pearson item-subscale correlations) and scale descriptive statistics (mean, standard deviations, missing items, range, floor and ceiling effects, and reliability (Cronbach's alpha coefficient) were assessed for the entire sample. Participants answering "No answer" on the question on income (question three in EPRES-Se) were excluded from the analyses of this question due to the ambiguity of the response alternative. Exploratory factor analysis was conducted in order to determine the underlying factor structure of the data. Principal axis factoring, with varimax rotation, extracting eigenvalues >1 was used, which is the method used in previous EPRES-studies (8-10). Subanalyses were conducted without informal workers, i.e., participants answering "I have no contract" to the question on contract duration (question one in EPRES-Se). Further, as the sample was recruited with respondent-driven sampling (RDS), weighted analyses were conducted in addition to the unweighted analyses. RDSII weights (44) were calculated in RDS Analyst 0.42 for Windows (Los Angeles, CA). The results from the weighted analyses will be shown in full in the supplementary material. All analyses were performed using SPSS version 23 (IBM SPSS Statistics for Windows, Version 23. Armonk, NY:IBM Corp).

Ethical considerations

Permission from the Regional Ethics Committee of Stockholm was given for the study,

with dnr: 2016/1291-31/5. Informed consent was attained from all participants by the respondent clicking "Yes" to the question "I understand the information given above and want to participate".

Patient and public involvement

In PREMIS, a reference group consisting of individuals with experience from precarious employment and labour union representatives, was involved in the design of the PREMIS-survey (design of survey and formulation of questions not otherwise standardized) and data collection process (deciding on the appropriate compensation for participation, recruitment of participants and testing the survey software) through active discussions and workshops. Results will be disseminated to study participants through the website of the PREMIS-study.

RESULTS

Adaptations of EPRES-Se

The following adaptations were made to the EPRES-Se in comparison with EPRES-2010.

(1) The response alternatives in 'temporariness' were stated as categories, as opposed to free text values of number of days, months or years in EPRES-2010, in order to increase usability in the web-survey context. For the same reason, the question on contract duration which contained three dependent items in EPRES-2010, was

collapsed into one question in EPRES-Se. In addition, the response options "I do not have a contract" was added in order to capture informal work and "Do not know" was added in order to capture poor contractual relationship.

(2) In 'wages', the question of income was presented in local currency (SEK) and intervals were set to ~300 EUR as the 150-200 EUR intervals used in the EPRES-2010 version were perceived as too narrow in the Swedish context. In EPRES-2010, intervals were 150 EUR - 200 EUR below a monthly income of 1200 EUR, and 300 EUR above an income of 1201 EUR.

(3) In EPRES-2010, the two response alternatives capturing working conditions that were decided unilaterally by the employer, were merged into one response option in the Swedish adaptation in order to enhance usability . Further, as some workers, especially freelancers, are given a fixed budget with no hours specified, the response alternative "Not applicable. I work project-based" was added for the question on how salary was decided upon,

(4) One of the items in 'vulnerability', "afraid to demand better working conditions…", was taken from the original EPRES-scale (8) according to the recommendations made by Vives et al. 2015 (10).

(5) In 'rights', the question on pension in EPRES-2010 , which contained both pension due to old age and disability, was split in two as these are distinct systems unrelated to one another in the Swedish context. Retirement pension (i.e., pension due to old age) was kept in EPRES-Se and disability pension was removed. However, a new

item assessing the right to sickness benefit was added in the subscale instead, capturing both long term sick leave and shorter spells of sickness absence.

(6) In 'exercise of rights' the item on taking a day off for family reasons was clarified by adding "care of a sick child, care of a sick relative etc." within brackets.

EPRES-Se

The final version of EPRES-Se consisted of a total of 23 items and six dimensions: 'temporariness' (two items), 'wages' (three items), 'disempowerment' (two items), 'vulnerability' (five items), 'rights' (five items) and 'exercise rights' (six items). As in the EPRES-2010, the response scales were 5-point ordinal scales for 'temporariness', 5-point ordinal and 5-point frequency scales for 'wages', 5-point frequency scales for 'vulnerability' and 'exercise rights', and 5-point and 3-point categorical scales for 'disempowerment' and 'exercise rights', respectively. See EPRES-Se in supplementary material A.

Coding of EPRES-Se

Similarly as EPRES-2010, subscale scores were computed as averages and transformed into a 0-4 scale. The global EPRES score is the average of the six subscales, ranging from 0-4, where 0 represent the lowest level of precariousness and 4 represent the highest level of precariousness.

For questions in 'temporariness', response options were coded slightly different compared to EPRES-2010 in order to accommodate the changes made in the Swedish

version. For instance, in the question of duration of contract, response options "Do not have a contract" and "Do not know" were coded as 4 (most precarious), in comparison with the Spanish version where a contract length of less than six months was coded as 4. In the question on income, intervals were larger and consistent in size, as compared to the Spanish version. The cut-offs for income were based on the Swedish median net income for 2016, which was just above 18000 SEK for individuals 20-64 years of age (45). The merging of items in 'disempowerment' did not affect the coding. The coding of the individual items along with the English translation of EPRES-Se can be found in the supplementary material B.

Issues leading to recoding of 'temporariness' dimension

When conducting the data analyses it was revealed that 79% (n=139) of the respondents answering 'indefinitely' to the EPRES question on contract length ("How long is your current employment contract valid?") also answered that they were employed on demand/by the hour on a question assessing employment type included in the PREMIS-survey. We suspected that this combination could be a type of "zero hour" contract, in which the employer is not required to offer the employee any fixed number of hours of work at all per day, week or month (35). Thereby, this type of employment situation could be regarded as contingent with a high degree of precariousness. This was confirmed as the group indicating an indefinite contract length *and* on-demand/by the hour employment, were most similar (in terms of the other EPRES subscales) to employees with a contract lasting less than 1 month and

least alike employees with a fixed-term contract >2 years. Consequently, we re-coded the group with an indefinite contract *and* on demand/by the hour-employment from 0 to 3 (i.e., the same coding as the response alternative <1 month contract). Those with any other employment type and an indefinite contract (n=36) remained coded as 0. See results of subscale-average comparisons in the supplementary material C.

Psychometric properties of EPRES-Se

The demographic characteristics of the sample is shown in Table 1. The sample consisted of a larger proportion 25-29 year-olds (45%) compared to the other age-groups, and a larger proportion women (54%) as compared to men. Further, the sample was dominated by workers employed on demand/by the hour (59%).

Table 2 shows the item-descriptive statistics. There was a small proportion of missing values (< 3%). Item means were similar within subscales, with the greatest mean difference found within 'wages' (item mean difference = 1.6). All response options within the items were used by participants, although to a varying extent. Item-subscale correlations were around 0.6-0.8 in 'vulnerability' and 'exercise of rights'; and around 0.4-0.6 in 'wages' and 'rights'. There was a weak correlation between item and subscale in 'disempowerment' and no correlation between items in 'temporariness'. With exception of the latter, all items correlated higher with their corresponding subscale compared to other subscales.

Table 1. Demographic characteristics of the study population (frequencies and percentages), N=415

		N	%
Age	18-24	122	29
	25-29	185	45
	30-64	108	26
Sex	Male	190	46
	Female	225	54
Employment	Temporary employment	121	29
	Employed on demand/by the hour	243	59
	Self-employed (involuntary)	13	3
	Intern	2	1
	Part-time employed (involuntary)	36	9

Table 3 shows the scale descriptive statistics. The subscale mean scores ranged between 1.4 and 2.3, with a global average of 1.9. The proportion of participants with any missing values in the subscales were around 1%, except in the case of 'wages' where it was 3.1%. The latter also included participants answering "No answer" (n=9). Subscale scores ranged between 0-4, and global scale score ranged between 0.09-3.07. Both floor and ceiling effects were generally low (< 5%), with floor effects being highest for 'disempowerment' (9.2%) and 'vulnerability' (11.7%), and ceiling effects being highest for 'rights' (18.0%). Cronbach's alpha coefficients were around 0.7 or higher for 'wages', 'vulnerability', 'rights' and 'exercise of rights'. Only 'temporariness' exhibited a Cronbach's alpha coefficient close to 0. The global alpha coefficient was 0.83.

The exploratory factor analysis extracted six factors with eigenvalues above 1 (eigenvalues = 5.3; 3.2; 2.3; 1.6; 1.3; 1.1). The emerging factors were the same as in EPRES-2010, thereby confirming the original factor structure. Together, the six factors explained 64.1% of the variance. The six factors and their rotated factor loadings are

shown in Table 4. All loadings were above 0.35, except in the case of "length of contract".

Subanalyses were conducted in order to investigate the potential effect of including informal workers in the sample (n=35), which had minor influence on the correlation between temporariness-items (r=0.002) and reliability of the subscale (-0.003). However, in the factor analysis seven factors with eigenvalues >1 emerged (5.3; 3.2; 2.3; 1.6; 1.3; 1.1; 1.0), explaining 68.5% of the variance. The seventh factor was caused by a split of the temporariness dimension, grouping items on length of contract (duration) and time working for employer (tenure) in separate factors, with factor loadings of 0.33 and 0.42 respectively.

Analyses for the weighted population sample resulted in virtually the same results in regard to item-subscale correlations, Cronbach's alpha coefficients, floor and ceiling effects, as well as factor loadings from the exploratory factor analysis of EPRES-Se, and did thereby not affect the interpretation of the results. See the weighted results in table 1-4 in Supplementary material D.

Table 2. Item descriptive statistics and Pearson item-subscale correlations of EPRES-Se

Item	Missing %[1]	Mean	SD[2]	Response value frequency (%)[3]					Pearson item subscale correlations[4]					
				0	1	2	3	4	T	W	D	V	R	ER
Temporariness[5]														
Length of contract	0.0	2.6	1.1	36 (8.7)	24 (5.8)	75 (18.1)	228 (54.9)	52 (12.5)	**-0.04**	0.04	0.05	0.06	0.08	0.04
Time working empl.	0.0	2.1	0.9	17 (4.1)	92 (22.2)	171 (41.2)	119 (28.7)	16 (3.9)	**-0.04**	0.06	0.11	-0.04	0.31	0.13
Wages														
Income monthly	2.2	2.4	1.2	43 (10.6)	45 (11.1)	87 (21.4)	171 (42.1)	60 (14.8)	0.09	**0.39**	0.14	-0.07	0.29	0.17
Cover basic need	1.0	0.8	0.9	175 (42.6)	171 (41.6)	44 (10.7)	14 (3.4)	7 (1.7)	-0.02	**0.60**	0.07	0.21	0.13	0.26
Cover unforeseen expen.	1.0	1.8	1.1	60 (14.6)	113 (27.5)	136 (33.1)	70 (17.0)	32 (7.8)	0.08	**0.55**	0.08	0.39	0.14	0.26
Disempowerment[5]														
Working hour settled	0.0	2.1	1.2	84 (20.2)	8 (1.9)	110 (26.5)	190 (45.8)	23 (5.5)	0.12	0.17	**0.34**	0.10	0.26	0.23
Salary settled	0.0	2.2	1.2	77 (18.6)	8 (1.9)	101 (24.3)	210 (50.6)	19 (4.6)	0.07	0.03	**0.34**	0.02	0.13	0.09
Vulnerability														
Demand work cond.	1.0	1.6	1.2	79 (19.2)	129 (31.4)	113 (27.5)	63 (15.3)	27 (6.6)	0.01	0.13	0.09	**0.75**	0.04	0.28
Unfair treatment	1.0	1.3	1.1	114 (27.7)	159 (38.7)	67 (16.3)	50 (12.2)	21 (5.1)	-0.03	0.12	0.08	**0.78**	-0.01	0.26
Afraid fired	1.0	1.5	1.2	106 (25.8)	130 (31.6)	81 (19.7)	60 (14.6)	34 (8.3)	0.06	0.20	0.10	**0.78**	0.04	0.35
Treated authoritarian	1.0	1.3	1.1	107 (26.0)	160 (38.9)	87 (21.2)	36 (8.8)	21 (5.1)	-0.04	0.20	-0.01	**0.63**	0.02	0.23
Easily replaced	1.0	1.6	1.3	91 (22.1)	124 (30.2)	92 (22.4)	55 (13.4)	49 (11.9)	0.06	0.22	0.02	**0.74**	0.04	0.27
Rights														
Right parental leave	1.2	1.2	0.8	100 (24.4)	130 (31.7)	180 (43.9)			0.18	0.16	0.26	0.05	**0.58**	0.16
Right retirement	1.2	1.2	0.8	107 (26.1)	113 (27.6)	190 (46.3)			0.26	0.22	0.23	0.07	**0.60**	0.16
Right unemployment	1.2	1.0	0.9	156 (38.0)	100 (24.4)	154 (37.6)			0.15	0.24	0.15	-0.01	**0.60**	0.08
Right severance pay	1.2	1.4	0.6	20 (4.9)	223 (54.4)	167 (40.7)			0.11	0.06	0.03	-0.02	**0.48**	0.03
Right sickness benefits	1.2	0.9	0.8	160 (39.0)	110 (26.8)	140 (34.1)			0.26	0.18	0.17	0.03	**0.53**	0.12
Exercise of rights														

