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ORIGINAL RESEARCH

Occupational Physical Activity Among Pregnant Employees in the Danish Workforce: The PRECISE Occupational Cohort Profile

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Purpose: Occupational physical activity (OPA) has been linked to adverse pregnancy outcomes, although findings are not consistent. This paper describes the PRECISE Occupational Cohort, designed with the purpose to obtain comprehensive information on OPA with objective measurements and prospective information on pregnancy-related discomforts and sick leave among pregnant employees in Denmark.

Methods: A total of 1556 pregnant participants were included between January 2023 and June 2024 from six obstetric departments in relation to the first trimester ultrasound scan. Information on OPA, pregnancy-related discomforts and sick leave was collected by repeated weekly questionnaires. Additionally, a subgroup of 327 pregnant participants and 90 non-pregnant co-workers were invited for repeated objective measurements, and/or workplace observations. A total of 603 accelerometer measurements from 412 unique participants, and 138 workplace observations were obtained from 102 unique participants. Time spent standing, walking and forward bending was acquired by accelerometers, and information on lifting and person-handlings was quantified by observations. All participants covered 197 occupational codes.

Results: A total of 1008 pregnant participants on average responded to the weekly questionnaires from pregnancy weeks 12–40. High frequencies of pregnancy discomforts were reported throughout pregnancy, and on average only 11% reported no discomforts. Pregnancy-related sick leave increased throughout pregnancy, peaking in pregnancy week 29, where 26% reported at least one day of pregnancy-related sick leave in the past week.

Conclusion: This cohort provides unique repeated measurements with comprehensive information about pregnant employees across many jobs, disclosing high levels of pregnancy discomforts and sick leave throughout pregnancy. The information will enable investigation of the associations of OPA, pregnancy-related discomforts and sick leave on a more detailed level than now. The objective measurements with novel information on OPA will contribute to the development of quantitative Job Exposure Matrices enabling investigation of the association between OPA and adverse pregnancy outcomes in larger populations, with the potential to strengthen preventive guidelines.

Keywords: adverse pregnancy outcomes, objective measurements, pregnancy cohort, pregnancy-related sick leave

Introduction

Occupational physical activity (OPA), such as prolonged standing, walking, forward bending and lifting, remains a concern in risk assessment and counselling of pregnant workers, given its potential impact on maternal and fetal health.[1–10] Approximately, 80% of women of reproductive age are engaged in the labor force in Denmark and many

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continue to work throughout pregnancy.[11] A large Danish national analysis showed that nearly 50% of women aged 18–45 years stand and walk for three quarters of their work time and 9% perform tasks including heavy lifting.[12]

Research has linked OPA with adverse pregnancy outcomes including preterm delivery,[1–4] fetal growth retardation,[5–7] and miscarriage,[8–10] although findings in systematic reviews are not consistent.[13–16] The etiology of the association between OPA and adverse pregnancy outcomes remains poorly understood. Nonetheless, findings have prompted the Danish Working Environment Authority to recommend breaks every 1 to 1.5 hours of standing, and advise against lifting more than 10 kg at a time or exceeding a cumulative total of 1000 kg per day.[17] However, more robust data is needed to strengthen the credibility of these guidelines.

OPA has also been linked with pregnancy discomforts such as pelvic girdle pain and pregnancy-related lower back pain.[18–21] These discomforts may contribute to sick leave and have significant physical, psychological, and socioeconomic implications for both pregnant workers and society.[22,23] As pregnancy discomforts rarely involve hospital contacts and thereby entry into Danish registries, knowledge of pregnancy discomforts relies mainly on self-reported data. Due to the fluctuating nature of discomforts, and possibly also working conditions during pregnancy, repeated assessments are needed to comprehend how OPA influences pregnancy discomforts and sick leave. Most studies investigating pregnancy-related discomforts and adverse pregnancy outcomes have predominantly utilized self-reported data to assess OPA and are often conducted only once or twice during pregnancy. This approach introduces a risk of recall bias, inaccuracies, and crude exposure measures. While some studies have applied Job Exposure Matrices (JEMs) for exposure assessments, these too have been based on self-report or expert assessment and were not always specifically developed for pregnant women,[1,24–28] which may also result in imprecise findings. To prevent sick leave or other negative consequences, more knowledge on OPA and development or aggravation of pregnancy discomforts along with adverse pregnancy outcomes is needed.

In order to overcome limitations in previous studies on OPA in pregnant women, we established the PRECISE Occupational Cohort to collect comprehensive information with:

- accelerometer measurements to assess physical activity, such as standing, walking, and forward bending,
- workplace observations to assess lifting and person-handlings, and
- repeated weekly questionnaires throughout pregnancy collecting information on OPA, pregnancy discomforts, and sick leave.

The objective of the present paper is to describe the PRECISE Occupational Cohort. We present data sampling methods, coverage and content, descriptive results based on repeated self-reported questionnaires, strengths and limitations, and possibilities for future studies.

