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ORIGINAL ARTICLE

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A comparison of work environment, job insecurity, and health between marginal part-time workers and full-time workers in Denmark using pooled register data

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Abstract

Objectives: This study aimed to evaluate characteristics of the work environment, job insecurity, and health of marginal part-time workers (8.0-14.9 hours/week) compared with full-time workers (32.0-40.0 hours/week).

Methods: The study population included employees in the survey Work Environment and Health in Denmark (WEHD) in 2012, 2014, or 2016 (n = 34 960). Survey information from WEHD on work environment and health was linked with register-based information of exposure based on working hours 3 months prior to the survey, obtained from the register Labour Market Account. Associations between marginal part-time work and work environment and health were assessed using logistic regression models.

Results: Marginal part-time workers reported less quantitative job demands, lower levels of influence at work, poorer support from colleagues and leaders, less job satisfaction and poorer safety, as well as more job insecurity. Results on negative social relations in the workplace and physical workload were more ambiguous. Marginal part-time workers were more likely to report poorer self-rated health, treatment-requiring illness, and depressive symptoms compared with full-time workers. Adjusting for characteristics of the work environment showed an indication of altered odds ratios for self-rated health and depressive symptoms, whereas job insecurity did not.

Conclusions: This study finds that marginal part-time workers experience a poorer psychosocial work environment and safety, higher job insecurity, and poorer health than full-time workers. Work environment characteristics may confound or mediate the association between marginal part-time work and health. However, prospective studies are needed to determine the causal direction of the revealed associations.

KEYWORDS
full-time workers, non-standard work, part-time workers, precariousness, working hours

1 | INTRODUCTION

Marginal part-time work, characterized by few weekly working hours,[1,2] can be a way to meet fluctuations in demands, job creation, or avoid layoffs.[1,2] For the employee, it may facilitate a way into or staying connected to the labor market.[1,2] Marginal part-time work has become increasingly widespread since 2008 in Denmark.[3-5] In the Nordic countries, marginal part-time workers (<15 hours/week) accounted for 4% in Sweden and Finland, 7% Norway, and 15% in Denmark, of all employed in 2015, yet the Danish number may be overestimated and other studies estimate that marginal part-time account for around 11% in Denmark.[3] Another reason for the variation between the Nordic countries may be related to high percentages of students having marginal part-time work in Denmark.[3] A large share of marginal part-time workers in all the Nordic countries are young,[3] women,[3,6,7] and low-skilled workers.[3] However, sector variations exist[3,5] with marginal part-time work being most common in wholesale and retail trade, hotels, and restaurants.[3]

Previous research suggests that marginal part-time workers are likely to experience a different work environment than their peers in full-time positions.[8] A case-study within Danish retail revealed that systems for the facilitation of information dissemination and critics are mainly aimed at full-time workers.[9] Thus, employees with part-time may miss information or feedback if they are not included in these systems. Studies have also found less job variety,[10] learning opportunities,[11] and complex tasks[12] among marginal part-time workers. Moreover, marginal part-time work may include employment instability, lack of power, rights, and poor terms,[13] as well as higher levels of job or income insecurity.[3,14] Several work environment characteristics[15-17] and job insecurity[18,19] have been associated with poor mental[15,16,18,19] and somatic health.[16-19] Thus, marginal part-time workers may experience a less supportive work environment and higher levels of job insecurity, which may influence their health negatively, compared to full-time-workers.

Only a few studies have addressed characteristics of the work environment[7,10-12,20] and health[7,20,21] among marginal part-time workers and some characteristics of the work environment, for example, arguments and conflicts, seem to remain unstudied. Results from the few studies are not consistent, but generally show a poorer work environment,[7,10-12] while results on health are more deviating.[7,20,21] Thus, previous findings are not conclusive and may be context-specific. In addition, studies have used self-reported data of both exposure and outcome,[7,11,20,21] which may give rise to information bias. Therefore, this study aimed to assess if marginal part-time workers (8.0-14.9 hours/week) have a poorer work environment, experience higher job insecurity, and poorer health than full-time workers (32.0-40.0 hours/week) by using Danish register-based information on exposure.