Take weekend off	1.0	1.6	1.1	86 (20.9)	93 (22.6)	154 (37.5)	48 (11.7)	30 (7.3)	-0.01	0.23	0.18	0.18	0.10	**0.62**
Take vacation	1.2	1.9	1.1	50 (12.2)	88 (21.5)	163 (39.8)	77 (18.8)	32 (7.8)	0.14	0.22	0.20	0.30	0.15	**0.68**
Take day off	1.2	1.6	1.1	88 (21.5)	85 (20.7)	166 (40.5)	50 (12.2)	21 (5.1)	0.15	0.19	0.21	0.24	0.16	**0.75**
Take day off, pers.	1.0	1.9	1.2	63 (15.3)	78 (19.0)	159 (38.7)	69 (16.8)	42 (10.2)	0.11	0.21	0.08	0.36	0.07	**0.74**
Sick leave	1.2	1.6	1.1	98 (23.9)	74 (18.0)	163 (39.8)	50 (12.2)	25 (6.1)	0.06	0.22	0.20	0.26	0.12	**0.69**
Go to doctor	1.0	1.1	1.1	140 (34.1)	126 (30.7)	106 (25.8)	25 (6.1)	14 (3.4)	0.11	0.26	0.09	0.25	0.14	**0.64**

[1] Proportion of participants with any missing item; [2] SD=Standard Deviation; [3]Frequency (%) of participants indicating the specific response. 0 indicates the lowest precariousness score, 4 indicating the highest precariousness score. [4] Corrected for overlap, i.e., item is removed from the corresponding subscale. T=Temporariness; W=Wages; D=Disempowerment ;V=Vulnerability; R=Rights; ER=Exercise rights. [5]Inter-item correlations

Table 3. Scale descriptive statistics: range, mean, standard deviation (SD), floor and ceiling effects and Cronbach's alpha coefficient

Subscale	Items	Mean	SD	Missing (%)[1]	Obs. range	Floor %[2]	Ceiling %[2]	Cronbach's alpha
Temporariness	2	2.3	0.7	0.0	0-4	0.5	1.0	-0.08
Wages	3	1.6	0.8	3.1	0-4	4.2	0.7	0.69
Disempowerment	2	2.1	1.0	0.0	0-4	9.2	1.4	0.50
Vulnerability	5	1.4	1.0	1.0	0-4	11.7	1.9	0.89
Rights	5	2.3	1.2	1.2	0-4	2.9	18.0	0.78
Exercise of rights	6	1.6	0.9	1.2	0-4	6.8	1.0	0.88
EPRES-se	23	1.9	0.5	3.4	0.09-3.07	0.2	0.2	0.83

[1] Proportion of participants with any missing item

[2] Proportion of participants with lowest (floor) and highest (ceiling) EPRES-Se scores

Table 4. Factor loadings from exploratory factor analysis of the EPRES-Se

	Factor					
	Exercise rights	Vulnerability	Rights	Wages	Disempowerment	Temporariness
Temporariness						
Length of contract						**0.12**
Time working empl.	0.12		0.36			**-0.36**
Wages						
Income monthly	0.14	-0.16	0.23	**0.49**		0.35
Cover basic need	0.17	0.13		**0.71**		
Cover unforseen expen.	0.12	0.32		**0.79**		-0.10
Disempowerment						
Working hour settled	0.17		0.21		**0.52**	0.15
Salary settled					**0.60**	
Vulnerability						
Demand work cond.	0.14	**0.80**				
Unfair treatment	0.11	**0.84**				
Afraid fired	0.20	**0.80**				
Treated authoritarian	0.11	**0.66**		0.12		0.13
Easily replaced	0.12	**0.77**		0.15		
Rights						
Right parental leave			**0.67**		0.21	
Right retirement			**0.69**		0.16	
Right unemployment			**0.69**	0.11		0.29
Right severance pay			**0.55**		-0.10	
Right sickness benefits			**0.60**		0.11	
Exercise rights						

Take weekend off	**0.65**			0.10		0.14
Take vacation	**0.70**	0.18			0.12	-0.13
Take day off	**0.80**	0.10	0.10		0.13	-0.13
Take day off, pers.	**0.78**	0.24				-0.10
Sick leave	**0.72**	0.11			0.12	0.15
Go to doctor	**0.66**	0.11		0.13		

Table showing factor loadings >0.1

DISCUSSION

Key findings and summary

The scale generally performed well, with a small proportion of missing values across all subscales, usage of all response options and good global reliability. The factor structure established in the Spanish EPRES-2010 (10) was confirmed. The subscales 'vulnerability', 'wages', 'rights' and 'exercise of rights' generally worked well in the Swedish context, with high item-subscale correlations, subscale reliability and factor loadings. However, 'temporariness' did not perform as expected and would need revision. In addition, although 'disempowerment' showed acceptable psychometric properties, the subscale might benefit from additional adaptation.

'Temporariness'

As opposed to previous studies, (8-10), temporariness yielded very poor psychometric properties. The items in the subscale did not correlate, there was a negative Cronbach's alpha coefficient and a low factor loading for the item on contract duration. Only minor changes in terms of correlation and Cronbach's alpha was initiated by the removal of informal workers and self-employed. This subanalysis

did, however, split the temporariness dimension in two separate factors, both of which had higher factor loadings. On the basis of these results, we believe that the temporariness dimension needs further development and evaluation in a population of both standard and non-standard employees. Based on the results from the present study, we offer the following thoughts on this matter:

Firstly, it is important to acknowledge the sample selection. As the sample was restricted to non-standard employees (i.e., permanent, full-time, employees were excluded), the lower end of the precariousness scale had a smaller proportion than what would be expected if standard employees with longer duration and tenure would have been included in the sample. This limitation is likely to have contributed to the lack of correlation between the items. However, considering that the sample was intentionally recruited in order to capture a population of precariously employed individuals, the poor psychometric properties of temporariness also shows that these items are not necessarily related in a meaningful was when measuring precariousness among non-standard employees.

Secondly, in the current context, the Swedish legislation (the Employment Protection Act SFS 1982:80) prevents an employer to hire an employee for more than two years during a five-year period (consecutive or in shorter repeated contracts) without having to employ (or dismiss) the employee in a permanent contract (46). Thereby, an employee with an 18-month tenure might be more precarious than an employee with a 6-month tenure as the latter has longer time left before being forced in or out. Further, approximately 50% of temporary employees in Sweden has

had repeated contracts with the same employer (37), which is an additional reasons that could contribute to the lack of correlation between tenure and duration of contract.

Thirdly, we found that several participants were employed by the hour or on demand while still indicating an indefinite contract length. This highlights the difficulties in assessing temporariness only by contract duration (and tenure). Temporariness is the dimension most likely to be dependent on context. Given the proposed mechanism of temporariness leading to ill-health mediated via feelings of insecurity, temporariness is most relevant in labour markets which do not offer regulatory protection for certain groups of workers, such as permanent employees in most European countries, which does not apply to the same extent in the USA (47).

However tempting it would be suggest the inclusion of questions regarding "contract type" in a future development of EPRES, the continuous flexibilization of the labour market and fast changes in employment practices in combination with contextual differences, makes it increasingly difficult – at least if international comparison using similar scales is sought after.

From a mechanistic standpoint and with an aspiration to develop a scale which could be used in international comparison independent of context, we believe that an item that measures the future employment opportunities with the current employer as objectively as possible should be developed. EPRES-Se and other translations could further be adapted, for example by combining the contract duration and tenure-items with an item assessing the number of repeated contracts with the same

employer or an item assessing how often during a specific time interval the employment contract is up for renewal. Contract duration could also be complemented or replaced by a question more explicitly assessing the remaining duration of the contract at the time of answering the survey.

'Wages'

The income-item corelated moderately with the other items in the subscale (items assessing how well the income covers basic needs and unforeseen expenses). Previous studies report similar findings for this item (8-10). One explanation to these results is the quantitative nature of the income-item as compared to the other items. Slightly more than half, 57%, of the participants scored a precariousness level of 3 or 4 on income, which is not surprising as the sample is constituted by young non-standard employees. However, only 5% and 25% of the sample scored a precariousness level of 3 or 4 on the other two items respectively. How well one can cover basic needs and unforeseen expenses could depend on more than income, such as family support. Approximately 24% of adults aged 20-27 years in Sweden still live at home. In the majority of municipalities in large city regions, this figure is more than 50% in the majority of municipalities in large city regions. About half of those living at home pay nothing in rent (48). As 74% of the sample is between 18-29 years old, it is likely that at least a part of the participants still live at home and receive help from their family. Including standard employees in the sample could potentially have increased the item-

subscale correlation as we would expect a larger proportion of participants with a high income.

Aside from the income-item, item-subscale correlations for the remaining two items and subscale reliability were acceptable and only a fraction of the sample did not provide an answer to the item on income (2.2%). Therefore, as in the other EPRES scales, we believe the subscale can be used in its current form in future studies.

'Disempowerment'

The items in 'disempowerment' had acceptable item-subscale correlations and reliability. However, some response options ("my working hours/salary was decided within my working team" and "do not know") were hardly used at all in, indicating that these options might not be appropriate for the current population in the Swedish context. Further, the remaining response options were also inadequate from an adaptational point of view. For example, the working hours/salary being in line with collective bargaining agreements does not imply that the working hours/salary was not set by the employer; these options are not mutually exclusive. In a revised EPRES-Se, the disempowerment-items would benefit from revision and clarification. Combining response options not mutually exclusive could be considered as one way of improving the subscale, such as "my working hours are in accordance with Swedish law and the collective agreement, decided by my employer" and "my working hours are not in accordance with Swedish law and the collective agreement, decided by my employer".

'Rights'

The new item assessing sickness benefit had an acceptable item-subscale correlation and factor loading, similar to the other item-subscale correlations and factor loadings in the subscale, Further, the subscale reliability was good. Taken together, these results point towards that the new item worked well in the subscale.

Strengths and limitations

This study finds strength in the fact that it is the first study translating and adapting EPRES-2010 to the Swedish context, as well as the first study to assess the psychometric properties of the resulting EPRES-Se. In addition, this work provides context-specific recommendations for future research using EPRES-Se. This study is, however, not without limitations.

The main limitations is the sample. As this study lies within the frame of the PREMIS-project (43), the sample was restricted to employees with a non-standard employment. EPRES, however, is developed to measure precariousness independent of the type of employment (8). By only assessing the psychometric properties of the scale in a population of non-standard employees, the scale properties cannot be directly compared to similar studies as the heterogeneity of the sample is limited. A sample representative of the entire work force would have provided better insights as to how the scale behaves among Swedish employees. A next step which this study has provided strong grounds for.

Further, being a convenience sample limits the generalizability of the results.

However, as the weighted results confirmed the psychometric properties of the scale, we could expect similar results in a representative sample applying the same sample restrictions.

Conclusion

The study found that EPRES-Se worked well in the current context, with high global reliability, endorsement of all response options (for all items) and few missing values. The psychometric properties for five out of six subscales were satisfactory, considering this being the first translation and adaptation. However, one subscale, 'temporariness', worked poorly and would need revision before implementing the scale in further research. As employment precariousness is an emergent determinant of health it is important that PE can be properly measured. The EPRES-Se is an important step in this direction. We therefore encourage others to continue working with EPRES-Se and to validate it further in populations of both standard and non-standard employees. In order to enable international comparisons and multinational studies, similar studies in other European countries are also called for.

STATEMENTS

Author contributions: The study was conceived by Theo Bodin (TB) and Gun Johansson (GJ). All authors, TB, GJ, Johanna Jonsson (JJ), Alejandra Vives (AV), Joan Benach (JB), Katarina Kjellberg (KK) and Jenny Selander (JS), contributed to the design of the study. TB translated and back-translated the EPRES, and AV supported the translation process and examined the back translation. JJ collected the data with support from TB and GJ. JJ and TB conducted the analyses. JJ wrote the draft(s) of the manuscript. All authors, TB, GJ, JJ, AV, JB, KK and JS reviewed the draft(s) and provided feedback on its content. All authors approved the contents of the final manuscript.

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Conflict of interest: The authors declare that there are no conflicts of interest.

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Data sharing: Deidentified participant data are from the PREMIS study whose authors may be contacted at johanna.jonsson@ki.se. Data cannot be made publicly available for ethical and legal reasons, but could be made available to researchers who meet the criteria for access to confidential data after approval from the Regional Ethics Committee of Stockholm.