Methods

Study Population

Between January 2023 and June 2024 participants were recruited to the PRECISE Occupational Cohort. Pregnant participants were primarily recruited from one of the six enrolled obstetric departments in Denmark (Roskilde, Hvidovre, Herlev, Nordsjælland, Odense, and Kolding) in relation to the routine 1st trimester ultrasound scan. Around 97% of all pregnant women in Denmark attend this ultrasound scan,[29] which is performed between pregnancy week 11 and 13. Recruitment lasted five to eight months in each obstetric department, with overlapping periods. At the departments in charge of the ultrasound scan, there were advertisements for the PRECISE project. Pregnant women were offered a pamphlet with brief description of the project, and the possibility to provide their job title and contact information to receive further project details. Interested women received an invitation letter in e-Boks, a secure digital mailbox,[30] including more detailed project information and the possibility to consent or decline participation. If consenting, participants received a baseline questionnaire followed by repeated SMS questionnaires every sixth day until the end of pregnancy. Pregnant participants who were unemployed, on permanent sick leave, below the age of 18 years, could not read English/Danish, or had a multiple pregnancy were excluded (Figure 1). Based on their self-reported job title, participants were assigned job codes according to DISCO-08 (the Danish version of the International Standard Classification of Occupations, ISCO-2008) by the occupational specialist and principal investigator LMB. When in

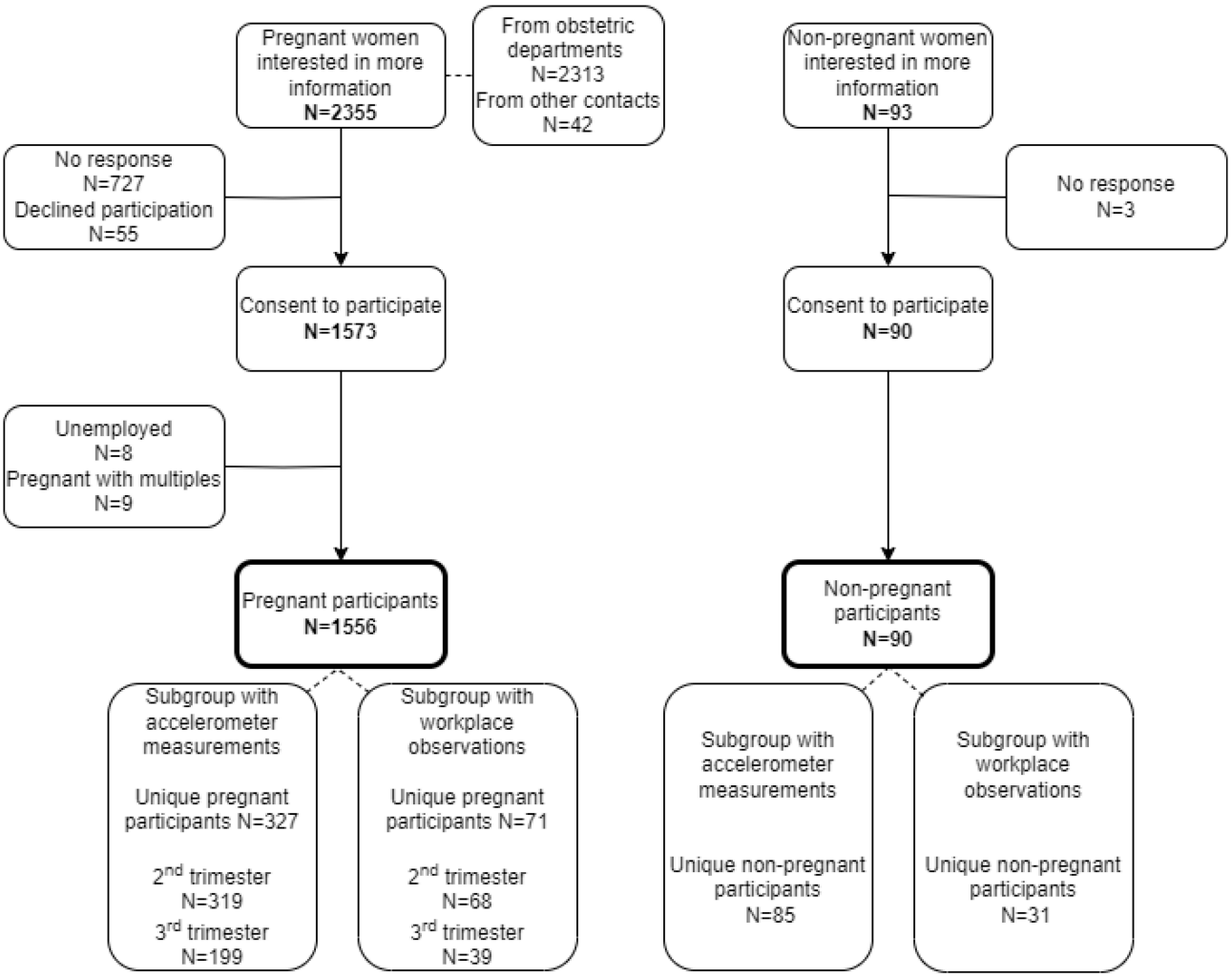

Figure 1 Flowcharts of the recruitment process in the PRECISE Occupational Cohort from January 2023-June 2024 with division by pregnant participants and non-pregnant participants.

doubt, the participants were contacted and asked to explain their job function. Non-pregnant participants aged 18–45 years were mainly recruited from the same workplaces as the pregnant participants. Non-pregnant participants were recruited as a proxy for women in their 1st trimester, solely for the purpose of collecting objective measurements for the development of trimester-specific JEMs. In total, 90 non-pregnant women participated. Additional recruitment methods included ads in union-magazines, direct contact to workplaces, participant referrals, and social media. Considering the approximate number of pregnant women who attended the ultrasound during the inclusion period, around 20% (N=2448) were interested in more project information and 1556 participated in the study (Figure 1).