2 | METHOD

2.1 | Data

This study links exposure information from The Labour Market Account without standardization of hours (LMA)[22] with outcomes in the Work Environment and Health in Denmark (WEHD) survey,[23] and covariates from Statistics Denmark's population registers.[24-27]

The LMA[22] is a unique Danish register with administrative data of labor market status since 2008.[22] It is based on information from several registers, including the e-income register from The Danish Tax Agency with employer-registered information on all paid jobs of all Danish citizens.[22,28] The register covers the total Danish population and less than 4% (in 2013) of (paid) working hours in the register are imputed due to missing or invalid information.[28] Thus, LMA is considered to be of high quality.[22,28]

The WEHD survey was established for governmental use to monitor the work environment and health among Danish employees.[29] It was sent out every second year between 2012 and 2018 to a sample of employees aged 18-69 years old who lived in Denmark, worked at least 35 hours per month, and had an income of at least 3000 Danish Kroner per month (approximately 400 EUR).[29] The WEHD survey was sent to more than 50 000 employees in each wave (2012: n = 50 806; 2014: n = 50 875; 2016: n = 65 741) and response rates were above 50% (2012: 51.5%, 2014: 57.3%, 2016: 52.9%).[23] Fewer men, young employees, and employees with low socioeconomic status (SES) participated, which is similar to what has been reported in previous similar surveys.[29]

Finally, we used population register information from Statistics Denmark, including The Danish Civil Registration System,[24] The Population Education Register,[25] The Income Statistics Register,[26] and The Employment Classification Module.[27]

2.2 | Study population

We included all respondents of the WEHD in 2012, 2014, or 2016, who were between 18 and 64 years old, not on maternity leave and had at least 8 hours of work/week on average in the 3 months prior to answering the questionnaire. Employees who responded to more than one questionnaire were included with their most recent questionnaire

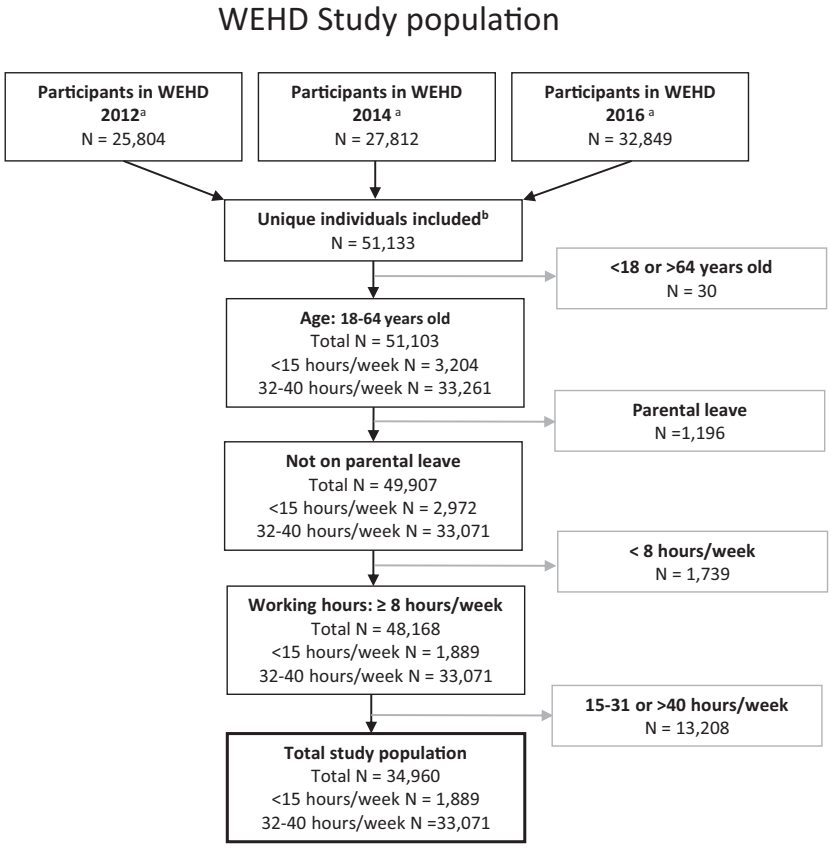

FIGURE 1 Flow chart of the study population

[a] Participants who answered at least one of the assessed question from the WEHD survey.
[b] If a person participated in more than one WEHD survey, the most recent observation was included.

response. The study population included 34 960 unique individuals with 8 to <15 or 32-40 hours of work/week (see Figure 1).

2.3 | Comparison with the Danish source population

To analyse whether the study population was representative of the source population, we used information from the total working population in Denmark (n = 1,841,566) from the LMA[22] with the same inclusion criteria as for the study population (see Figure S1 for flow chart). We assessed demographic characteristics of the participants in the study population and the source population (see Table S1) as well as the association between participation in WEHD and marginal part-time work (see Table S2). A smaller share of marginal part-time workers, compared with full-time workers, participated in the survey (OR 0.60, 95% CI 0.55-0.65). This difference was reduced after adjustment for gender, age, and SES (OR 0.78, 95% CI 0.71-0.86). Thus, analyses were presented in a crude model and model 1 adjusted for gender, age, and SES.

2.4 | Measurements

2.4.1 | Marginal part-time work

Data on marginal part-time work were obtained from the LMA based on information on working hours (from salaried employees, self-employed, and co-working spouses). Each employees' average number of weekly working hours, across the three months prior to the WEHD response date, was calculated. Marginal part-time work was defined as 8.0-14.9 hours work/week, based on previously used definitions of marginal part-time as <15 hours/week.[3] The lower cut was applied as WEHD only included employees with an average of at least 8 hours of work per week (35 hours/month). In Denmark, the norm for full-time work is 37 hours per week and a 5-day workweek. Thus, we used full-time work, defined as 32.0-40.0 hours per week on average for the past three months, as the reference group.