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SUPPLEMENTARY MATERIAL

Supplementary material A. EPRES-Se

TEMPORALITET	
1. Hur länge gäller ditt nuvarande kontrakt? Om du har flera arbetsgivare anger du den arbetsgivare du arbetar för flest timmar en genomsnittlig månad.	- Tillsvidare - 2 år eller mer - 1 år eller mer - 6 månader eller mer - 3 månader eller mer - 1 månad eller mer - Kortare än 1 månad - Har inget kontrakt - Vet ej
2. Hur länge har du jobbat för samma arbetsgivare/uppdragsgivare? Om du har flera arbetsgivare anger du den arbetsgivare du arbetar för flest timmar en genomsnittlig månad.	- Mindre än 1 månad - 1 månad till mindre än 3 månader - 3 månader till mindre än 6 månader - 6 månader till mindre än 1 år - 1 år till mindre än 2 år - 2 år till mindre än 5 år - 5 år eller mer
LÖN	
3. Ungefär hur mycket tjänar du per månad netto (efter skatt)? Lägg ihop summan för din vita lön efter skatt + svart lön + eventuell dricks, en genomsnittlig månad.	- 3 000 kr eller mindre - Mellan 3 001 och 6 000 kr - Mellan 6 001 och 9 000 kr - Mellan 9 001 och 12 000 kr - Mellan 12 001 och 15 000 kr - Mellan 15 001 och 18 000 kr - Mellan 18 001 och 21 000 kr - Mellan 21 001 och 24 000 kr - Mellan 24 001 och 27 000 kr - Mellan 27 001 och 30 000 kr - Mer än 30 000 kr - Inget svar
Hur ofta tillåter din nuvarande lön dig att... **4. Täcka dina dagliga grundläggande behov?** **5. Täcka oförutsedda utgifter av betydelse?**	- Alltid - Ofta - Ibland - Sällan - Aldrig

MAKTLÖSHET

6. Hur bestämdes arbetstiderna för ditt nuvarande arbete?
Välj det alternativ som stämmer bäst in på dig. Om du har flera arbetsgivare anger du den arbetsgivare du arbetar för flest timmar en genomsnittlig månad.

- De följer lag och kollektivavtalet
- De bestämdes av arbetsgivaren
- De var en överenskommelse mellan mig och min chef
- De var en överenskommelse i mitt arbetslag
- Vet ej
- Ej relevant, arbetar uppdragsbaserat

7. Hur bestämdes lönen för ditt nuvarande arbete?
Välj det alternativ som stämmer bäst in på dig. Om du har flera arbetsgivare anger du den arbetsgivare du arbetar för flest timmar en genomsnittlig månad.

- Den följer kollektivavtalet
- Den bestämdes av arbetsgivaren
- Den var en överenskommelse mellan mig och min chef
- Den var en överenskommelse i mitt arbetslag
- Vet ej

SÅRBARHET

Ange hur ofta hos din arbetsgivare som...
Om du har flera arbetsgivare anger du den arbetsgivare du arbetar för flest timmar en genomsnittlig månad.

Var god besvara alla frågor.

8. Du är rädd för att kräva bättre arbetsvillkor

9. Du är försvarslös mot orättvis behandling från överordnande

10. Du är rädd för att få sparken om du inte gör allt arbetsgivaren ber om

11. Du blir behandlad auktoritärt

12. De får dig att känna dig lätt utbytbar

- Alltid
- Ofta
- Ibland
- Sällan
- Aldrig

RÄTTIGHETER

Har du rätt till något av följande?
Var god besvara alla frågor.

13. Föräldraledighet

14. Ålderspension

15. A-kassa

16. Avgångsvederlag vid uppsägning

17. Sjukersättning/sjukpenning

- Ja
- Nej
- Vet ej

UTÖVANDE AV RÄTTIGHETER

Hur ofta i den organisation där du arbetar kan du utöva följande rättigheter?
Om du har flera arbetsgivare anger du den arbetsgivare du arbetar för flest timmar en genomsnittlig månad.

Var god besvara alla frågor.

18. Ta helg/veckovila utan problem

19. Ta semesterdagar utan problem

20. Ta en ledig dag av familjeskäl utan problem (vård av sjukt barn, vård av sjuk anhörig etc.)

21. Ta en ledig dag av personliga skäl utan problem

22. Sjukskriva dig utan problem

23. Gå till läkare när du behöver

- Alltid
- Ofta
- Ibland
- Sällan
- Aldrig

Supplementary material B. English translation of EPRES-Se with coding

TEMPORARINESS			Coding
1. How long is your current employment contract valid? If you have more than one employer, please indicate the employer you work the most hours for during an average month.	-	Indefinitely	0
	-	2 years or more	1
	-	1 year or more	1
	-	6 months or more	2
	-	3 months or more	3
	-	1 month or more	3
	-	Less than 1 month	3
	-	Do not have a contract	4
	-	Do not know	4
2. How long have you been working for the same employer? If you have more than one employer, please indicate the employer you work the most hours for during an average month.	-	Less than 1 month	4
	-	1 month to less than 3 months	3
	-	3 months to less than 6 months	3
	-	6 months to less than 1 year	2
	-	1 year to less than 2 years	2
	-	2 years to less than 5 years	1
	-	5 years or more	0
WAGES			
3. Approximately how much do you earn per month after taxes? Add the amount for your salary after tax deductions + salary for illicit work + any tips, during an average month.	-	3000 SEK or less	4
	-	Between 3001 and 6000 SEK	4
	-	Between 6001 and 9000 SEK	3
	-	Between 9001 and 12 000 SEK	3
	-	Between 12 001 and 15 000 SEK	2
	-	Between 15 001 and 18 000 SEK	2
	-	Between 18 001 and 21 000 SEK	1
	-	Between 21 001 and 24 000 SEK	1
	-	Between 24 001 and 27 000 SEK	0
	-	Between 27 001 and 30 000 SEK	0
	-	More than 30 000 SEK	0
	-	No answer	-
How often does your current salary allow you to...	-	Always	0
	-	Often	1
4. Cover you daily basic needs?	-	Sometimes	2
5. Cover unforeseen expenses of significance?	-	Rarely	3
	-	Never	4

DISEMPOWERMENT

6. How were your working hours settled for your current job? Indicate the alternative that fits you best. If you have more than one employer, please indicate the employer you work the most hours for during an average month.	- My working hours are in accordance with Swedish law and the collective agreement - My employer decided my working hours - My working hours are the result of an agreement between me and my manager - My working hours are the result of an agreement within my work team - Do not know - Not applicable. I work project-based	0 3 2 1 4 2
7. How was the salary settled for your current job? Indicate the alternative that fits you best. If you have more than one employer, please indicate the employer you work the most hours for during an average month.	- My salary is accordance with the collective agreement - My salary was set by my employer - My salary is the result of an agreement between me and my manager - My salary is the result of an agreement in my work team - Do not know	0 3 2 1 4

VULNERABILITY

Indicate how often, at your employer...
If you have more than one employer, please indicate the employer you work the most hours for during an average month.

Please indicate an answer to all of the questions.

8. You feel afraid to demand better working conditions	- Always - Often - Sometimes - Rarely - Never	4 3 2 1 0
9. You are defenceless towards unfair treatment by your superiors		
10. You feel afraid of being fired if you do not comply with everything your employer asks of you		
11. You are treated in an authoritarian manner		

12. You are made to feel easily replaceable

RIGHTS

Do you have the right to any of the following?
Please indicate an answer to all of the questions.

13. Parental leave	- Yes	0
	- No	1
14. Retirement due to old age	- Do not know	2

15. Unemployment insurance fund (A-kassa)

16. Severance pay in the event of termination

17. Sickness benefit

EXERCISE OF RIGHTS

How often, in the organisation where you work, are you able to exercise the following rights?
If you have more than one employer, please indicate the employer you work the most hours for during an average month.

Please indicate an answer to all of the questions.

18. Take the weekend off/ weekly rest without problem	- Always	0
	- Often	1
19. Take vacation days without problem	- Sometimes	2
	- Rarely	3
20. Take a day off for family reasons without problem (care of a sick child, care of a sick relative etc.)	- Never	4

21. Take a day off for personal reasons without problem

22. Go on sick leave without problem

23. Go to the doctor when needed

Supplementary material C. Comparison of subscale means for recoding of participants with an indefinite contract and on demand/by the hour employment

Crosstabulation of type of employment and contractual length

Table showing crosstabulation of type of employment and contractual length (EPRES-Se item 1)

	Type of employment			
Contractual length	**Temporary employment**	**Employed on demand/by the hour**	**Self-employed (involuntary), intern, part-time**	**Total**
Indefinitely	16[a]	139[b]	20[a]	175
2 years or more	3	3	1	7
1 year or more	9	7	1	17
6 months or more	34	32	9	75
3 months or more	24	19	6	49
1 month or more	16	6	2	24
Less than 1 month	11	5	0	16
I do not have a contract	2	21	12	35
Do not know	6	11	0	17
Total	121	243	51	415

[a] Used in comparison 2
[b] Used in comparison 1

1. Comparison of subscale means for employees with an indefinite contractual length and on demand/by the hour employment

Table showing subscale averages for employees with an indefinite contractual length and an on demand/by the hour employment

Subscale	N	Minimum	Maximum	Mean	Std. Deviation
Wages	135	0.00	3.67	1.76	0.72
Disempowerment	139	0.00	4.00	2.21	0.97
Vulnerability	137	0.00	4.00	1.35	0.94
Rights	136	0.00	4.00	2.35	1.06
Exercise of rights	136	0.00	3.50	1.74	0.71
Valid N	134				

Table showing least sum of squares-differences between subscale averages for employees with an on demand/by the hour employment, comparing employees with an indefinite contractual length vs. employees wth any other contractual length

EPRES-Se item 1. How long is your current employment valid?

Subscale	2 y	1y	6m	3m	1m	<1m	No contract	I don't know
Wages	0.014	0.652	0.320	0,100	0.348	0.096	0.142	0.025
Disempowerment	0.379	0.284	0.072	0.367	0.295	0.212	0.165	0.151
Vulnerability	1.216	0.092	0.320	0,004	0.518	0.251	0.461	0.658
Rights	2.086	0.467	0.053	0,659	0.180	0.113	0.123	0.338
Exercise of rights	0.185	0.764	0.135	0,191	0.315	0.040	0.046	0.558
Sum	3.880	2.258	0.899	1.320	1.657	**0.713**	0.936	1.731

2. Comparison of subscale means for employees with an indefinite contractual length and any other type of employment (excluding on demand/by the hour)

Table showing subscale averages for employees with an indefinite contract length and any other type of employment

Subscale	N	Minimum	Maximum	Mean	Std. Deviation
Wages	35	0.33	4.00	1.819	0.919
Disempowerment	36	0.00	4.00	2.167	1.095
Vulnerability	36	0.00	4.00	1.167	0.966
Rights	36	0.00	4.00	2.356	1.182
Exercise of rights	36	0.00	4.00	1.690	0.876
Valid N	35				

Table showing least sum of squares-differences between subscale averages for employees with any other employment (excluding on demand/by the hour employees), comparing employees with an indefinite contractual length vs. employees with any other contractual length

EPRES-Se item 1. How long is your current employment valid?

Subscale	2 y	1y	6m	3m	1m	<1m	No contract	I don't know
Wages	1.402	0.486	0.510	0.624	0.504	0.819	0.264	0.459
Disempowerment	0.541	0.216	0.190	0.083	0.083	0.121	0.190	0.000
Vulnerability	0.533	0.233	0.517	0.667	0.500	0.258	0.276	0.633
Rights	1.456	0.836	0.132	0.276	0.378	0.792	0.298	0.422
Exercise of rights	0.357	0.957	0.252	0.179	0.227	0.311	0.404	0.032
Sum	4.289	2.727	1.601	1.828	1.692	2.301	1.433	1.547

Supplementary material D. Weighted results, table 1-4

Table 1. Weighted demographic characteristics of the study population (percentages), N=415

		%
Age	18-24	34%
	25-29	43%
	30-64	23%
Sex	Male	50%
	Female	50%
Employment	Temporary employment	21%
	Employed on demand/by the hour	64%
	Self-employed (involuntary)	3%
	Intern	1%
	Part-time employed (involuntary)	10%

Table 2. Weighted item descriptive statistics and Pearson item-subscale correlations of EPRES-Se