Questionnaires

The performance of the baseline and weekly SMS questionnaires were tested in November 2022 by interviewing ten pregnant women at Zealand University Hospital, Roskilde, after they had completed the questionnaires. Based on their feedback, the questionnaires were subsequently revised. The baseline questionnaire collected information on current occupation, current and previous pregnancies, and lifestyle (Supplementary Figure 1). The weekly SMS questionnaires addressed OPA, pregnancy discomforts and sick leave during the past week (Supplementary Figure 2). When possible, national, and international questionnaire scales were used.[12,31,32] To minimize recall bias, the SMS questionnaire inquired information of OPA from the prior workday only. The SMS questionnaires were sent on varying weekdays (every sixth day) to account for special work tasks on specific days. Pregnant participants were considered potential responders

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until they either responded "not pregnant anymore", reached pregnancy week 42, or after 32 questionnaires, whichever came first. Non-pregnant participants received a similar baseline questionnaire but no weekly questionnaires (Supplementary Figure 3). All questionnaires were administered via the Capitol Region's secure web application, RedCap (Research Electronic Data Capture).

Objective Measurements

Objective measurements included accelerometer measurements worn for seven days and workplace observations for two to three working hours.

Based on the distribution of pregnant workers in the Danish workforce and existing knowledge of occupations and physical workload,[33,34] we a priori identified occupations of special interest for objective measurement investigations. We prioritized occupations with high female prevalence and with representation of both high and low expected OPA to ensure variation in exposure and adequate coverage for most pregnant workers in Denmark. Participants within these occupations received a telephone call from a member of the PRECISE project and were offered participation in the objective measurements. Participants were contacted at least three times and received one SMS before further attempts to reach them ceased. If a participant reported no regular lifting ≥1 kg at work, workplace observations were not performed.

Pregnant participants were invited to the objective measurements twice (once during 2nd trimester and once during 3rd trimester), and non-pregnant participants were invited once.

Accelerometer Measurements

Two tri-axial accelerometers, Axivity AX3®,[35] were mounted by double-sided adhesive tape (3M, Hair-Set, St. Paul, Minnesota, US) and waterproof fixation tape (Leukoplast, Hypafix® transparent, Hull, UK). One was placed on the upper back (T1-T2 level) and one on the front of the right thigh midway between the patella and crista iliac.[36] The accelerometers are small (23x32.5x7.6mm), light (11g), and waterproof. During the seven-day measurement, participants were asked to register times of work, leisure, and sleep, and to note if there was any non-wear time in a provided diary. The accelerometers and diaries were returned by mail in a prepaid envelope. Accelerometers were initialized with the Axivity Software Open movement version V1.0.0.43. Data was processed with ActiPASS,[37] a customized software based on the validated software Acti4[38] which incorporates additional quality checks to ensure accurate data processing. Diaries were entered manually and validated through individual quality-check visualizations computed by ActiPASS. Time spent sitting, standing and walking was determined using algorithms from thigh-worn accelerometers, and time spent forward bending from trunk-worn accelerometers, with data recorded in one second epochs.[37] A member of the PRECISE project group visited the participant to attach the accelerometers the first time, and accelerometers were mostly sent by mail and attached by the participants themselves the second time. All participants residing in Jutland or Funen received the accelerometers by mail both times; however, a member of the project group guided the attachment by telephone the first time. A total of 603 accelerometer measurements were obtained from 412 unique participants, including 319 measurements from 2nd trimester, 199 from 3rd trimester, and 85 from non-pregnant participants.

Workplace Observations

Observations of occupational lifting and person-handlings were quantified by registering number of lifts, weight of burdens (kg), and number and type of person-handlings (Supplementary Figures 4 and 5). All lifts ≥1 kg were registered if the object was raised from the surface by the participant. Pulling or pushing objects were not registered. Digital scales (KERN & SOHN, kern-mgd, Balingen, Germany) were used to weigh objects; if it was not possible to weigh objects, the observer estimated the weight in consultation with the participant. Observations were performed by one of the eight PRECISE project members. All observers completed a 2-hour training course, including video sessions prior to observations, to minimize inter-observer differences.

All participants in subgroups with objective measurements were offered a personal report of their physical activity.

A total of 138 workplace observations were obtained from 102 unique participants, including 68 observations from 2nd trimester, 39 from 3rd trimester, and 31 from non-pregnant participants. A flowchart of the study population and subgroups is presented in Figure 1.

The included participants represented 197 different occupational DISCO-08 codes, and the distribution of participation with workplace observations, accelerometer measurements, or only questionnaires is depicted in Figure 2.

An overview of the comprehensive data collection is presented in Table 1.