2.4.2 | Demographic characteristics

Based on existing literature, a number of covariates were included. We used information from the LMA on *gender*, *age*

(in 10-year intervals), *sector* (categorized by the Danish work sector code2007 [DB07]), *job* (based on Statistics Denmark's Danish International Standard Classification of Occupations, revision 2008 [DISCO-08] codes and categorized by the first digit), and *social benefits* (pension, student, sickness, and flex [subsidized job], see Table S5 for codes). Information on the *region of residence* and *marital status* (categorized as a partner [married or registered partnership] or no partner [all others]) was obtained from The Danish Civil Registration System. *Education level* was obtained from The Population Education Register[25] with information on the highest obtained level of education (categorized using the Danish International Standard Classification of Education, see Table S6 for codes). *Income* was obtained from The Income Statistics Register[26] and presented as percentiles (p) (low [<p25], intermediate [p25-p75], and high [>p75]). *SES* was obtained from The Employment Classification Module[27] based on information on the individual's most important source of income or work (see Table S7 for codes).

2.4.3 | Outcomes

We studied psychosocial work environment characteristics (quantitative job demands, influence at work, support from colleagues and leaders, negative social relations, and job satisfaction), physical workload, safety, job insecurity, and health characteristics based on questions from the WEHD survey. See Appendix S8 for the included survey questions and the categorizations of response categories.

2.4.4 | Work environment characteristics

The psychosocial characteristics included *quantitative job demands* (not having enough time for work tasks, availability outside of normal work hours, and struggling to meet deadlines) categorized as *high* or *low*; *influence at work* (influence on how and when to solve work tasks and sufficient authority) categorized as *low* or *high*; *support from colleagues and leaders* (leader feedback on work, acknowledgement from management, acknowledgement among colleagues and help among colleagues) categorized as *poor* or *good*; *negative social relations* (involvement in arguments or conflicts, exposed to bullying and physical violence or threats of violence at the workplace in the previous 12 months) categorized as *yes* or *none*; and *job satisfaction* (interesting and inspiring work tasks, and overall job satisfaction) categorized as *low* or *high*. The physical characteristics included *physical workload* (how physically hard workers perceived the work) categorized as hard or not hard*;* and physical work demands (based on an index score of how much of the time workers sat, walked or stood, worked with back twisted, arms lifted, had repetitive arm movements, squatting or kneeling, pushing or pulling and lifting) categorized as *low* or *high*. Lastly, safety characteristics included occupational accidents (occupational accidents the past year resulting in more than one day's absence) categorized as *yes* or *none;* and safety instruction (receiving the necessary guidance and instruction to work safely) categorized as *poor* or *good*.

2.4.5 | Job insecurity

Job insecurity (worrying about becoming unemployed and worrying about being transferred) was categorized as *high* or *low*.

2.4.6 | Health characteristics

Self-rated health was categorized as *poor* or *good*. *Treatment-requiring illness* the past year comprised of 11 questions (on depression, asthma, diabetes, atherosclerosis or heart attack, cerebral thrombosis, eczema, cancer, hearing loss, back disease, migraine, or other long-term illness) and categorized as *any* or *none*. *Pain* (pain within the last 3 months) was categorized as *pain* or *no pain*. *Depressive symptoms* were measured by the Major Depressive Inventory (MDI)[30] and categorized as *no* or *depressive symptoms (MDI≥20)*. *Stress* (feelings of stress the past 2 weeks) was categorized as *stress* or *no stress*, and finally, *sleep disturbance* (frequent awakenings with difficulties falling asleep again or not feeling rested in the past 4 weeks) was categorized as *high* or *low*.

2.5 | Data analysis

We use the unique Danish identification number and the WEHD response date to link the exposure to the outcomes on an individual level. Associations between marginal part-time work and work environment, job insecurity, and health outcomes were assessed by logistic regression. We used full-time workers (32-40 hours/week) as the reference in all analyses. Results on the association between marginal part-time and work environment, job insecurity, and health (Tables 2 and 3), are presented in a crude model without any adjustment and in model 1 including adjustment for age, gender, and SES (plus treatment-requiring illness in results on health outcomes). To assess if work environment or job insecurity explained some of the association between marginal part-time work and the health outcomes, in Table 4, we adjusted the associations between marginal part-time work and the health outcomes for model 1 and quantitative job demands, influence at work, support from colleagues and leaders, negative social relations, job satisfaction, physical workload, safety,

and job insecurity, respectively. Odds ratios (OR) with 95% confidence intervals (95% CI) are presented and all analyses were performed in SAS 9.4.