Item	Missing %[1]	Mean	SD[2]	Response frequency[3]					Pearson item subscale correlations[4]					
				0	1	2	3	4	T	W	D	V	R	ER
Temporariness														
Length of contract[5]	0.0	2.5	1.1	9.5	5.8	17.9	56.0	10.9	**-0.05**	0.02	-0.03	0.06	0.06	0.05
Time working empl.[5]	0.0	2.1	0.9	2.8	22.1	43.8	27.8	3.5	**-0.05**	0.15	0.17	0.05	0.36	0.21
Wages														
Income monthly	3.5	2.6	1.0	6.9	6.6	23.3	47.0	16.1	0.13	**0.40**	0.04	0.01	0.27	0.23
Cover basic need	1.2	0.8	0.9	40.2	44.2	11.4	2.5	1.7	0.01	**0.61**	0.03	0.27	0.13	0.28
Cover unforeseen expen.	1.2	1.8	1.1	13.3	28.7	34.3	15.6	8.1	0.13	**0.57**	0.08	0.42	0.17	0.22
Disempowerment														
Working hour settled[5]	0.0	2.2	1.2	18.7	0.7	31.3	42.7	6.5	0.06	0.13	**0.33**	0.08	0.20	0.16
Salary settled[5]	0.0	2.2	1.2	19.3	2.1	19.3	54.1	5.2	0.07	-0.03	**0.33**	0.00	0.10	0.11
Vulnerability														
Demand work cond.	1.2	1.4	1.1	21.8	33.0	28.4	11.4	5.4	0.04	0.20	0.09	**0.76**	0.09	0.25
Unfair treatment	1.2	1.2	1.1	28.5	39.2	18.4	9.9	4.0	0.04	0.20	0.08	**0.80**	0.10	0.26
Afraid fired	1.2	1.4	1.2	28.4	30.9	21.4	13.3	6.0	0.09	0.31	0.10	**0.79**	0.17	0.38
Treated authoritarian	1.2	1.2	1.1	28.4	38.1	19.1	9.9	4.5	0.03	0.21	-0.04	**0.64**	0.12	0.23
Easily replaced	1.2	1.6	1.2	21.6	33.2	22.7	11.5	11.1	0.13	0.30	-0.02	**0.74**	0.15	0.24
Rights														
Right parental leave	1.2	1.2	0.8	23.0	33.7	43.3			0.19	0.20	0.22	0.12	**0.59**	0.22
Right retirement	1.2	1.2	0.8	24.4	29.8	45.8			0.29	0.20	0.23	0.17	**0.59**	0.28
Right unemployment	1.2	1.0	0.9	36.7	24.7	38.6			0.13	0.17	0.05	0.07	**0.60**	0.12
Right severance pay	1.2	1.3	0.6	6.0	53.2	40.8			0.14	0.11	0.04	0.05	**0.50**	0.05
Right sickness benefits	1.2	1.0	0.9	38.7	26.8	34.5			0.28	0.15	0.10	0.13	**0.53**	0.15
Exercise of rights														
Take weekend off	1.2	1.7	1.1	19.9	17.4	44.6	11.5	6.5	0.07	0.23	0.14	0.21	0.13	**0.67**
Take vacation	1.2	1.9	1.0	12.3	20.1	43.4	18.3	6.0	0.15	0.25	0.18	0.27	0.19	**0.71**
Take day off	1.2	1.7	1.1	21.4	17.8	41.4	13.6	5.8	0.18	0.22	0.19	0.25	0.20	**0.77**
Take day off, pers.	1.2	1.9	1.1	13.7	19.1	41.8	16.4	9.0	0.12	0.23	0.05	0.37	0.19	**0.71**
Sick leave	1.2	1.6	1.1	21.7	19.1	42.9	12.1	4.1	0.11	0.22	0.15	0.23	0.19	**0.70**
Go to doctor	1.2	1.2	1.1	34.3	27.1	28.2	7.2	3.2	0.19	0.28	0.07	0.24	0.19	**0.67**

[1] Proportion of participants with any missing item; [2] SD=Standard Deviation; [3]Frequency (%) of participants indicating the specific response. 0 indicates the lowest precariousness score, 4 indicating the highest precariousness score. [4] Corrected for overlap, i.e., item is removed from the corresponding subscale. T=Temporariness; W=Wages; D=Disempowerment ;V=Vulnerability; R=Rights; ER=Exercise rights. [5]Inter-item correlations

Table 3. Weighted scale descriptive statistics: range, mean, standard deviation (SD), floor and ceiling effects and Cronbach's alpha coefficient

Subscale	Items	Mean	SD	Missing (%)[1]	Obs. range	Floor %[2]	Ceiling %[2]	Cronbach's alpha
Temporariness	2	2.3	0.7	0.0	0-4	0.3	1.3	-0.10
Wages	3	1.7	0.8	4.7	0-4	3.0	1.0	0.70
Disempowerment	2	2.2	1.0	0.0	0-4	8.7	2.4	0.50
Vulnerability	5	1.4	1.0	1.2	0-4	14.3	2.0	0.90
Rights	5	2.3	1.1	1.3	0-4	3.8	17.9	0.78
Exercise of rights	6	1.6	0.9	1.3	0-4	7.3	1.0	0.89
EPRES-se	23	1.9	0.5	4.8	0.09-3.07	0.2	0.7	0.84

[1] Proportion of participants with any missing item

[2] Proportion of participants with lowest (floor) and highest (ceiling) EPRES-Se scores

Table 4. Weighted factor loadings from exploratory factor analysis of the EPRES-Se

	Factor					
	Exercise rights	**Vulnerability**	**Rights**	**Wages**	**Disempowerment**	**Temporariness**
Temporariness						
Length of contract						**-0.21**
Time working empl.	0.17		0.37		0.14	**-0.36**
Wages						
Income monthly	0.20	-0.11	0.24	**0.49**		-0.25
Cover basic need	0.20	0.19		**0.66**		
Cover unforeseen expen.		0.35		**0.84**		0.19
Disempowerment						
Working hour settled			0.14		**0.43**	
Salary settled					**0.69**	0.15
Vulnerability						
Demand work cond.	0.11	**0.81**				
Unfair treatment		**0.86**				
Afraid fired	0.24	**0.80**		0.12	0.13	-0.12
Treated authoritarian	0.11	**0.67**			-0.14	
Easily replaced		**0.76**		0.17		
Rights						
Right parental leave	0.15		**0.69**		0.19	
Right retirement	0.17		**0.68**		0.24	-0.13
Right unemployment			**0.70**			-0.17
Right severance pay			**0.56**			
Right sickness benefits			**0.60**			0.14
Exercise rights						
Take weekend off	**0.69**			0.11		-0.11
Take vacation	**0.74**	0.12			0.10	
Take day off	**0.82**	0.10				0.14
Take day off, pers.	**0.73**	0.25			-0.10	0.10
Sick leave	**0.74**				0.15	-0.16
Go to doctor	**0.69**		0.11	0.15		

Table showing factor loadings >0.1

The weighted exploratory factor analysis extracted six factor with eigenvalues >1 (eigenvalues: 5.6; 3.0; 2.5; 1.5; 1.4; 1.1). These factors were the same as in EPRES-2010, thereby confirming the EPRES-2010 scale structure. Together, the six factor explained 65.4% of the variance.

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
Outcome data	15*	Report numbers of outcome events or summary measures
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses

Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Measuring precarious employment in Sweden: Translation, adaptation and psychometric properties of the Employment Precariousness Scale (EPRES)

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Measuring precarious employment in Sweden: Translation, adaptation and psychometric properties of the Employment Precariousness Scale (EPRES)

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ABSTRACT

Objectives: Precarious employment is a determinant of poor health and health inequality. However, the evidence of health consequences and mechanisms underlying the associations, are still limited due to a lack of a comprehensive multidimensional definition and measurement instrument. The Employment Precariousness Scale (EPRES) is a Spanish, multidimensional scale, developed to measure degree of precarious employment. The aim of this study was to translate the EPRES-2010 into Swedish, adapt it to the Swedish context, and to assess the psychometric properties of the Swedish EPRES.

Method: EPRES was translated, adapted and implemented for data collection within the research project PREMIS. During 2016-2017, questionnaire data was collected from 483 non-standard employees in Stockholm, Sweden, sampled with web-based respondent-driven sampling. Analyses included item descriptive statistics, scale descriptive statistics and exploratory factor analysis.

Results: The final EPRES-Se consisted of six dimensions and 23 items. There was a high response rate to all items and response options. Global Cronbach's alpha was 0.83. Subscales 'vulnerability', 'rights' and 'exercise rights' had reliability coefficients between α= 0.78-0.89 and item-subscale correlations between r= 0.48-0.78. 'Temporariness' had poor reliability (α= -0.08) and inter-item correlation (r= -0.04), while 'disempowerment" showed acceptable psychometric properties (α= 0.5; r= 0.34). Exploratory factor analysis confirmed the original EPRES factor structure.

Conclusions: 'Vulnerability', 'wages' 'rights', 'exercise rights' and 'disempowerment'

worked in the Swedish context; however 'temporariness' would need revising before implementing the EPRES-Se in further research. Continued work and validation of EPRES-Se is encouraged. In order to enable international comparisons and multinational studies, similar studies in other European countries are also called for.

Strengths and limitations of this study:

- First translation and adaptation of the EPRES-2010 to Swedish and the Swedish context
- First assessment of the psychometric properties of the EPRES-Se
- Relatively small sample restricted to non-standard employees
- Limited generalizability of results

INTRODUCTION

Precarious employment (PE) is considered a social determinant of poor health and health inequality (1-3). PE is present in both developing as well as developed countries (4, 5). However, evidence of the health consequences of precarious employment, and by which mechanisms PE harm workers' health, is still limited due to the lack of a comprehensive multidimensional definition and measurement instrument (6). This lack also brings about challenges in terms of capturing the size of the population in precarious employment, conducting occupational health and safety surveillance (6, 7), as well as cross-country comparisons. The Employment Precariousness Scale (EPRES) is a Spanish questionnaire developed to measure six dimensions of precarious employment. EPRES has previously been validated in Spanish and Chilean populations (8-11), and also applied to the population of Catalonia (12), but as of yet there is no Swedish translation or adaptation.

Precarious Employment

During the past decades, neoliberal economics and policies together with increased globalization, trade competition, technological innovation and financial crises, has had a considerable impact on the dynamics of the labour market (5, 13, 14). These impacts have had several implications, including an increase in privatization, downsizing, outsourcing, a weakening of union input and collective regulation, and a more competitive and uncertain context for workers, with increases in flexible work, unemployment and non-standard employment arrangements (5, 13, 14). Furthermore,

there has been a decline in attachment to employers, risk shifting from employer to employees, growth in perceived and actual job insecurity and work-based stress, as well as diminished bargaining power and rights (13, 14).

Non-standard arrangements, in comparison with standard employment contracts (i.e., open-ended full-time contracts), includes part-time work (underemployment), temporary work, temporary agency work, zero hour contracts, "gig" work arrangements and self-employment (1, 4, 7, 14, 15). Non-standard work can also include holding multiple jobs (16). A comprehensive term used to describe forms of non-standard employment is "precarious employment" (17). Precarious employment does not, however, solely refer to the type of employment, but also to unfavorable employment conditions, such as vulnerability, low pay, low levels of social security and rights (3, 4, 14, 17-21). As these elements are not exclusively found in non-standard employments *per se*, employees in a standard employment also are at risk of experiencing precariousness (14, 22, 23). Thereby, it is important to move beyond a simplistic categorical grouping of employment, such as temporary vs. permanent, and instead work towards a comprehensive multidimensional approach that enables a better understanding of precarious employment (16, 23).

Several definitions and attempts to create multidimensional constructs capturing precarious employment already exist. In terms of the previous, Rodgers and Rodgers include employment instability, employment insecurity, lack of protection and economic/social vulnerability as components in their definition of precarious employment (17); and the International Labour Organization (ILO) include low wage,

poor protection from termination of employment, lack of access to social protection/benefits (usually associated with full-time standard employment) and lack of/limited access to exercise rights at work (21). To our knowledge, two validated questionnaires have been developed for the purpose of measuring precarious employment: The Employment Precarity Index, identifying employment precarity by ten questions and dividing scores in four groups: secure, stable, vulnerable and precarious (23); and the EPRES with its six dimensions: 'temporariness', 'wages', 'disempowerment', 'vulnerability', 'rights' and 'exercise rights', where precarity ranges from low to high (10). Several studies have also used a combination of indicators as proxy measures in order to identify precarious employment (see e.g. (24-26)). Despite these efforts, there is of yet no universally accepted definition or operationalization.

By the means of a cross-national multidimensional definition and measurement instrument of precarious employment, comparative and more precise estimations of health effects would be made possible. Previously, PE has been linked to an array of health issues including mental and physical health (2, 27) and occupational injuries (28). Previous research on related concepts such as job insecurity and temporary employment also show consistent associations with various health outcomes (29-32). Mechanisms linking precarious employment and health are not yet fully understood but pathways that have been suggested include more harmful working conditions, limited control over one's professional and personal lives, feelings of insecurity and incomes below the subsistence level, which consequently can affect other social determinants of health such as housing quality, lifestyles and so on (33).

The Employment Precariousness Scale (EPRES)

EPRES is a Spanish, multidimensional theory-based scale, developed to measure degree of precarious employment among waged and salaried workers (8). EPRES is comprised of 22 items and six subscales corresponding to six dimensions: 'temporariness' (contract duration; two items), 'wages' (low or insufficient; possible economic deprivation; three items), 'disempowerment' (level of negotiation of employment conditions; two items), 'vulnerability' (defenselessness to authoritarian treatment; five items), 'rights' (entitlement to workplace rights and social security benefits; four items) and 'exercise rights' (powerlessness, in practice, to exercise workplace rights; six items) (8, 9). EPRES items are scored on a 5-point or 3-point scale, depending on item, and all items taken together will give a global score ranging between 0 (least precarious) and 4 (most precarious) (34). EPRES has demonstrated good acceptability, good internal consistency and evidence of construct validity in Spanish and Chilean populations (8, 9). The original EPRES scale was revised in 2015 (hereafter known as EPRES-2010), which showed good metric properties and improved sensitivity to worker vulnerability and employment stability (10). Further details about EPRES and its development has been described elsewhere (34).