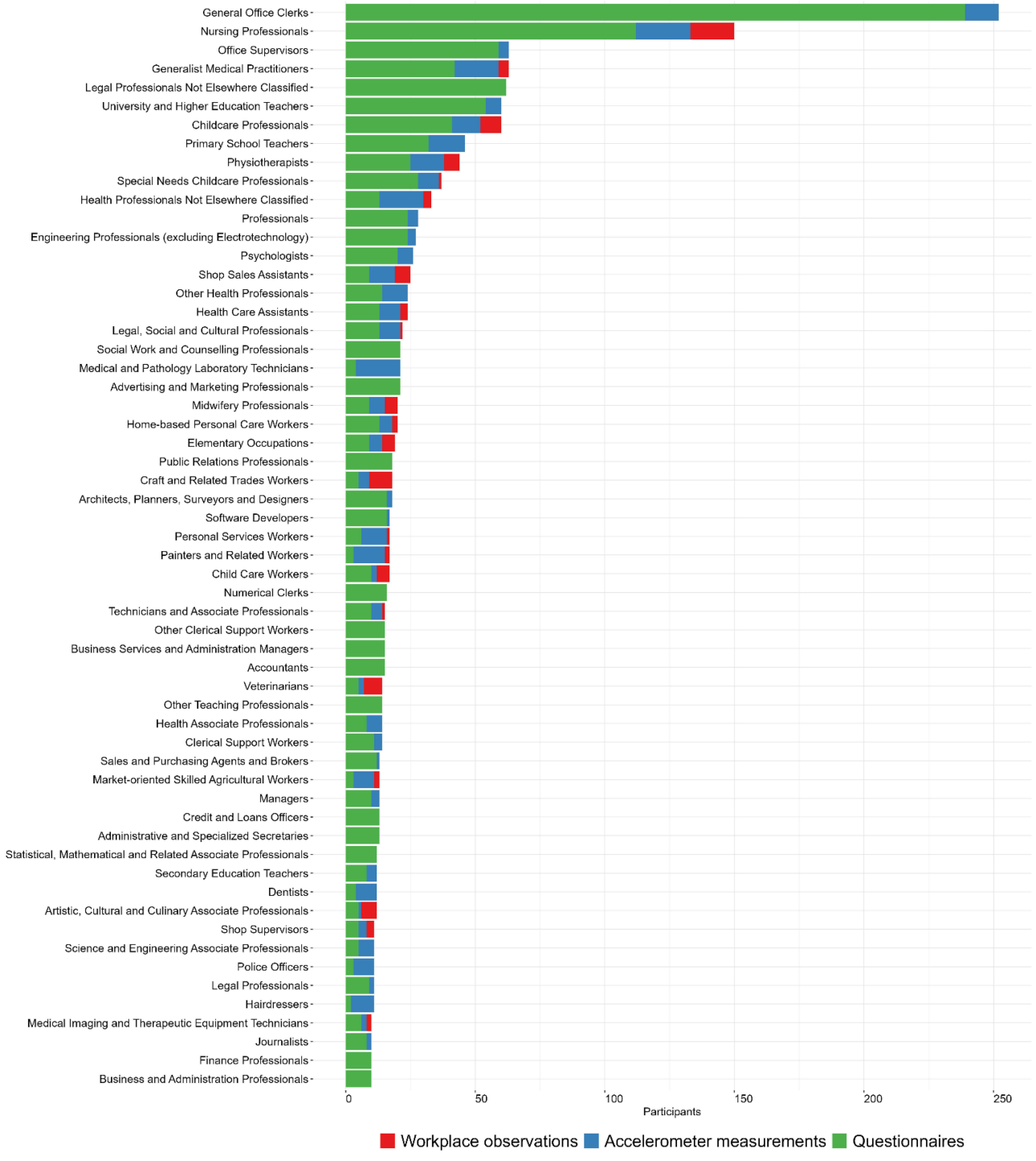

Figure 2 Occupations of all participants in the PRECISE Occupational Cohort (N=1646) with illustration of participation in workplace observation, accelerometer measurement or questionnaires only. If participating in both workplace observation and accelerometer subgroups, the participant is illustrated as a workplace observation participant. Occupations are grouped by DISCO-08 at four-digit level or nearest level containing at least 10 participants.

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Table 1 Overview of Data Available For the PRECISE Occupational Cohort

Category	Data Source	Variables
Occupation	Baseline and weekly questionnaires	Job title Work hours Work periods (day, evening, night) Working conditions (physical, mental, psychosocial) Employment type Time of informing employer of pregnancy*
Occupational and leisure time physical activity	Accelerometer measurements from 2nd and 3rd trimester pregnant participants and non-pregnant participants	Durations of occupational and leisure time: Standing, walking, moving, running, sitting, lying, walking/running stairs, cycling, sleeping, back bent 20°, 30°, 60°and 90° angles while in upright or sitting position Number of steps
	Workplace observations from 2nd and 3rd trimester pregnant participants and non-pregnant participants	Number of lifts Weights of lifts Number of person-handlings Type of person-handlings, including usage of assistive device, with/without co-worker Weight of person being handled
	Baseline and weekly questionnaires	Occupational time standing, walking, sitting, back bent >30° Occupational lifting and person-handlings General physical activity (low and high intensity) Heavy lifting during leisure time >20 kilograms
Absence	Baseline and weekly questionnaires	Days of pregnancy and non-pregnancy-related absence from work*
Pregnancy/fertility	Baseline and weekly questionnaires	Gestational week* Fertility treatment* Previous pregnancy discomforts* Current pregnancy discomforts* Miscarriages* Parity*
Health and lifestyle	Baseline questionnaire	Diseases Self-rated physical and mental health Education Alcohol Smoking BMI (pre-pregnancy) Physical activity (pre-pregnancy) Living condition (kids, spouse)

Notes: Baseline questionnaire information is available for both pregnant and non-pregnant participants whereas weekly questionnaire information only is available for pregnant participants. *Not available for non-pregnant participants.

Baseline characteristics were described through calculations of means and standard deviations, number of participants and percentages, or medians with 5 and 95 percentiles in each group. All medians and percentiles were calculated as the mean of the five values nearest to the actual value to comply with local data regulation. All analyses were conducted in R version 4.4.2.