2.5.1 | Supplementary analyses

In previous studies, a large proportion of Danish marginal part-time workers reported education or training as a reason for working reduced hours (85%).[3] Students may differ from other marginal part-time workers in their work environment, job insecurity, and health. Thus, we conducted supplementary analyses of the work environment, job insecurity, and health excluding participants receiving student allowances, that is, a monthly public support scheme provided to all students regardless of parent's income in Denmark.

3 | RESULTS

The WEHD study population had a mean age of 45.4 years, and 51% were women. Compared with full-time workers, marginal part-time workers were younger, more often women, had lower educational attainment and lower income, fewer had a partner and children, and they more often received social benefits from a pension, student allowances, sick pay or flex (see Table 1).

3.1 | Marginal part-time work and work environment

In Table 2, after adjusting for age, gender, and SES results on quantitative work demands show that marginal part-time workers less often report too little time for their work tasks (OR 0.81, 95% CI 0.67-0.97) and that they struggle to keep deadlines (OR 0.79, 95% CI 0.69-0.91), compared with full-time workers. We also observed an indication of marginal part-time workers being less available outside normal work hours (OR 0.88, 95% CI 0.77-1.01). Concerning influence at work, OR of low influence on how and when to solve work tasks and low authority was 2.18 (95% CI 1.61-2.94), 1.54 (95% CI 1.26-1.88) and 1.37 (95% CI 1.12-1.69) for marginal part-time work, respectively. In terms of support from colleagues and leaders, marginal part-time workers more often reported rare or no feedback (OR 1.19, 95% CI 1.03-1.38), poorer degree of acknowledgement (OR 1.36, 95% CI 1.01-1.84), and help (OR 1.67, 95% CI 1.20-2.34) from colleagues, but not less acknowledgement from the management. We observed no clear associations between marginal part-time work and bullying and violence or threats, yet marginal part-time workers were less likely to report conflicts (OR 0.71, 95% CI 0.62-0.81). Moreover, marginal part-time

TABLE 1 Characteristics of (n = 34 960) participants from the Work Environment and Health in Denmark (WEHD) in 2012, 2014, and 2016

	8 to <15 hours /week		32-40 hours/ week	
Total	**1889**		**33 071**	
	n	**%**	**N**	**%**
Age				
18-24	744	39	1129	3
25-34	294	16	4347	13
35-44	195	10	8186	25
45-54	310	16	11 005	33
55-64	346	18	8404	25
Gender				
Women	1155	61	16 811	51
Region				
North Jutland	170	9	3086	9
Central Jutland	408	22	7491	23
Southern Denmark	411	22	7112	22
Capital	708	37	10 939	33
Zealand	192	10	4443	13
Sector				
Agriculture, forestry and fishing	38	2	347	1
Manufacturing, quarrying and supply	107	6	4686	14
Construction	73	4	1331	4
Transportation and trading etc	642	34	5959	18
Information and communication	58	3	1399	4
Finance and insurance	32	2	1398	4
Real estate activities	<20	<1	485	1
Professional service activities	201	11	3156	10
Public administration, education & health	586	31	12 913	39
Culture, recreation and other	130	7	1395	4
Missing	<20	<1	<20	<1
Job				
Managers	31	2	1992	6
Professionals	309	16	11 537	35
Technicians and associate professionals	104	6	5022	15
Clerical support workers	238	13	3149	10
Services and sales workers	619	33	3904	12

(Continues)

TABLE 1 (Continued)

	8 to <15 hours /week		32-40 hours/ week	
Total	**1889**		**33 071**	
	n	**%**	**N**	**%**
Skilled agricultural, forestry & fishery workers	<20	<1	158	0
Craft and related trades workers	85	5	2404	7
Plant and machine operators & assemblers	57	3	1457	4
Elementary occupations	245	13	1806	5
Armed forces occupations	<20	<1	316	1
Missing	174	9	1326	4
Highest attained education				
Primary	555	29	4038	12
Secondary	941	50	15 943	48
Higher	347	18	12 722	38
Missing	46	2	368	1
Income				
Low	1,403	74	5516	17
Intermediate	395	21	17 554	53
High	91	5	10 001	30
Socioeconomic status				
Self-employed	<20	<1	51	0
Ground level salaried employed	375	20	10 271	31
Mid-level salaried employed	158	8	8463	26
High level salaried employed	113	6	9572	29
Other salaried employed	315	17	4176	13
Public income supported	150	8	199	1
Students	767	41	339	1
Marital status				
Partner	619	33	20 577	62
Missing	0	0	<20	<1
Children living at home				
Yes	781	41	17 458	53
Missing	0	0	<20	<1
Social benefits[a]				
Pension	135	7	240	1
Student	805	43	59	0
Sickness	367	20	613	2
Flex	198	10	24	0
Questionnaire year				
2012	657	35	10 884	33
2014	563	30	11 803	36
2016	669	35	10 384	31