Precarious employment in Sweden

In Sweden, much of previous research has focused on health outcomes of PE and related exposures. Some studies have focused on exposures such as temporary

employment (35), peripheral employment (36), and temporary employment and job insecurity (37). Fewer studies have created proxies of multidimensional exposures of PE, for instance by combining previous unemployment, temporary/permanent employment and perceived job insecurity (38); or by identifying multiple indicators of precarious employment (e.g., type of contract, income, working times etc.) (26). It is challenging to put Sweden in a larger comparative context of precarious employment as there is no consensus on its operationalization. Sweden has, according to some definitions (as defined by a typological approach of 11 indicators), one of the smallest proportions of precarious employees among the Scandinavian countries (19). However, in other measures (defined by involuntary part-time work, temporary employment and fear of job-loss) Sweden has the highest proportion of precarious employed individuals (24) and the highest proportion of fixed-term employment contracts (39) in the same context. Reports show that the Swedish labour market is growing increasingly more insecure, especially for temporary employees (40, 41). The proportion of temporary employees has been stable around 15-17% since the late 1990's (41, 42). There has, however, been reports on a shift within this group where longer-term positions have been replaced by a higher proportion of on-demand employees and day laborers, which are more precarious by nature (40, 41, 43). Especially women (19%, compared to 15% among men), 16-24 year-olds (56%, compared to 21% among 25-34 year-olds and 9% among 35-44 year-olds), and foreign born (24%, compared to 15% among individuals born in Sweden) are likely of holding a temporary employment (41). These are groups that reportedly are exposed to high employment precariousness (19).

Further, around 10% of the employees in Sweden are not covered by collective bargaining agreements and around 9% have multiple jobs. The latter has seen an increase with 1.5% percentage points since 2005 (43). According to a definition by the Swedish Labour Policy Council, the group of atypical employees is constituted by those that fulfil one of the following: not being covered by a collective bargaining agreement, have a temporary employment, are employed by a temp agency or are self-employed, have their own company, hold multiple jobs or are working in the informal sector. This group of atypical workers is estimated to be around 35-39% of the Swedish workforce (43), and likely of experiencing precariousness.

Thereby, despite the stabile levels of temporary employment in Sweden, it could be assumed that the level of precariousness has increased on the Swedish labour market. A study from Finland, however, indicate that the precariat (as defined by atypical employment, previous unemployment, fear of job-loss, poor prospects of employment and low earnings) has not seen an increase the past couple of decades (44). Without longitudinal studies with precise measures of precarious employment assessing changes over time, evidence in Sweden remains inconclusive.

To our knowledge, this is the first study in Sweden aiming at translating and adapting a validated multidimensional measurement of precarious employment, EPRES, to Swedish and the Swedish context. It is an important step in the direction to more precisely and fully comprehend the distribution and trends of precarious employment in the Swedish population, as well as it will allow for future studies on health outcomes of precarious employment. Further, such an instrument will also

enable well-needed cross-country comparisons.

Aim

The aim of this study was to translate the EPRES-2010 into Swedish, adapt it to the Swedish context, and to assess the psychometric properties of the Swedish EPRES.

METHOD

In order to fulfil the study aims, the EPRES-2010 was first translated into Swedish and subsequently adapted to suit the Swedish context (hereafter known as EPRES-Se). Thereafter, EPRES-Se was piloted and implemented as a part of the survey used in the research project Precarious Employment in Stockholm (PREMIS).

Translation and adaptation of EPRES

The translation and adaptation process of the EPRES-2010 consisted of five steps: 1. Translation from Spanish to Swedish; 2. Cultural adaptation to fit the Swedish context; 3. Back translation to Spanish and adjustments; 4. Pilot testing; 5. Final adaptations based on user feedback in pilot.

1. The Spanish version of the revised EPRES-2010 scale, which has been published elsewhere (10), was translated into Swedish. The translation was done by a bilingual member of the research team (TB) in close discussion with AV, a native Spanish speaker with previous experience of validation studies of EPRES.

2. Several adaptations of the questionnaire were implemented in order to fit Swedish labour market conditions. The questionnaire and its translation was discussed during workshops in the project team, which consisted of Swedish, Spanish and Chilean researchers within public - and occupational health, as well as within the reference group involved in PREMIS, which consisted of labour union members and workers with experience of precarious employment.

3. Several drafts of the Swedish questionnaire were translated back to Spanish during the adaptation process and discussed until the final translation was decided upon.

4. A two-stage pilot testing was performed: first face-to-face with five volunteers from the reference group, and thereafter online with six volunteers who were currently working but without a permanent full-time employment. The latter were also asked to participate in an evaluation of the survey either via the phone or online.

5. With the input from the pilot, a few minor adaptations were made to the EPRES.

Further, in order to offer non-Swedish speaking participants an opportunity to participate in the PREMIS-study, the PREMIS-survey, including the Swedish version of EPRES, was translated into English by an external, professional, translator. After the translation, minor changes in terms of style and terminology was made by the research group. The English translation of the EPRES-Se was not validated in this study, nor has it been validated in any previous studies.

Implementation of the EPRES-Se

PREMIS is an ongoing, longitudinal, web-based study conducted in Stockholm county, Sweden. PREMIS aims at methodological development in terms of sampling strategies and assessment of precarious employment, as well as at studying health outcomes of precarious employment. In 2016-2017, 483 non-standard employees were sampled with web-based respondent-driven sampling (webRDS). WebRDS uses peer-to-peer recruitment to build a sample from populations that are hard-to-reach and therefore lacks a sampling frame (45). Questionnaire data was collected through an online survey tool specifically developed for RDS (46). The PREMIS-survey included all the items of the EPRES-Se, as well as questions on employment type, occupational environment, health outcomes and background. The survey could be completed in Swedish or English.

As one of the aims of PREMIS was to sample precarious employees with webRDS, a process which has been described elsewhere (47), participation in the study was restricted to individuals considered particularly vulnerable to precarious employment conditions, such as individuals with temporary employment, on-demand employment, involuntary part-time employment and involuntary self-employment. The inclusion criteria for participants were: living and/or working in Stockholm County, being aged 18-65 years, having and indicating a Swedish personal identification number, and having a current employment. Exclusion criteria were: having a fixed, full-time, employment, being voluntarily self-employed or being a student. Out of the 483

participants included in the sample, 68 participants were excluded due to not matching criteria of county (n=6), re-using or giving an incorrect personal number (n = 8 and n=17, respectively), being underage (n = 1) or suspected cheating (i.e., systematic repeated participation; n=36), giving a final sample of 415 participants.

Statistical analysis

Item descriptive statistics (mean, standard deviations, response frequencies, missing responses and Pearson item-subscale correlations) and scale descriptive statistics (mean, standard deviations, missing items, range, floor and ceiling effects, and reliability (Cronbach's alpha coefficient) were assessed for the entire sample. Participants answering "No answer" on the question on income (question three in EPRES-Se) were excluded from the analyses of this question due to the ambiguity of the response alternative. Exploratory factor analysis was conducted in order to determine the underlying factor structure of the data. Principal axis factoring, with varimax rotation, extracting eigenvalues >1 was used, which is the method used in previous EPRES-studies (8-10). Subanalyses were conducted without informal workers, i.e., participants answering "I have no contract" to the question on contract duration (question one in EPRES-Se). Further, as the sample was recruited with respondent-driven sampling (RDS), weighted analyses were conducted in addition to the unweighted analyses. RDSII weights (48) were calculated in RDS Analyst 0.42 for Windows (Los Angeles, CA). In short, weights are based on the self-reported network size in the target population (*degree)* of the participant and applied in order to account

for over-sampling of individuals included in large social networks. Participants with large social networks are given a smaller weight, and vice versa (48, 49). The results from the weighted analyses will be shown in full in the supplementary material. All analyses were performed using SPSS version 23 (IBM SPSS Statistics for Windows, Version 23. Armonk, NY:IBM Corp).

Ethical considerations

Permission from the Regional Ethics Committee of Stockholm was given for the study, with dnr: 2016/1291-31/5. Informed consent was attained from all participants by the respondent clicking "Yes" to the question "I understand the information given above and want to participate".

Patient and public involvement

In PREMIS, a reference group consisting of individuals with experience from precarious employment and labour union representatives, was involved in the design of the PREMIS-survey (design of survey and formulation of questions not otherwise standardized) and data collection process (deciding on the appropriate compensation for participation, recruitment of participants and testing the survey software) through active discussions and workshops. Results will be disseminated to study participants through the website of the PREMIS-study.

RESULTS

Adaptations of EPRES-Se

The following adaptations were made to the EPRES-Se in comparison with EPRES-2010.

(1) The response alternatives in 'temporariness' were stated as categories, as opposed to free text values of number of days, months or years in EPRES-2010, in order to increase usability in the web-survey context. For the same reason, the question on contract duration which contained three dependent items in EPRES-2010, was collapsed into one question in EPRES-Se. In addition, the response options "I do not have a contract" was added in order to capture informal work and "Do not know" was added in order to capture poor contractual relationship.

(2) In 'wages', the question of income was presented in local currency (SEK) and intervals were set to ~300 EUR as the 150-200 EUR intervals used in the EPRES-2010 version were perceived as too narrow in the Swedish context. In EPRES-2010, intervals were 150 EUR - 200 EUR below a monthly income of 1200 EUR, and 300 EUR above an income of 1201 EUR.

(3) In EPRES-2010, the two response alternatives capturing working conditions that were decided unilaterally by the employer, were merged into one response option in the Swedish adaptation in order to enhance usability . Further, as some workers, especially freelancers, are given a fixed budget with no hours specified, the response alternative "Not applicable. I work project-based" was added for the question on how salary was decided upon,

(4) One of the items in 'vulnerability', "afraid to demand better working conditions…", was taken from the original EPRES-scale (8) according to the recommendations made by Vives et al. 2015 (10).

(5) In 'rights', the question on pension in EPRES-2010 , which contained both pension due to old age and disability, was split in two as these are distinct systems unrelated to one another in the Swedish context. Retirement pension (i.e., pension due to old age) was kept in EPRES-Se and disability pension was removed. However, a new item assessing the right to sickness benefit was added in the subscale instead, capturing both long term sick leave and shorter spells of sickness absence.

(6) In 'exercise of rights' the item on taking a day off for family reasons was clarified by adding "care of a sick child, care of a sick relative etc." within brackets.

EPRES-Se

The final version of EPRES-Se consisted of a total of 23 items and six dimensions: 'temporariness' (two items), 'wages' (three items), 'disempowerment' (two items), 'vulnerability' (five items), 'rights' (five items) and 'exercise rights' (six items). As in the EPRES-2010, the response scales were 5-point ordinal scales for 'temporariness', 5-point ordinal and 5-point frequency scales for 'wages', 5-point frequency scales for 'vulnerability' and 'exercise rights', and 5-point and 3-point categorical scales for 'disempowerment' and 'exercise rights', respectively. See EPRES-Se in supplementary material A.

Coding of EPRES-Se

Similarly as EPRES-2010, subscale scores were computed as averages and transformed into a 0-4 scale. The global EPRES score is the average of the six subscales, ranging from 0-4, where 0 represent the lowest level of precariousness and 4 represent the highest level of precariousness.

For questions in 'temporariness', response options were coded slightly different compared to EPRES-2010 in order to accommodate the changes made in the Swedish version. For instance, in the question of duration of contract, response options "Do not have a contract" and "Do not know" were coded as 4 (most precarious), in comparison with the Spanish version where a contract length of less than six months was coded as 4. In the question on income, intervals were larger and consistent in size, as compared to the Spanish version. The cut-offs for income were based on the Swedish median net income for 2016, which was just above 18000 SEK for individuals 20-64 years of age (50). The merging of items in 'disempowerment' did not affect the coding. The coding of the individual items along with the English translation of EPRES-Se can be found in the supplementary material B.

Issues leading to recoding of 'temporariness' dimension

When conducting the data analyses it was revealed that 79% (n=139) of the respondents answering 'indefinitely' to the EPRES question on contract length ("How long is your current employment contract valid?") also answered that they were employed on demand/by the hour on a question assessing employment type included

in the PREMIS-survey. We suspected that this combination could be a type of "zero hour" contract, in which the employer is not required to offer the employee any fixed number of hours of work at all per day, week or month (39). Thereby, this type of employment situation could be regarded as contingent with a high degree of precariousness. This was confirmed as the group indicating an indefinite contract length *and* on-demand/by the hour employment, were most similar (in terms of the other EPRES subscales) to employees with a contract lasting less than 1 month and least alike employees with a fixed-term contract >2 years. Consequently, we re-coded the group with an indefinite contract *and* on demand/by the hour-employment from 0 to 3 (i.e., the same coding as the response alternative <1 month contract). Those with any other employment type and an indefinite contract (n=36) remained coded as 0. See results of subscale-average comparisons in the supplementary material C.