Ethical Approval

The PRECISE Occupational Cohort was approved by the Knowledge Centre on Data Protection Compliance under the records of processing regarding health science research projects within the Capital Region of Denmark (Privacy: P-2022-

201). The scientific ethics committee assessed on July 7th, 2022, that no review was needed. The project was registered and approved at Clinical trials (NCT05670145) before start of inclusion. This study complies with the Declaration of Helsinki.

Results

Mean age was 31.1 years (SD 3.9), and median pregnancy week at baseline inclusion was 15.0 (5–95 percentile 13.0–22.7) for all pregnant participants (Table 2). In addition, 89% of all pregnant participants had already informed

Table 2 Selected Baseline Characteristics of the PRECISE Occupational Cohort

	Pregnant Participants			Non-Pregnant Participants
	All (N=1556)	**Accelerometer (N=327)**	**Observations (N=71)**	**All (N=90)**
Age in years, mean [SD]	31.1 [3.9]	30.7 [3.9]	30.8 [4.5]	31.3 [5.7]
BMI (kg/m^2), N (%)*				
Underweight (<18.5)	39 (3)	8 (3)	4 (6)	3 (3)
Normal (18.5–24.9)	954 (61)	184 (57)	40 (56)	53 (60)
Overweight (25.0–29.9)	351 (23)	84 (25)	19 (27)	24 (27)
Obese (≥30)	209 (13)	48 (15)	8 (11)	9 (10)
Smoking status, N (%)				
Daily or occasionally	23 (2)	8 (3)	<3 (<1)	18 (20)
Formerly	423 (27)	83 (26)	<20 (<30)	13 (15)
Never	1094 (70)	230 (71)	50 (70)	54 (62)
Use of other nicotine-containing product	5 (<1)	0 (0)	0 (0)	3 (3)
Average alcohol consumption (units/wk), N (%)				
None	1541 (99)	>320 (>98)	71 (100)	33 (37)
1–4	7 (<1)	<3 (<1)	0 (0)	47 (53)
5 or more	0 (0)	0 (0)	0 (0)	9 (10)
Highest educational level, N (%)				
Primary school	18 (1)	8 (2)	<3 (<3)	<3 (<3)
Vocational education	82 (5)	38 (12)	9 (13)	12 (13)
High school/business school	49 (3)	10 (3)	>3 (>5)	>6 (>7)
Short tertiary education (up to 2.5 years)	118 (8)	30 (9)	5 (7)	5 (6)
Medium tertiary education (3–4 years)	581 (37)	148 (46)	36 (51)	39 (43)
Long tertiary education (5 years or more)	705 (46)	90 (28)	15 (21)	24 (27)
Lives with spouse/partner, N (%)	1510 (97)	319 (98)	70 (99)	64 (71)
Leisure time physical activity (hrs/wk), mean [SD]*	5.6 [4.1]	5.9 [4.7]	5.8 [5.1]	5.8 [5.1]
Leisure time intense physical activity (hrs/wk), mean [SD]*	2.0 [2.2]	2.0 [2.4]	1.9 [2.1]	2.8 [4.2]
Average work time (hrs/wk), mean [SD]	35.7 [5.2]	35.4 [5.2]	35.4 [5.9]	35.0 [4.7]
Shift work, N (%)				
Mixed working hours without night shifts	1434 (92)	284 (87)	54 (76)	72 (81)
Mixed working hours including night shifts	120 (8)	41 (13)	17 (24)	17 (19)
Recruitment from obstetrical department, N (%)				
Roskilde	153 (10)	63 (19)	18 (25)	
Hvidovre	429 (28)	109 (33)	29 (41)	
Herlev	189 (12)	22 (7)	7 (10)	
Odense	371 (24)	46 (14)	0 (0)	
Kolding	164 (10)	23 (7)	0 (0)	
Nordsjælland	203 (13)	44 (14)	10 (14)	
Other	47(3)	20 (6)	7 (10)	

(*Continued*)

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Table 2 (Continued).

	Pregnant Participants			Non-Pregnant Participants
	All (N=1556)	**Accelerometer (N=327)**	**Observations (N=71)**	**All (N=90)**
Pregnancy week at baseline, median [P5-P95]	15.0 [13.0–22.7]	14.8 [12.8–22.4]	14.8 [11.9–23.5]	
Parity, N (%)				
0	867 (56)	188 (58)	38 (54)	
1	546 (35)	109 (33)	27 (38)	
≥2	143 (9)	30 (9)	6 (8)	
Previous miscarriages, N (%)	365 (24)	78 (24)	20 (28)	
Fertility treatment for current pregnancy, N (%)	198 (13)	37 (11)	9 (13)	
Has informed employer of current pregnancy, N (%)	1385 (89)	294 (90)	68 (96)	
Pregnancy week of informing employer of pregnancy, median [P5-P95]	9.6 [4.6–14.7]	7.6 [4.6–13.6]	7.6 [4.2–13.6]	

Notes: Pregnant participants are represented in more than one column, if they contribute with at least one accelerometer measurements and/or one workplace observation. Medians and 5th and 95th percentiles [P5-P95] are based on information from 5 individuals with values closest to the actual median/percentile. *BMI and physical activity were pre-pregnancy for pregnant participants and current for non-pregnant participants.
Abbreviations: SD, standard deviation; BMI, Body Mass Index; kg, kilograms; wk, week; hrs, hours.

their employer of pregnancy at time of inclusion, and median pregnancy week for informing their employer was 9.6 (5–95 percentile 4.6–14.7).

As expected, there was a lower proportion of current smoking (2%) and alcohol consumption (<1%) among all pregnant participants compared to non-pregnant participants (20% for smoking and 63% for alcohol consumption). Also, a higher proportion of pregnant participants lived with spouse/partner (97%) compared to non-pregnant participants (71%).