[a]Individuals can be present in more than one benefit category (pension, student, sickness, flex).

workers more often reported low job satisfaction (OR 1.87, 95% CI 1.40-2.49) and a low degree of interesting and inspiring work tasks (OR 1.83, 95% CI 1.52-2.21). Results on physical workload were less clear, and we observed lower reports of a perceived hard physical work among marginal part-time workers (OR 0.87, 95% CI 0.76-0.99), but not lower physical work demands. Regarding safety at work, marginal part-time workers more often reported experiencing an occupational accident within the past year (OR 1.31, 95% CI 1.03-1.68) and poor guidance and instructions to work safely (OR 1.32, 95% CI 1.10-1.59).

Marginal part-time workers reported higher job insecurity, with a higher degree of worrying about unemployment (OR 1.51, 95% CI 1.27-1.79) and transference (OR 1.67, 95% CI 1.36-2.05), compared with full-time workers.

As shown in Table 3, marginal part-time workers had higher odds of poor self-rated health (OR 3.05, 95% CI 2.55-3.64), treatment-requiring illness (OR 1.98, 95% CI 1.73-2.26) and depressive symptoms (OR 1.72, 95% CI 1.45-2.05) after adjustment for age, gender, SES and treatment-requiring illness. Our results also indicated that marginal part-time workers reported a higher degree of stress (OR 1.19, 95% CI 1.00-1.41), sleep disturbances (OR 1.12, 95% CI 0.98-1.27), and pain (1.13 95% CI 0.96-1.33), though not statistically significant. When the analyses were adjusted for work environment characteristics (Table 4), OR of treatment-requiring illness, sleep disturbance, and pain remained stable. The OR for poor self-rated health increased after adjustment for several psychosocial work environment characteristics. Conversely, physical workload and safety attenuated the OR of self-rated health. The estimate for depressive symptoms was elevated after adjustment for quantitative job demands and negative social relations. OR for stress, was elevated after adjusting for quantitative job demands. Adjusting for job insecurity did not appear to alter the OR for health.

Excluding students in the supplementary analyses, generally increased the OR, but did not change the main conclusions (see Tables S3 and S4), except for physical workload, which showed higher odds of hard physical work

TABLE 2 Work environment characteristics and job insecurity among marginal part-time workers compared with full-time workers (n = 34 960)

	8 to <15 hours/week		32-40 hours/week (reference)		Crude			Model 1		
	n	%	n	%	OR	95% CI	*P*	OR	95% CI	*P*
Quantitative job demands (high)										
Not enough time	179	12.4	6460	20.2	0.56	0.49-0.66	<.001	0.81	0.67-0.97	.021
Available outside work hours	512	35.6	13 040	40.7	0.81	0.72-0.90	<.001	0.88	0.77-1.01	.065
Hard to keep deadlines	360	25.0	11 870	37.1	0.57	0.50-0.64	<.001	0.79	0.69-0.91	.001
Influence at work (low)										
Influence on how to solve work tasks	84	5.8	630	2.0	3.07	2.43-3.88	<.001	2.18	1.61-2.94	<.001
Influence on when to solve work tasks	188	12.9	2282	7.1	1.95	1.66-2.28	<.001	1.54	1.26-1.88	<.001
Sufficient authority	174	12.1	2208	7.0	1.84	1.56-2.17	<.001	1.37	1.12-1.69	.002
Support from colleagues and leaders (poor)										
Leader feedback	386	26.9	8577	27.1	0.99	0.88-1.11	.853	1.19	1.03-1.38	.016
Work acknowledgement from management	336	23.4	7586	24.0	0.97	0.86-1.10	.630	1.07	0.92-1.24	.403
Acknowledgement of work between colleagues	71	4.9	1021	3.2	1.57	1.23-2.01	<.001	1.36	1.01-1.84	.046
Help between colleagues	54	3.7	759	2.4	1.60	1.20-2.11	.001	1.67	1.20-2.34	.003
Negative social relations in the workplace (yes)										
Arguments or conflicts	617	42.9	18 566	58.1	0.54	0.49-0.60	<.001	0.71	0.62-0.81	<.001
Bullying	168	11.7	3625	11.3	1.04	0.88-1.22	.666	1.07	0.88-1.30	.514
Threats or violence	148	10.3	3190	10.0	1.04	0.87-1.24	.683	1.11	0.90-1.38	.323
Job satisfaction (low)										
Interesting work tasks	266	18.4	1818	5.7	3.75	3.25-4.32	<.001	1.83	1.52-2.21	<.001
General job satisfaction[a]	76	8.2	1160	5.5	1.54	1.21-1.96	.001	1.87	1.40-2.49	<.001
Physical workload										
Hard physical work (hard)	180	14.8	2931	13.1	1.15	0.98-1.36	.084	1.08	0.89-1.31	.429
Physical work demands (high)	596	31.6	6560	19.8	1.86	1.68-2.06	<.001	0.87	0.76-0.99	.035
Safety										
Occupational accidents (yes)	106	7.4	1728	5.4	1.40	1.14-1.71	.001	1.31	1.03-1.68	.028
Safety instruction (poor)	218	18.2	3370	13.0	1.49	1.28-1.74	<.001	1.32	1.10-1.59	.003
Job insecurity (high)										
Worry of unemployment	252	16.7	3686	11.3	1.57	1.37-1.81	<.001	1.51	1.27-1.79	<.001
Worry of transfer	141	9.5	2533	7.8	1.23	1.03-1.47	.024	1.67	1.36-2.05	<.001