Psychometric properties of EPRES-Se

The demographic characteristics of the sample is shown in Table 1. The sample consisted of a larger proportion 25-29 year-olds (45%) compared to the other age-groups, and a larger proportion women (54%) as compared to men. Further, the sample was dominated by workers employed on demand/by the hour (59%).

Table 2 shows the item-descriptive statistics. There was a small proportion of missing values (< 3%). Item means were similar within subscales, with the greatest mean difference found within 'wages' (item mean difference = 1.6). All response options within the items were used by participants, although to a varying extent. Item-

subscale correlations were around 0.6-0.8 in 'vulnerability' and 'exercise of rights'; and around 0.4-0.6 in 'wages' and 'rights'. There was a weak correlation between item and subscale in 'disempowerment' and no correlation between items in 'temporariness'. With exception of the latter, all items correlated higher with their corresponding subscale compared to other subscales.

Table 1. Demographic characteristics of the study population (frequencies and percentages), N=415

		N	%
Age	18-24	122	29
	25-29	185	45
	30-64	108	26
Sex	Male	190	46
	Female	225	54
Employment	Temporary employment	121	29
	Employed on demand/by the hour	243	59
	Self-employed (involuntary)	13	3
	Intern	2	1
	Part-time employed (involuntary)	36	9

Table 3 shows the scale descriptive statistics. The subscale mean scores ranged between 1.4 and 2.3, with a global average of 1.9. The proportion of participants with any missing values in the subscales were around 1%, except in the case of 'wages' where it was 3.1%. The latter also included participants answering "No answer" (n=9). Subscale scores ranged between 0-4, and global scale score ranged between 0.09-3.07. Both floor and ceiling effects were generally low (< 5%), with floor effects being highest for 'disempowerment' (9.2%) and 'vulnerability' (11.7%), and ceiling effects being highest for 'rights' (18.0%). Cronbach's alpha coefficients were around 0.7 or higher for

'wages', 'vulnerability', 'rights' and 'exercise of rights'. Only 'temporariness' exhibited a Cronbach's alpha coefficient close to 0. The global alpha coefficient was 0.83.

The exploratory factor analysis extracted six factors with eigenvalues above 1 (eigenvalues = 5.3; 3.2; 2.3; 1.6; 1.3; 1.1). The emerging factors were the same as in EPRES-2010, thereby confirming the original factor structure. Together, the six factors explained 64.1% of the variance. The six factors and their rotated factor loadings are shown in Table 4. All loadings were above 0.35, except in the case of "length of contract".

Subanalyses were conducted in order to investigate the potential effect of including informal workers in the sample (n=35), which had minor influence on the correlation between temporariness-items (r=0.002) and reliability of the subscale (-0.003). However, in the factor analysis seven factors with eigenvalues >1 emerged (5.3; 3.2; 2.3; 1.6; 1.3; 1.1; 1.0), explaining 68.5% of the variance. The seventh factor was caused by a split of the temporariness dimension, grouping items on length of contract (duration) and time working for employer (tenure) in separate factors, with factor loadings of 0.33 and 0.42 respectively.

Analyses for the weighted population sample resulted in virtually the same results in regard to item-subscale correlations, Cronbach's alpha coefficients, floor and ceiling effects, as well as factor loadings from the exploratory factor analysis of EPRES-Se, and did thereby not affect the interpretation of the results. See the weighted results in table 1-4 in Supplementary material D.

Table 2. Item descriptive statistics and Pearson item-subscale correlations of EPRES-Se

Item	Missing %[1]	Mean	SD[2]	Response value frequency (%)[3]					Pearson item subscale correlations[4]					
				0	1	2	3	4	T	W	D	V	R	ER
Temporariness[5]														
Length of contract	0.0	2.6	1.1	36 (8.7)	24 (5.8)	75 (18.1)	228 (54.9)	52 (12.5)	**-0.04**	0.04	0.05	0.06	0.08	0.04
Time working empl.	0.0	2.1	0.9	17 (4.1)	92 (22.2)	171 (41.2)	119 (28.7)	16 (3.9)	**-0.04**	0.06	0.11	-0.04	0.31	0.13
Wages														
Income monthly	2.2	2.4	1.2	43 (10.6)	45 (11.1)	87 (21.4)	171 (42.1)	60 (14.8)	0.09	**0.39**	0.14	-0.07	0.29	0.17
Cover basic need	1.0	0.8	0.9	175 (42.6)	171 (41.6)	44 (10.7)	14 (3.4)	7 (1.7)	-0.02	**0.60**	0.07	0.21	0.13	0.26
Cover unforeseen expen.	1.0	1.8	1.1	60 (14.6)	113 (27.5)	136 (33.1)	70 (17.0)	32 (7.8)	0.08	**0.55**	0.08	0.39	0.14	0.26
Disempowerment[5]														
Working hour settled	0.0	2.1	1.2	84 (20.2)	8 (1.9)	110 (26.5)	190 (45.8)	23 (5.5)	0.12	0.17	**0.34**	0.10	0.26	0.23
Salary settled	0.0	2.2	1.2	77 (18.6)	8 (1.9)	101 (24.3)	210 (50.6)	19 (4.6)	0.07	0.03	**0.34**	0.02	0.13	0.09
Vulnerability														
Demand work cond.	1.0	1.6	1.2	79 (19.2)	129 (31.4)	113 (27.5)	63 (15.3)	27 (6.6)	0.01	0.13	0.09	**0.75**	0.04	0.28
Unfair treatment	1.0	1.3	1.1	114 (27.7)	159 (38.7)	67 (16.3)	50 (12.2)	21 (5.1)	-0.03	0.12	0.08	**0.78**	-0.01	0.26
Afraid fired	1.0	1.5	1.2	106 (25.8)	130 (31.6)	81 (19.7)	60 (14.6)	34 (8.3)	0.06	0.20	0.10	**0.78**	0.04	0.35
Treated authoritarian	1.0	1.3	1.1	107 (26.0)	160 (38.9)	87 (21.2)	36 (8.8)	21 (5.1)	-0.04	0.20	-0.01	**0.63**	0.02	0.23
Easily replaced	1.0	1.6	1.3	91 (22.1)	124 (30.2)	92 (22.4)	55 (13.4)	49 (11.9)	0.06	0.22	0.02	**0.74**	0.04	0.27
Rights														
Right parental leave	1.2	1.2	0.8	100 (24.4)	130 (31.7)	180 (43.9)			0.18	0.16	0.26	0.05	**0.58**	0.16
Right retirement	1.2	1.2	0.8	107 (26.1)	113 (27.6)	190 (46.3)			0.26	0.22	0.23	0.07	**0.60**	0.16
Right unemployment	1.2	1.0	0.9	156 (38.0)	100 (24.4)	154 (37.6)			0.15	0.24	0.15	-0.01	**0.60**	0.08
Right severance pay	1.2	1.4	0.6	20 (4.9)	223 (54.4)	167 (40.7)			0.11	0.06	0.03	-0.02	**0.48**	0.03
Right sickness benefits	1.2	0.9	0.8	160 (39.0)	110 (26.8)	140 (34.1)			0.26	0.18	0.17	0.03	**0.53**	0.12
Exercise of rights														

Take weekend off	1.0	1.6	1.1	86 (20.9)	93 (22.6)	154 (37.5)	48 (11.7)	30 (7.3)	-0.01	0.23	0.18	0.18	0.10	**0.62**
Take vacation	1.2	1.9	1.1	50 (12.2)	88 (21.5)	163 (39.8)	77 (18.8)	32 (7.8)	0.14	0.22	0.20	0.30	0.15	**0.68**
Take day off	1.2	1.6	1.1	88 (21.5)	85 (20.7)	166 (40.5)	50 (12.2)	21 (5.1)	0.15	0.19	0.21	0.24	0.16	**0.75**
Take day off, pers.	1.0	1.9	1.2	63 (15.3)	78 (19.0)	159 (38.7)	69 (16.8)	42 (10.2)	0.11	0.21	0.08	0.36	0.07	**0.74**
Sick leave	1.2	1.6	1.1	98 (23.9)	74 (18.0)	163 (39.8)	50 (12.2)	25 (6.1)	0.06	0.22	0.20	0.26	0.12	**0.69**
Go to doctor	1.0	1.1	1.1	140 (34.1)	126 (30.7)	106 (25.8)	25 (6.1)	14 (3.4)	0.11	0.26	0.09	0.25	0.14	**0.64**

[1] Proportion of participants with any missing item; [2] SD=Standard Deviation; [3]Frequency (%) of participants indicating the specific response. 0 indicates the lowest precariousness score, 4 indicating the highest precariousness score. [4] Corrected for overlap, i.e., item is removed from the corresponding subscale. T=Temporariness; W=Wages; D=Disempowerment ;V=Vulnerability; R=Rights; ER=Exercise rights. [5]Inter-item correlations

Table 3. Scale descriptive statistics: range, mean, standard deviation (SD), floor and ceiling effects and Cronbach's alpha coefficient

Subscale	Items	Mean	SD	Missing (%)[1]	Obs. range	Floor %[2]	Ceiling %[2]	Cronbach's alpha
Temporariness	2	2.3	0.7	0.0	0-4	0.5	1.0	-0.08
Wages	3	1.6	0.8	3.1	0-4	4.2	0.7	0.69
Disempowerment	2	2.1	1.0	0.0	0-4	9.2	1.4	0.50
Vulnerability	5	1.4	1.0	1.0	0-4	11.7	1.9	0.89
Rights	5	2.3	1.2	1.2	0-4	2.9	18.0	0.78
Exercise of rights	6	1.6	0.9	1.2	0-4	6.8	1.0	0.88
EPRES-se	23	1.9	0.5	3.4	0.09-3.07	0.2	0.2	0.83

[1] Proportion of participants with any missing item

[2] Proportion of participants with lowest (floor) and highest (ceiling) EPRES-Se scores

Table 4. Factor loadings from exploratory factor analysis of the EPRES-Se

	Factor					
	Exercise rights	Vulnerability	Rights	Wages	Disempowerment	Temporariness
Temporariness						
Length of contract						**0.12**
Time working empl.	0.12		0.36			**-0.36**
Wages						
Income monthly	0.14	-0.16	0.23	**0.49**		0.35
Cover basic need	0.17	0.13		**0.71**		
Cover unforseen expen.	0.12	0.32		**0.79**		-0.10
Disempowerment						
Working hour settled	0.17		0.21		**0.52**	0.15
Salary settled					**0.60**	
Vulnerability						
Demand work cond.	0.14	**0.80**				
Unfair treatment	0.11	**0.84**				
Afraid fired	0.20	**0.80**				
Treated authoritarian	0.11	**0.66**		0.12		0.13
Easily replaced	0.12	**0.77**		0.15		
Rights						
Right parental leave			**0.67**		0.21	
Right retirement			**0.69**		0.16	
Right unemployment			**0.69**	0.11		0.29
Right severance pay			**0.55**		-0.10	
Right sickness benefits			**0.60**		0.11	
Exercise rights						

Take weekend off	**0.65**			0.10		0.14
Take vacation	**0.70**	0.18			0.12	-0.13
Take day off	**0.80**	0.10	0.10		0.13	-0.13
Take day off, pers.	**0.78**	0.24				-0.10
Sick leave	**0.72**	0.11			0.12	0.15
Go to doctor	**0.66**	0.11		0.13		

Table showing factor loadings >0.1

DISCUSSION

Key findings and summary

The scale generally performed well, with a small proportion of missing values across all subscales, usage of all response options and good global reliability. The factor structure established in the Spanish EPRES-2010 (10) was confirmed. The subscales 'vulnerability', 'wages', 'rights' and 'exercise of rights' generally worked well in the Swedish context, with high item-subscale correlations, subscale reliability and factor loadings. However, 'temporariness' did not perform as expected and would need revision. In addition, although 'disempowerment' showed acceptable psychometric properties, the subscale might benefit from additional adaptation.

'Temporariness'

As opposed to previous studies, (8-10), temporariness yielded very poor psychometric properties. The items in the subscale did not correlate, there was a negative Cronbach's alpha coefficient and a low factor loading for the item on contract duration. Only minor changes in terms of correlation and Cronbach's alpha was initiated by the removal of informal workers. This subanalysis did, however, split

the temporariness dimension in two separate factors, both of which had higher factor loadings. On the basis of these results, we believe that the temporariness dimension needs further development and evaluation in a population of both standard and non-standard employees. Based on the results from the present study, we offer the following thoughts on this matter:

Firstly, it is important to acknowledge the sample selection. As the sample was restricted to non-standard employees (i.e., permanent, full-time, employees were excluded), the lower end of the precariousness scale had a smaller proportion than what would be expected if standard employees with longer duration and tenure would have been included in the sample. This limitation is likely to have contributed to the lack of correlation between the items. However, considering that the sample was intentionally recruited in order to capture a population of precariously employed individuals, the poor psychometric properties of temporariness also shows that these items are not necessarily related in a meaningful was when measuring precariousness among non-standard employees.