Overall, there was a high prevalence of highly educated pregnant participants (medium and long tertiary education, 83%); however, a higher proportion of lower educational level (primary school and vocational education) was seen in the accelerometer subgroup (14%), observation subgroup (16%) and non-pregnant group (16%) compared to all pregnant participants (6%). This was expected, as these subgroups were selected by occupations with an expected higher degree of OPA. Furthermore, a higher proportion of participants had shift work, including night shifts in the subgroups with accelerometer measurements (13%), workplace observations (24%) and non-pregnant participants (19%), compared to all pregnant participants (8%). Work time was similar across all groups, the mean hours/week was 35.7 (SD 5.2) for all pregnant participants.

BMI and leisure time physical activity did not differ between all groups, and parity, miscarriage, and fertility treatment did not differ between the groups of pregnant participants.

In total, 1505 pregnant participants responded to at least one weekly questionnaire, and the average number of pregnant participants responding to weekly questionnaires from pregnancy week 12 to 40 was 1008. Figure 3 illustrates the trend in response rates among pregnant participants throughout pregnancy. Overall, response rates were high and steady with a slight decline from pregnancy week 35 to 40.

Throughout pregnancy weeks 12 to 40, there were high frequencies of self-reported pregnancy-related discomforts (Figure 4), and on average only 11% of the responding participants reported no discomforts. The most common discomforts were back pain/pelvic pain and fatigue, both of which affected approximately 75% of participants by the end of pregnancy. Nausea/vomiting decreased from 38% to 21% from pregnancy week 12 to 20 and was hereafter stable, while the proportion of Braxton Hicks contractions and lower extremity edema increased as pregnancy progressed to approximately 86% and 45%, respectively.

Self-reported sick leave among the responders generally increased throughout the course of pregnancy with a maximum at pregnancy week 29. During this pregnancy week, 31% of the responding participants reported at least one day of sick leave in the past week, and 26% attributed their leave to pregnancy-related sick leave (Figure 5). Thereafter, sick leave decreased with large reductions around pregnancy weeks 32, 34, and 36, corresponding to the most common times for pregnancy leave in Denmark.

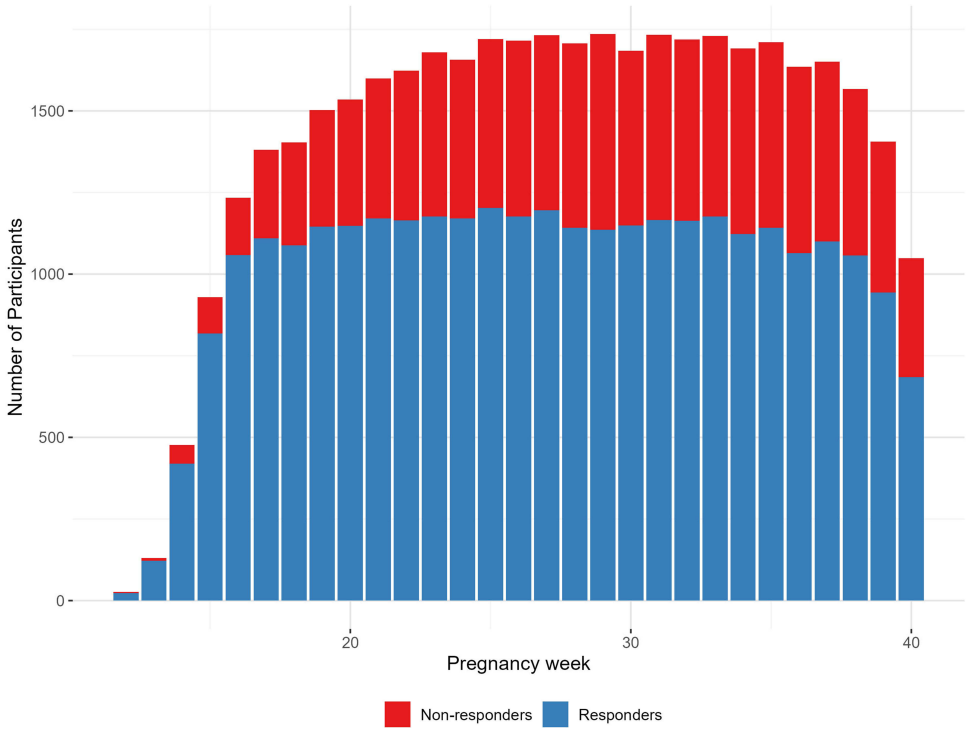

Figure 3 Pregnant participants responding and not responding the weekly SMS questionnaires throughout pregnancy weeks 12–40.

Discussion

The PRECISE Occupational Cohort is, to our knowledge, the first to investigate OPA, pregnancy-related discomforts and sick leave throughout pregnancy across various occupations using repeated objective measurements and questionnaires.

The main strength of the PRECISE Occupational Cohort is the usage of objective measurements for exposure assessment. Information of physical activity collected from accelerometers has proven to be considerably more precise compared to self-report;[39–41] however, information regarding OPA throughout pregnancy is still not well defined. A recent American study has applied accelerometers on a pregnancy cohort and obtained detailed information of all-day physical activity but is limited by only using self-report for assessment of OPA.[42] Measurements in our cohort were performed during both 2nd and 3rd trimester, and by using non-pregnant measurements as a proxy for 1st trimester, it is possible to consider the timing of exposure during pregnancy in future studies. This is important as alterations of OPA by changes in both behavior and workplace adjustments are expected. Due to the inclusion time (median pregnancy week 15), we lack information on exposure from the 1st trimester. Therefore, non-pregnant women were recruited, as OPA can be considered similar during 1st trimester and among non-pregnant workers in most occupations, as minimal physical changes are expected in early pregnancy. This must, however, be taken with caution, as other factors such as pregnancy discomforts may interfere with work ability.