Note: Abbreviations: OR, odds ratio, CI, confidence interval.

Reference group: 32-40 hours/week. Model 1: Adjusted for gender, age, and SES.

%: The percentage of workers reporting the outcome within marginal part-time workers and full-time workers.

[a]General job satisfaction was not part of the 2012 questionnaire.

TABLE 3 Health characteristics of marginal part-time workers compared with full-time workers (n = 34 960)

	8 to <15 hours/week		32-40 hours/week (reference)		Crude			Model 1		
	n	%	n	%	OR	95% CI	*P*	OR	95% CI	*P*
Poor self-rated health	253	17.7	2402	7.5	2.65	2.30-3.05	<.001	3.05	2.55-3.64	<.001
Treatment-requiring illness	647	45.8	11 205	35.4	1.54	1.39-1.72	<.001	1.98	1.73-2.26	<.001
Depressive symptoms	281	21.0	3119	10.8	2.19	1.91-2.51	<.001	1.72	1.45-2.05	<.001
Stress	274	19.2	4684	14.7	1.38	1.20-1.58	<.001	1.19	1.00-1.41	.048
High sleep disturbance	647	45.2	12 748	40.0	1.24	1.12-1.38	<.001	1.12	0.98-1.27	.099
Pain	1123	78.4	24 265	76.1	1.14	1.00-1.30	.047	1.13	0.96-1.33	.156

Note: Reference group: 32-40 hours/week. Model 1: adjusted for gender, age, SES, and treatment-requiring illness (not in the outcome: treatment-requiring illness).

%: The percentage of workers reporting the outcome within marginal part-time workers and full-time workers.

Abbreviations: CI, confidence interval; OR, odds ratio.

in marginal part-time workers (OR 1.30, 95% CI 1.06-1.60). In particular, OR were enlarged for occupational accidents, worry of unemployment and hard physical work as well as poor self-rated health and treatment-requiring illness.

4 | DISCUSSION

This study finds that marginal part-time workers report less quantitative job demands, lower levels of influence at work, poorer support from colleagues and leaders, less job satisfaction, poorer safety, and higher levels of job insecurity compared with full-time workers. We found no clear associations between marginal part-time work and negative social relations and physical workload. In addition, marginal part-time workers generally reported poorer health than full-time workers, particularly for self-rated health, treatment-requiring illness, and depressive symptoms. Our findings indicate that characteristics of the work environment to some degree altered the estimates for poor self-rated health and depressive symptoms, while the other health characteristics remained more stable. Job insecurity did not alter the OR for health.

4.1 | Marginal part-time work and work environment

Our findings on the work environment extend the evidence and are generally in line with the few previous studies on populations from Scandinavia and the Netherlands. These studies also found lower quantitative job demands,[7,10] poorer influence at work,[7,10] and poorer safety[31] among marginal part-time workers compared with full-time workers. Our findings on job satisfaction are also in line with some previous findings on less interesting work tasks,[10-12] yet other studies also showed no association or higher job satisfaction.[7,11,32] We only identified one study on support from colleagues and leaders,[7] which indicated no association between marginal part-time work and assistance from colleagues. To the best of our knowledge, no previous studies have assessed marginal part-time work and negative social relations or physically demanding work.

Low quantitative job demands combined with low influence at work, place marginal part-time workers as passive employees according to the Job Demand Control Model by Robert Karasek.[33] Being a passive employee can result in dissatisfying jobs,[33] in line with our findings on job satisfaction. There may well be a dualism in part-time work, where some people choose voluntarily to work part-time, for example, for a better work-life balance, while others are forced into part-time work if they cannot find a permanent full-time job.[34] Working fewer hours or more hours than desired has been related to job dissatisfaction.[35] Thus, our finding of lower job satisfaction among marginal part-time workers could be related to the marginal part-time work being involuntary, though studies suggest that only a small fraction (5%) of marginal part-time work in Denmark is involuntary.[36] In terms of physical workload, our findings were ambiguous and need further exploration. Reports of occupational accidents were higher among marginal part-time workers and the estimate increased after excluding students. Considering the fewer hours of work among marginal part-time workers, the actual risk of an accident per hour of work is expected to be even higher for marginal part-time workers.