Secondly, in the current context, the Swedish legislation (the Employment Protection Act SFS 1982:80) prevents an employer to hire an employee for more than two years during a five-year period (consecutive or in shorter repeated contracts) without having to employ (or dismiss) the employee in a permanent contract (51). Thereby, an employee with an 18-month tenure might be more precarious than an employee with a 6-month tenure as the latter has longer time left before being forced in or out. Further, approximately 50% of temporary employees in Sweden has

had repeated contracts with the same employer (41), which is an additional reasons that could contribute to the lack of correlation between tenure and duration of contract.

Thirdly, we found that several participants were employed by the hour or on demand while still indicating an indefinite contract length. This highlights the difficulties in assessing temporariness only by contract duration (and tenure). Temporariness is the dimension most likely to be dependent on context. Given the proposed mechanism of temporariness leading to ill-health mediated via feelings of insecurity, temporariness is most relevant in labour markets which do not offer regulatory protection for certain groups of workers, such as permanent employees in most European countries, which does not apply to the same extent in the USA (52).

However tempting it would be suggest the inclusion of questions regarding "contract type" in a future development of EPRES, the continuous flexibilization of the labour market and fast changes in employment practices in combination with contextual differences, makes it increasingly difficult – at least if international comparison using similar scales is sought after.

From a mechanistic standpoint and with an aspiration to develop a scale which could be used in international comparison independent of context, we believe that an item that measures the future employment opportunities with the current employer as objectively as possible should be developed. EPRES-Se and other translations could further be adapted, for example by combining the contract duration and tenure-items with an item assessing the number of repeated contracts with the same

employer or an item assessing how often during a specific time interval the employment contract is up for renewal. Contract duration could also be complemented or replaced by a question more explicitly assessing the remaining duration of the contract at the time of answering the survey.

'Wages'

The income-item corelated moderately with the other items in the subscale (items assessing how well the income covers basic needs and unforeseen expenses). Previous studies report similar findings for this item (8-10). One explanation to these results is the quantitative nature of the income-item as compared to the other items. Slightly more than half, 57%, of the participants scored a precariousness level of 3 or 4 on income, which is not surprising as the sample is constituted by young non-standard employees. However, only 5% and 25% of the sample scored a precariousness level of 3 or 4 on the other two items respectively. How well one can cover basic needs and unforeseen expenses could depend on more than income, such as family support. Approximately 24% of adults aged 20-27 years in Sweden still live at home. In the majority of municipalities in large city regions, this figure is more than 50% in the majority of municipalities in large city regions. About half of those living at home pay nothing in rent (53). As 74% of the sample is between 18-29 years old, it is likely that at least a part of the participants still live at home and receive help from their family. Including standard employees in the sample could potentially have increased the item-

subscale correlation as we would expect a larger proportion of participants with a high income.

Aside from the income-item, item-subscale correlations for the remaining two items and subscale reliability were acceptable and only a fraction of the sample did not provide an answer to the item on income (2.2%). Therefore, as in the other EPRES scales, we believe the subscale can be used in its current form in future studies.

'Disempowerment'

The items in 'disempowerment' had acceptable item-subscale correlations and reliability. However, some response options ("my working hours/salary was decided within my working team" and "do not know") were hardly used at all in, indicating that these options might not be appropriate for the current population in the Swedish context. Further, the remaining response options were also inadequate from an adaptational point of view. For example, the working hours/salary being in line with collective bargaining agreements does not imply that the working hours/salary was not set by the employer; these options are not mutually exclusive. In a revised EPRES-Se, the disempowerment-items would benefit from revision and clarification. Combining response options not mutually exclusive could be considered as one way of improving the subscale, such as "my working hours are in accordance with Swedish law and the collective agreement, decided by my employer" and "my working hours are not in accordance with Swedish law and the collective agreement, decided by my employer".

'Rights'

The new item assessing sickness benefit had an acceptable item-subscale correlation and factor loading, similar to the other item-subscale correlations and factor loadings in the subscale, Further, the subscale reliability was good. Taken together, these results point towards that the new item worked well in the subscale.

Strengths and limitations

This study finds strength in the fact that it is the first study translating and adapting EPRES-2010 to the Swedish context, as well as the first study to assess the psychometric properties of the resulting EPRES-Se. In addition, this work provides context-specific recommendations for future research using EPRES-Se. This study is, however, not without limitations.

The main limitations is the sample. As this study lies within the frame of the PREMIS-project (47), the sample was restricted to employees with a non-standard employment. EPRES, however, is developed to measure precariousness independent of the type of employment (8). By only assessing the psychometric properties of the scale in a population of non-standard employees, the scale properties cannot be directly compared to similar studies as the heterogeneity of the sample is limited. A sample representative of the entire work force would have provided better insights as to how the scale behaves among Swedish employees. A next step which this study has provided strong grounds for.

Finally, the relatively small sample size could influence the reliability of the

results, which should be kept in mind when interpreting and generalizing the results. Further, being a convenience sample limits the generalizability of the results. However, as the weighted results confirmed the psychometric properties of the scale, we could expect similar results in a representative sample applying the same sample restrictions.

Conclusion

The study found that EPRES-Se worked well in the current context, with high global reliability, endorsement of all response options (for all items) and few missing values. The psychometric properties for five out of six subscales were satisfactory, considering this being the first translation and adaptation. However, one subscale, 'temporariness', worked poorly and would need revision before implementing the scale in further research. As employment precariousness is an emergent determinant of health it is important that PE can be properly measured. The EPRES-Se is an important step in this direction. We therefore encourage others to continue working with EPRES-Se and to validate it further in populations of both standard and non-standard employees. Our hope is for a revised EPRES-Se with satisfactory psychometric properties to be implemented in research both as an independent tool and included in nation-wide surveys. In order to enable international comparisons and multinational studies, similar studies in other European countries are also called for.

STATEMENTS

Author contributions: The study was conceived by Theo Bodin (TB) and Gun Johansson (GJ). All authors, TB, GJ, Johanna Jonsson (JJ), Alejandra Vives (AV), Joan Benach (JB), Katarina Kjellberg (KK) and Jenny Selander (JS), contributed to the design of the study. TB translated and back-translated the EPRES, and AV supported the translation process and examined the back translation. JJ collected the data with support from TB and GJ. JJ and TB conducted the analyses. JJ wrote the draft(s) of the manuscript. All authors reviewed the draft(s) and provided feedback on its content. All authors approved the contents of the final manuscript.

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SUPPLEMENTARY MATERIAL

Supplementary material A. EPRES-Se

TEMPORALITET	
1. Hur länge gäller ditt nuvarande kontrakt? Om du har flera arbetsgivare anger du den arbetsgivare du arbetar för flest timmar en genomsnittlig månad.	- Tillsvidare - 2 år eller mer - 1 år eller mer - 6 månader eller mer - 3 månader eller mer - 1 månad eller mer - Kortare än 1 månad - Har inget kontrakt - Vet ej
2. Hur länge har du jobbat för samma arbetsgivare/uppdragsgivare? Om du har flera arbetsgivare anger du den arbetsgivare du arbetar för flest timmar en genomsnittlig månad.	- Mindre än 1 månad - 1 månad till mindre än 3 månader - 3 månader till mindre än 6 månader - 6 månader till mindre än 1 år - 1 år till mindre än 2 år - 2 år till mindre än 5 år - 5 år eller mer
LÖN	
3. Ungefär hur mycket tjänar du per månad netto (efter skatt)? Lägg ihop summan för din vita lön efter skatt + svart lön + eventuell dricks, en genomsnittlig månad.	- 3 000 kr eller mindre - Mellan 3 001 och 6 000 kr - Mellan 6 001 och 9 000 kr - Mellan 9 001 och 12 000 kr - Mellan 12 001 och 15 000 kr - Mellan 15 001 och 18 000 kr - Mellan 18 001 och 21 000 kr - Mellan 21 001 och 24 000 kr - Mellan 24 001 och 27 000 kr - Mellan 27 001 och 30 000 kr - Mer än 30 000 kr - Inget svar
Hur ofta tillåter din nuvarande lön dig att... **4. Täcka dina dagliga grundläggande behov?** **5. Täcka oförutsedda utgifter av betydelse?**	- Alltid - Ofta - Ibland - Sällan - Aldrig

MAKTLÖSHET

6. Hur bestämdes arbetstiderna för ditt nuvarande arbete?
Välj det alternativ som stämmer bäst in på dig. Om du har flera arbetsgivare anger du den arbetsgivare du arbetar för flest timmar en genomsnittlig månad.

- De följer lag och kollektivavtalet
- De bestämdes av arbetsgivaren
- De var en överenskommelse mellan mig och min chef
- De var en överenskommelse i mitt arbetslag
- Vet ej
- Ej relevant, arbetar uppdragsbaserat

7. Hur bestämdes lönen för ditt nuvarande arbete?
Välj det alternativ som stämmer bäst in på dig. Om du har flera arbetsgivare anger du den arbetsgivare du arbetar för flest timmar en genomsnittlig månad.

- Den följer kollektivavtalet
- Den bestämdes av arbetsgivaren
- Den var en överenskommelse mellan mig och min chef
- Den var en överenskommelse i mitt arbetslag
- Vet ej

SÅRBARHET

Ange hur ofta hos din arbetsgivare som...
Om du har flera arbetsgivare anger du den arbetsgivare du arbetar för flest timmar en genomsnittlig månad.

Var god besvara alla frågor.

8. Du är rädd för att kräva bättre arbetsvillkor

9. Du är försvarslös mot orättvis behandling från överordnande

10. Du är rädd för att få sparken om du inte gör allt arbetsgivaren ber om

11. Du blir behandlad auktoritärt

12. De får dig att känna dig lätt utbytbar

- Alltid
- Ofta
- Ibland
- Sällan
- Aldrig

RÄTTIGHETER

Har du rätt till något av följande?
Var god besvara alla frågor.

13. Föräldraledighet

14. Ålderspension

15. A-kassa

16. Avgångsvederlag vid uppsägning

17. Sjukersättning/sjukpenning

- Ja
- Nej
- Vet ej

UTÖVANDE AV RÄTTIGHETER

Hur ofta i den organisation där du arbetar kan du utöva följande rättigheter?
Om du har flera arbetsgivare anger du den arbetsgivare du arbetar för flest timmar en genomsnittlig månad.

Var god besvara alla frågor.

18. Ta helg/veckovila utan problem

19. Ta semesterdagar utan problem

20. Ta en ledig dag av familjeskäl utan problem (vård av sjukt barn, vård av sjuk anhörig etc.)

21. Ta en ledig dag av personliga skäl utan problem

22. Sjukskriva dig utan problem

23. Gå till läkare när du behöver

- Alltid
- Ofta
- Ibland
- Sällan
- Aldrig

Supplementary material B. English translation of EPRES-Se with coding

TEMPORARINESS			Coding
1. How long is your current employment contract valid? If you have more than one employer, please indicate the employer you work the most hours for during an average month.	-	Indefinitely	0
	-	2 years or more	1
	-	1 year or more	1
	-	6 months or more	2
	-	3 months or more	3
	-	1 month or more	3
	-	Less than 1 month	3
	-	Do not have a contract	4
	-	Do not know	4
2. How long have you been working for the same employer? If you have more than one employer, please indicate the employer you work the most hours for during an average month.	-	Less than 1 month	4
	-	1 month to less than 3 months	3
	-	3 months to less than 6 months	3
	-	6 months to less than 1 year	2
	-	1 year to less than 2 years	2
	-	2 years to less than 5 years	1
	-	5 years or more	0
WAGES			
3. Approximately how much do you earn per month after taxes? Add the amount for your salary after tax deductions + salary for illicit work + any tips, during an average month.	-	3000 SEK or less	4
	-	Between 3001 and 6000 SEK	4
	-	Between 6001 and 9000 SEK	3
	-	Between 9001 and 12 000 SEK	3
	-	Between 12 001 and 15 000 SEK	2
	-	Between 15 001 and 18 000 SEK	2
	-	Between 18 001 and 21 000 SEK	1
	-	Between 21 001 and 24 000 SEK	1
	-	Between 24 001 and 27 000 SEK	0
	-	Between 27 001 and 30 000 SEK	0
	-	More than 30 000 SEK	0
	-	No answer	-
How often does your current salary allow you to... **4. Cover you daily basic needs?** **5. Cover unforeseen expenses of significance?**	-	Always	0
	-	Often	1
	-	Sometimes	2
	-	Rarely	3
	-	Never	4

DISEMPOWERMENT

6. How were your working hours settled for your current job? Indicate the alternative that fits you best. If you have more than one employer, please indicate the employer you work the most hours for during an average month.	- My working hours are in accordance with Swedish law and the collective agreement - My employer decided my working hours - My working hours are the result of an agreement between me and my manager - My working hours are the result of an agreement within my work team - Do not know - Not applicable. I work project-based	0 3 2 1 4 2
7. How was the salary settled for your current job? Indicate the alternative that fits you best. If you have more than one employer, please indicate the employer you work the most hours for during an average month.	- My salary is accordance with the collective agreement - My salary was set by my employer - My salary is the result of an agreement between me and my manager - My salary is the result of an agreement in my work team - Do not know	0 3 2 1 4

VULNERABILITY

Indicate how often, at your employer...
If you have more than one employer, please indicate the employer you work the most hours for during an average month.