Participants were encouraged to wear the accelerometers for seven days, to account for intra-worker variations, and reduce the risk of behavioral change, similar to previous studies.[42–44] Workplace observations for assessment of lifting and person-handlings, lasted for 2–3 hours, and participants were asked to work as they normally would. We must, however, consider the risk of bias, if altering behavior occurs while being observed.[45] Furthermore, this approach may overlook time-specific work variations, and therefore the results of lifting and person-handlings should be interpreted with caution.

As almost all pregnant women in Denmark attend the 1st trimester ultrasound scan, the possibility to join the cohort was considered equal to all pregnant women. Furthermore, this scan is the first common visit to the secondary health care, making recruitment feasible. Nonetheless, a limitation of the PRECISE Occupational Cohort is the low participation. Of the pregnant women who provided contact information and expressed interest (n=2355), 67% consented to

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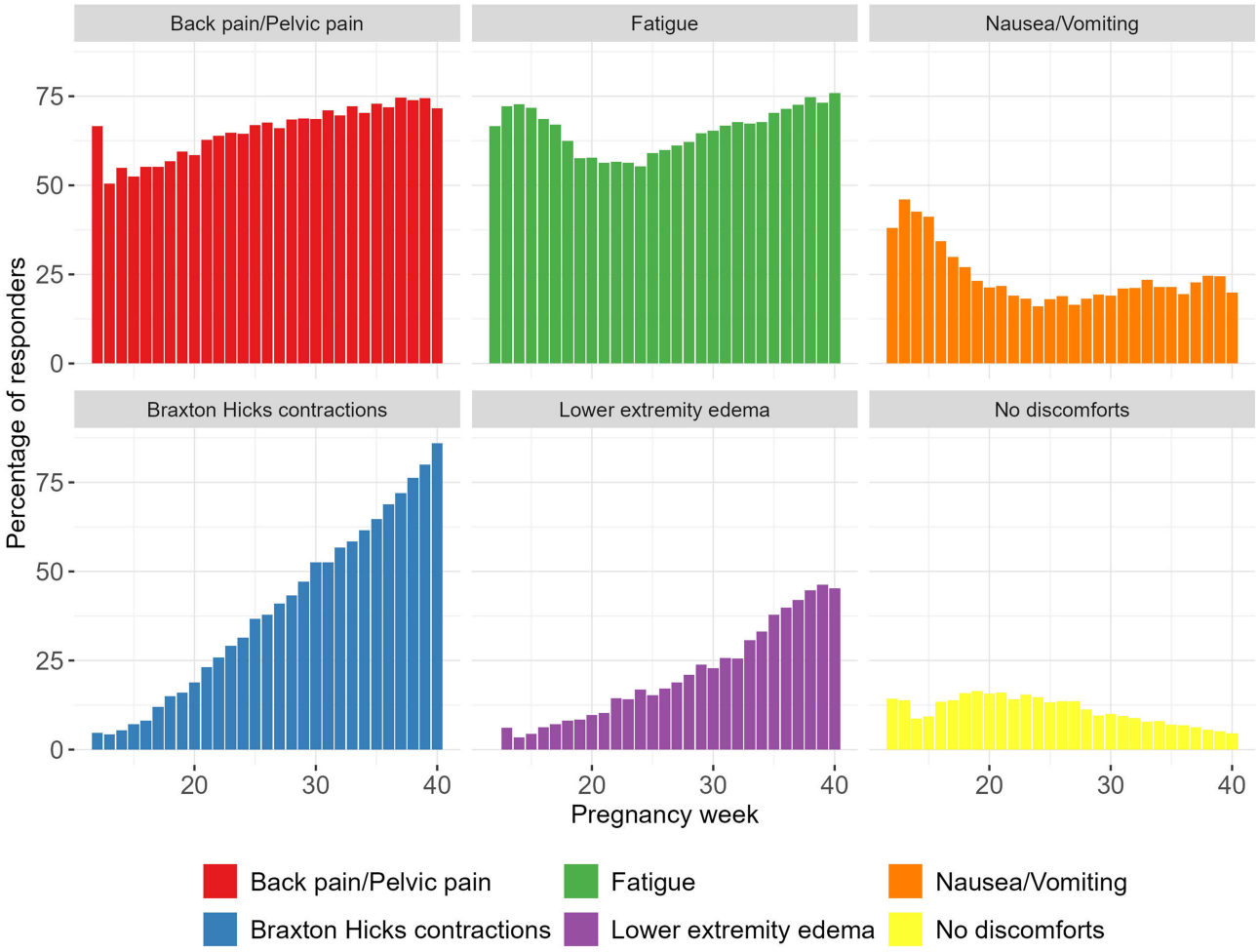

Figure 4 Self-reported pregnancy-related discomforts among responding participants throughout pregnancy weeks 12–40.

participate (n=1573). The true participation rate of the study population is, however, considerably lower, but unknown, as we do not know how many pregnant women received information about the project. A rough measure of the overall enrollment, considering approximately how many women attended the ultrasound during the study period, is 20%, which is lower than similar pregnancy cohorts.[31,46] A possible reason for the low participation could be that the enrollment process was hindered due to busyness at the obstetric departments, resulting in some pregnant women not receiving the project pamphlet. Although the weekly SMS questionnaire was short, some women may have perceived the task as too time-consuming. Material was available in both English and Danish; however, other language and cultural barriers may also have affected the participation.