TABLE 4 Health characteristics of marginal part-time workers compared with full-time workers adjusted for gender, age, SES, treatment-requiring illness, and the different work environment characteristics (n = 34 960)

8 to <15 vs 32-40 hours/week (reference)	Poor self-rated health		Treatment-requiring illness		Depressive symptoms		Stress		High sleep disturbance		Pain	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Model 2	3.05	2.55-3.64	1.98	1.73-2.26	1.72	1.45-2.05	1.19	1.00-1.41	1.12	0.98-1.27	1.13	0.96-1.33
Model 2 + Quantitative job demands[a]	3.21	2.68-3.84	2.03	1.77-2.32	1.88	1.57-2.24	1.37	1.15-1.65	1.16	1.02-1.32	1.14	0.96-1.35
Model 2 + Influence at work[b]	3.04	2.53-3.65	1.93	1.68-2.22	1.68	1.40-2.01	1.16	0.98-1.39	1.10	0.96-1.26	1.14	0.96-1.35
Model 2 + Interpersonal relationships and leadership[c]	3.19	2.65-3.84	1.97	1.72-2.26	1.79	1.49-2.14	1.21	1.02-1.44	1.12	0.98-1.29	1.16	0.97-1.38
Model 2 + Negative social relations[d]	3.28	2.73-3.93	2.04	1.78-2.34	1.89	1.58-2.26	1.26	1.06-1.50	1.16	1.01-1.32	1.16	0.98-1.37
Model 2 + Job satisfaction[e]	3.36	2.70-4.19	1.96	1.66-2.31	1.73	1.39-2.15	1.16	0.94-1.44	1.08	0.92-1.27	1.16	0.95-1.43
Model 2 + Physical workload[f]	2.51	2.06-3.06	1.94	1.67-2.24	1.68	1.39-2.03	1.14	0.95-1.38	1.08	0.94-1.25	1.06	0.87-1.29
Model 2 + Safety[g]	2.84	2.33-3.46	2.00	1.73-2.32	1.76	1.45-2.12	1.18	0.98-1.42	1.15	0.99-1.32	1.08	0.89-1.30
Model 2 + All work environment[h]	2.87	2.20-3.74	2.02	1.66-2.46	1.91	1.47-2.49	1.35	1.04-1.77	1.08	0.89-1.30	1.22	0.93-1.61
Model 2 + Job insecurity[i]	2.98	2.48-3.58	1.93	1.68-2.21	1.62	1.35-1.94	1.13	0.95-1.34	1.10	0.96-1.25	1.11	0.94-1.32

Note: Abbreviations: CI, confidence interval; OR, odds ratio.

Reference group: 32-40 hours/week. Model 2: adjusted for gender, age, SES, and treatment-requiring illness.

[a]Adjusted for: Not enough time, available outside work hours, and hard to keep deadlines.

[b]Adjusted for: Influence on how to solve work tasks, influence on when to solve work tasks and sufficient authority.

[c]Adjusted for: Leader feedback, work acknowledgement from management, acknowledgement of work between colleagues, and help between colleagues.

[d]Adjusted for: Arguments or conflicts, bullying and threats or violence.

[e]Adjusted for: Interesting work tasks and general job satisfaction.

[f]Adjusted for: Hard physical work and physical work demands.

[g]Adjusted for: Safety, occupational accidents, and safety instruction.

[h]Adjusted for: Quantitative job demands, influence at work, support from colleagues and leaders, negative social relations, job satisfaction, physical workload, and safety.

[i]Adjusted for: Worry of unemployment and worry of transfer.

4.2 | Marginal part-time work and job insecurity

Our findings on higher job insecurity among marginal part-time workers are in line with findings from other Nordic countries.[3] Yet, previous results on Danish marginal part-time workers suggested lower job insecurity among marginal part-time workers compared with full-time workers.[3] This discrepancy in the findings from the Danish studies is likely related to the different questions on job insecurity used, which in the previous study also includes unemployment 1 year earlier.

4.3 | Marginal part-time work and health

Our findings of poorer health among marginal part-time workers are in line with a British longitudinal study that indicated a higher risk of poor perceived health among marginal part-time workers without a permanent contract compared with permanent full-time works.[21] However, the association may be context-specific as this result was not reproduced in a German population.[21] The high OR in self-rated health, treatment-requiring illness, and depressive symptoms indicate that marginal part-time is more strongly related to long-term health characteristics compared to the more acute symptoms like stress, sleep, and pain.