Please indicate an answer to all of the questions.

8. You feel afraid to demand better working conditions	- Always - Often - Sometimes - Rarely - Never	4 3 2 1 0
9. You are defenceless towards unfair treatment by your superiors		
10. You feel afraid of being fired if you do not comply with everything your employer asks of you		
11. You are treated in an authoritarian manner		

12. You are made to feel easily replaceable

RIGHTS

Do you have the right to any of the following?
Please indicate an answer to all of the questions.

13. Parental leave	- Yes	0
	- No	1
14. Retirement due to old age	- Do not know	2
15. Unemployment insurance fund (A-kassa)		
16. Severance pay in the event of termination		
17. Sickness benefit		

EXERCISE OF RIGHTS

How often, in the organisation where you work, are you able to exercise the following rights?
If you have more than one employer, please indicate the employer you work the most hours for during an average month.

Please indicate an answer to all of the questions.

18. Take the weekend off/ weekly rest without problem	- Always	0
	- Often	1
19. Take vacation days without problem	- Sometimes	2
	- Rarely	3
20. Take a day off for family reasons without problem (care of a sick child, care of a sick relative etc.)	- Never	4
21. Take a day off for personal reasons without problem		
22. Go on sick leave without problem		
23. Go to the doctor when needed		

Supplementary material C. Comparison of subscale means for recoding of participants with an indefinite contract and on demand/by the hour employment

Crosstabulation of type of employment and contractual length

Table showing crosstabulation of type of employment and contractual length (EPRES-Se item 1)

	Type of employment			
Contractual length	**Temporary employment**	**Employed on demand/by the hour**	**Self-employed (involuntary), intern, part-time**	**Total**
Indefinitely	16[a]	139[b]	20[a]	175
2 years or more	3	3	1	7
1 year or more	9	7	1	17
6 months or more	34	32	9	75
3 months or more	24	19	6	49
1 month or more	16	6	2	24
Less than 1 month	11	5	0	16
I do not have a contract	2	21	12	35
Do not know	6	11	0	17
Total	121	243	51	415

[a] Used in comparison 2
[b] Used in comparison 1

1. Comparison of subscale means for employees with an indefinite contractual length and on demand/by the hour employment

Table showing subscale averages for employees with an indefinite contractual length and an on demand/by the hour employment

Subscale	N	Minimum	Maximum	Mean	Std. Deviation
Wages	135	0.00	3.67	1.76	0.72
Disempowerment	139	0.00	4.00	2.21	0.97
Vulnerability	137	0.00	4.00	1.35	0.94
Rights	136	0.00	4.00	2.35	1.06
Exercise of rights	136	0.00	3.50	1.74	0.71
Valid N	134				

Table showing least sum of squares-differences between subscale averages for employees with an on demand/by the hour employment, comparing employees with an indefinite contractual length vs. employees wth any other contractual length

EPRES-Se item 1. How long is your current employment valid?

Subscale	2 y	1y	6m	3m	1m	<1m	No contract	I don't know
Wages	0.014	0.652	0.320	0,100	0.348	0.096	0.142	0.025
Disempowerment	0.379	0.284	0.072	0.367	0.295	0.212	0.165	0.151
Vulnerability	1.216	0.092	0.320	0,004	0.518	0.251	0.461	0.658
Rights	2.086	0.467	0.053	0,659	0.180	0.113	0.123	0.338
Exercise of rights	0.185	0.764	0.135	0,191	0.315	0.040	0.046	0.558
Sum	3.880	2.258	0.899	1.320	1.657	**0.713**	0.936	1.731

2. Comparison of subscale means for employees with an indefinite contractual length and any other type of employment (excluding on demand/by the hour)

Table showing subscale averages for employees with an indefinite contract length and any other type of employment

Subscale	N	Minimum	Maximum	Mean	Std. Deviation
Wages	35	0.33	4.00	1.819	0.919
Disempowerment	36	0.00	4.00	2.167	1.095
Vulnerability	36	0.00	4.00	1.167	0.966
Rights	36	0.00	4.00	2.356	1.182
Exercise of rights	36	0.00	4.00	1.690	0.876
Valid N	35				

Table showing least sum of squares-differences between subscale averages for employees with any other employment (excluding on demand/by the hour employees), comparing employees with an indefinite contractual length vs. employees with any other contractual length

EPRES-Se item 1. How long is your current employment valid?

Subscale	2 y	1y	6m	3m	1m	<1m	No contract	I don't know
Wages	1.402	0.486	0.510	0.624	0.504	0.819	0.264	0.459
Disempowerment	0.541	0.216	0.190	0.083	0.083	0.121	0.190	0.000
Vulnerability	0.533	0.233	0.517	0.667	0.500	0.258	0.276	0.633
Rights	1.456	0.836	0.132	0.276	0.378	0.792	0.298	0.422
Exercise of rights	0.357	0.957	0.252	0.179	0.227	0.311	0.404	0.032
Sum	4.289	2.727	1.601	1.828	1.692	2.301	1.433	1.547

Supplementary material D. Weighted results, table 1-4

Table 1. Weighted demographic characteristics of the study population (percentages), N=415

		%
Age	18-24	34%
	25-29	43%
	30-64	23%
Sex	Male	50%
	Female	50%
Employment	Temporary employment	21%
	Employed on demand/by the hour	64%
	Self-employed (involuntary)	3%
	Intern	1%
	Part-time employed (involuntary)	10%

Table 2. Weighted item descriptive statistics and Pearson item-subscale correlations of EPRES-Se

Item	Missing %[1]	Mean	SD[2]	Response frequency[3]					Pearson item subscale correlations[4]					
				0	1	2	3	4	T	W	D	V	R	ER
Temporariness														
Length of contract[5]	0.0	2.5	1.1	9.5	5.8	17.9	56.0	10.9	**-0.05**	0.02	-0.03	0.06	0.06	0.05
Time working empl.[5]	0.0	2.1	0.9	2.8	22.1	43.8	27.8	3.5	**-0.05**	0.15	0.17	0.05	0.36	0.21
Wages														
Income monthly	3.5	2.6	1.0	6.9	6.6	23.3	47.0	16.1	0.13	**0.40**	0.04	0.01	0.27	0.23
Cover basic need	1.2	0.8	0.9	40.2	44.2	11.4	2.5	1.7	0.01	**0.61**	0.03	0.27	0.13	0.28
Cover unforeseen expen.	1.2	1.8	1.1	13.3	28.7	34.3	15.6	8.1	0.13	**0.57**	0.08	0.42	0.17	0.22
Disempowerment														
Working hour settled[5]	0.0	2.2	1.2	18.7	0.7	31.3	42.7	6.5	0.06	0.13	**0.33**	0.08	0.20	0.16
Salary settled[5]	0.0	2.2	1.2	19.3	2.1	19.3	54.1	5.2	0.07	-0.03	**0.33**	0.00	0.10	0.11
Vulnerability														
Demand work cond.	1.2	1.4	1.1	21.8	33.0	28.4	11.4	5.4	0.04	0.20	0.09	**0.76**	0.09	0.25
Unfair treatment	1.2	1.2	1.1	28.5	39.2	18.4	9.9	4.0	0.04	0.20	0.08	**0.80**	0.10	0.26
Afraid fired	1.2	1.4	1.2	28.4	30.9	21.4	13.3	6.0	0.09	0.31	0.10	**0.79**	0.17	0.38
Treated authoritarian	1.2	1.2	1.1	28.4	38.1	19.1	9.9	4.5	0.03	0.21	-0.04	**0.64**	0.12	0.23
Easily replaced	1.2	1.6	1.2	21.6	33.2	22.7	11.5	11.1	0.13	0.30	-0.02	**0.74**	0.15	0.24
Rights														
Right parental leave	1.2	1.2	0.8	23.0	33.7	43.3			0.19	0.20	0.22	0.12	**0.59**	0.22
Right retirement	1.2	1.2	0.8	24.4	29.8	45.8			0.29	0.20	0.23	0.17	**0.59**	0.28
Right unemployment	1.2	1.0	0.9	36.7	24.7	38.6			0.13	0.17	0.05	0.07	**0.60**	0.12
Right severance pay	1.2	1.3	0.6	6.0	53.2	40.8			0.14	0.11	0.04	0.05	**0.50**	0.05
Right sickness benefits	1.2	1.0	0.9	38.7	26.8	34.5			0.28	0.15	0.10	0.13	**0.53**	0.15
Exercise of rights														
Take weekend off	1.2	1.7	1.1	19.9	17.4	44.6	11.5	6.5	0.07	0.23	0.14	0.21	0.13	**0.67**
Take vacation	1.2	1.9	1.0	12.3	20.1	43.4	18.3	6.0	0.15	0.25	0.18	0.27	0.19	**0.71**
Take day off	1.2	1.7	1.1	21.4	17.8	41.4	13.6	5.8	0.18	0.22	0.19	0.25	0.20	**0.77**
Take day off, pers.	1.2	1.9	1.1	13.7	19.1	41.8	16.4	9.0	0.12	0.23	0.05	0.37	0.19	**0.71**
Sick leave	1.2	1.6	1.1	21.7	19.1	42.9	12.1	4.1	0.11	0.22	0.15	0.23	0.19	**0.70**
Go to doctor	1.2	1.2	1.1	34.3	27.1	28.2	7.2	3.2	0.19	0.28	0.07	0.24	0.19	**0.67**

[1] Proportion of participants with any missing item; [2] SD=Standard Deviation; [3]Frequency (%) of participants indicating the specific response. 0 indicates the lowest precariousness score, 4 indicating the highest precariousness score. [4] Corrected for overlap, i.e., item is removed from the corresponding subscale. T=Temporariness; W=Wages; D=Disempowerment ;V=Vulnerability; R=Rights; ER=Exercise rights. [5]Inter-item correlations

Table 3. Weighted scale descriptive statistics: range, mean, standard deviation (SD), floor and ceiling effects and Cronbach's alpha coefficient

Subscale	Items	Mean	SD	Missing (%)[1]	Obs. range	Floor %[2]	Ceiling %[2]	Cronbach's alpha
Temporariness	2	2.3	0.7	0.0	0-4	0.3	1.3	-0.10
Wages	3	1.7	0.8	4.7	0-4	3.0	1.0	0.70
Disempowerment	2	2.2	1.0	0.0	0-4	8.7	2.4	0.50
Vulnerability	5	1.4	1.0	1.2	0-4	14.3	2.0	0.90
Rights	5	2.3	1.1	1.3	0-4	3.8	17.9	0.78
Exercise of rights	6	1.6	0.9	1.3	0-4	7.3	1.0	0.89
EPRES-se	23	1.9	0.5	4.8	0.09-3.07	0.2	0.7	0.84

[1] Proportion of participants with any missing item

[2] Proportion of participants with lowest (floor) and highest (ceiling) EPRES-Se scores

Table 4. Weighted factor loadings from exploratory factor analysis of the EPRES-Se

	Factor					
	Exercise rights	**Vulnerability**	**Rights**	**Wages**	**Disempowerment**	**Temporariness**
Temporariness						
Length of contract						**-0.21**
Time working empl.	0.17		0.37		0.14	**-0.36**
Wages						
Income monthly	0.20	-0.11	0.24	**0.49**		-0.25
Cover basic need	0.20	0.19		**0.66**		
Cover unforeseen expen.		0.35		**0.84**		0.19
Disempowerment						
Working hour settled			0.14		**0.43**	
Salary settled					**0.69**	0.15
Vulnerability						
Demand work cond.	0.11	**0.81**				
Unfair treatment		**0.86**				
Afraid fired	0.24	**0.80**		0.12	0.13	-0.12
Treated authoritarian	0.11	**0.67**			-0.14	
Easily replaced		**0.76**		0.17		
Rights						
Right parental leave	0.15		**0.69**		0.19	
Right retirement	0.17		**0.68**		0.24	-0.13
Right unemployment			**0.70**			-0.17
Right severance pay			**0.56**			
Right sickness benefits			**0.60**			0.14
Exercise rights						
Take weekend off	**0.69**			0.11		-0.11
Take vacation	**0.74**	0.12			0.10	
Take day off	**0.82**	0.10				0.14
Take day off, pers.	**0.73**	0.25			-0.10	0.10
Sick leave	**0.74**				0.15	-0.16
Go to doctor	**0.69**		0.11	0.15		

Table showing factor loadings >0.1

The weighted exploratory factor analysis extracted six factor with eigenvalues >1 (eigenvalues: 5.6; 3.0; 2.5; 1.5; 1.4; 1.1). These factors were the same as in EPRES-2010, thereby confirming the EPRES-2010 scale structure. Together, the six factor explained 65.4% of the variance.

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
Outcome data	15*	Report numbers of outcome events or summary measures
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses

Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.