Findings in this study suggest an accumulation of unfavorable characteristics of the work environment and health among marginal part-time workers. Precarious employment[6] is a multidimensional construct with an accumulation of unfavorable aspects of employment quality.[13,14] No universal definition of this concept exists and both 'atypical' and 'non-standard' (which may cover marginal part-time) are widely used. A recent theoretical framework of precarious employment,[13] suggested that precarious employment may result in poor health and quality of life through a poorer work environment and material deprivation, also suggested as potential mechanisms by other studies.[4,37] A mediating effect by work environment characteristics between marginal part-time work and health has also been observed in some previous studies,[38,39] although other cross-sectional studies reported that marginal part-time workers themselves less often felt their health was affected by their work.[7,20] Our results indicated that several characteristics of the work environment altered the estimates of marginal part-time on self-rated health and depressive symptoms and therefore may confound or mediate the association. Due to the cross-sectional design of the present study reverse causation cannot be ruled out and prospective studies are needed to determine the direction of the revealed associations.

The supplementary analyses indicated higher experience of job insecurity in marginal part-time workers after excluding students, that is, students experience less job insecurity. This may be related to a transitional process of students, who may take on marginal part-time jobs voluntarily during their studies.[8] The supplementary results also indicated that students reported less poor work environment characteristics and better health. Previous studies have not conducted separate analyses on students. Yet, our findings suggest separating the effects of students in future studies.

4.4 | Strengths and limitations

One strength of this study is the relatively large study population with employees from different sectors and jobs. Another strength is that we assessed the possible selection bias from participation by use of register information for all working individuals living in Denmark. Given the moderate WEHD response rate, our sample may not be representative of all Danish employees and survey participation among marginal part-time workers indicated some degree of selection compared to full-time workers. Thus, there is a risk of selection bias from conditioning on a common effect (participation in WEHD) if work environment or health characteristics are also associated with participation. However, adjustment for age, gender, SES, and previous illness (in health outcomes) limited the possible bias. Furthermore, the use of self-reported data is necessary for the assessment of several work environment and health characteristics, which are not found in registers. Register-based information of the exposure reduced the risk of bias from self-reporting. Yet, unpaid and undeclared work hours may exist.[40] Thus, some marginal part-time workers may work more hours than registered. In addition, the WEHD survey did not include marginal part-time workers with less than 8 hours of work per week. We expect this may have reduced some of the effects and therefore consider our results to be conservative.

The use of exposures 3 months prior in time to the survey outcomes, is another strength as the exposure is known to be present prior to the survey response. However, reverse causality can still be a problem, in particular in relation to the health outcomes. Another possible issue is a healthy worker effect due to a selection into marginal part-time work and/or out of full-time work among people with health issues. Marginal part-time workers may include vulnerable workers, unable to work full-time, for example, due to health issues. However, our results on health were not explained by treatment-requiring illnesses in the past year. Thus, chronic diseases cannot solely explain the poorer health found among marginal part-time workers, yet additional diagnosed or undiagnosed health issues may still be present.

The generalizability of these findings may be limited to other Nordic countries, with somewhat similar labor market flexibility and welfare states. The policy context (eg

collective agreements) and social context (eg education level and social support), may modify the effect of marginal part-time work on health.[7,13,21] Also, the type of marginal part-time work (eg fixed term contracts or involuntariness) may confound or modify the effects of marginal part-time work on work environment and health. Thus, distinguishing between different types of marginal part-time workers may be valuable in future studies. Finally, given the high proportion of women in marginal part-time work, future studies may explore if the association with the work environment, job insecurity and health differ by gender.

In conclusion, our findings show that marginal part-time workers have a poorer psychosocial work environment and safety, more job insecurity and poorer health than full-time workers, which is not explained by age, gender, SES, and treatment-requiring illness (in health outcomes). Characteristics of the work environment may confound or mediate the association with health outcomes. These results suggest that marginal part-time workers are a vulnerable group of workers with an accumulation of unfavorable characteristics of the work environment and health. Prospective studies are needed to determine the direction of the revealed associations between marginal part-time work and work environment and health along with any potential mediating effect of work environment on health.

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DISCLOSURES

Ethics approval: The WEHD survey was conducted in accordance with the Helsinki declaration. The WEHD is registered by The Danish Data Protection Agency (2015-57-0074, NRCWE journal number 2013-10-11). *Informed consent:* Participants were informed about the purpose of the WEHD and by returning the questionnaire, the participants consented to participate. *Registry and the Registration No. of the study/Trial:* N/A. *Animal Studies:* N/A. *Conflict of interest:* The authors have no conflicts of interest to declare.

AUTHOR CONTRIBUTIONS

All authors contributed to the design of the study. HBN, LSG, and K.P analysed the data and HBN led the writing. All authors critically revised and approved the final manuscript.

DATA AVAILABILITY STATEMENT

This study is based on anonymized micro data available from Statistics Denmark. Access to data can only be permitted through an affiliation with a Danish authorized environment. For further information on data and data access please see www.dst.dk/en/TilSalg/Forskningsservice.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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