Compared to the general population of pregnant women in the Danish workforce, more participants in the PRECISE Occupational Cohort were non-smokers, lived with a partner/spouse and had a higher educational level.[47] Similar to other birth cohorts, this skewed population is most likely attributed to self-selection.[48] Thus, researchers using data from our cohort for future association studies should be aware of potential selection bias, which can occur in studies if participation is related to both the exposure and outcome.[49] This may occur with usage of the self-reported weekly questionnaires regarding pregnancy-related discomforts and sick leave. Data from the objective measurements will be used to construct JEMs, which allows for group-based exposure estimates.

A high proportion of the study population resided within the Capital Region of Denmark and other urban regions. This was expected, as the obstetric departments had more pregnant women under their care. Consequently, occupational variations may also have been limited. We observed a higher frequency of blue-collar workers in Jutland and Funen, which may indicate either higher quantities of blue-collar worker compared to Zealand or a general higher participation

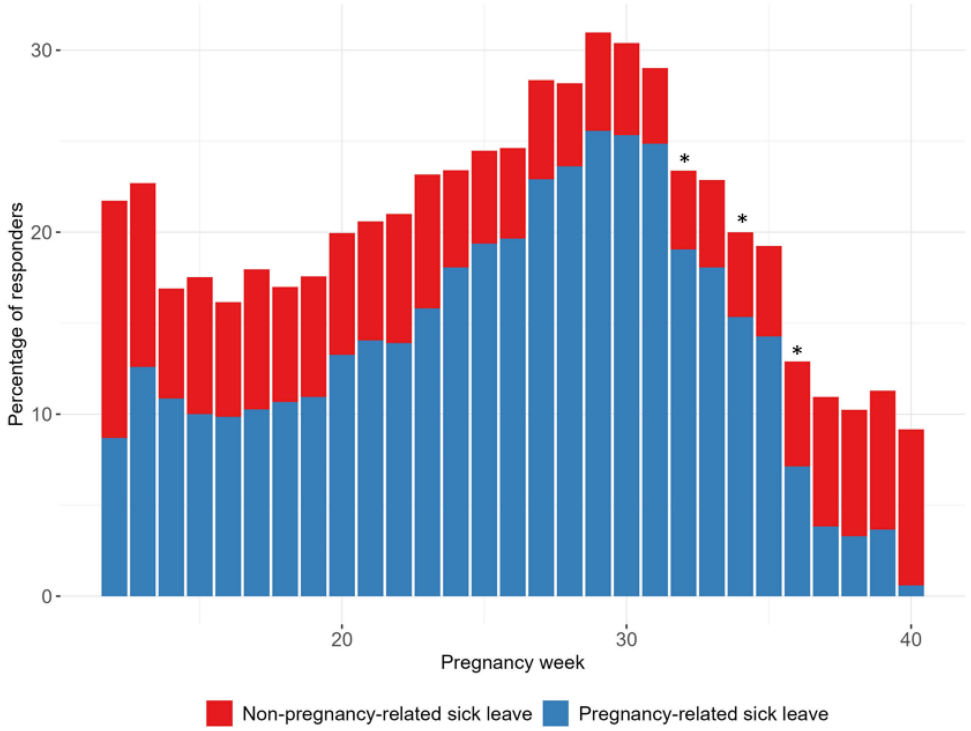

Figure 5 Pregnant participants weekly self-reported pregnancy-related sick leave and non-pregnancy-related sick leave throughout pregnancy weeks 12–40. *Marks the weeks where most pregnancy leaves typically begin in Denmark (pregnancy weeks 32, 34 and 36), depending on employment.

in these regions. Observations of participants living in Jutland and Funen were not possible, due to large geographical distances. Future studies should aim for a broader demographic representation encompassing regions with rural populations and consider including a higher degree of other recruitment methods such as workplace sites and union collaborations.

In Denmark, pregnant employees are required by law to inform their employer of their pregnancy at least three months before the expected due date.[50] In the PRECISE Occupational Cohort, the median timepoint for informing employer was already at pregnancy week ten. This is positive, as workplace adjustments may be implemented early for the pregnant workers. However, due to the skewed study population, with more women of higher socioeconomic position, we are not certain that this also occurs among women of lower socioeconomic position and thus can be generalized to other populations. Attention to occupations with high physical workload is needed, as the need for job adjustments or relocation might be even larger here.

Sick leave during pregnancy is high among pregnant workers in Europe,[51–53] and studies have linked pregnancy discomforts[22,23] and physical occupational risks during pregnancy[54–56] with sick leave. However, a recent systematic review found limited evidence for the association between occupational factors and sick leave during pregnancy, mainly due to the scarcity of studies and differences in exposure assessments, and therefore recommend further investigation.[57] As the Danish registries lack detailed information on pregnancy discomforts, the PRECISE Occupational Cohort provides novel data and enables investigation of associations between OPA, pregnancy-related discomforts and sick leave, which is important because such findings may have implications for preventive strategies.

Previous studies emphasize challenges regarding self-reported OPA, predominately due to recall bias and poor estimate reliability.[40,41] By merely asking about the most recent workday, we expect to reduce recall bias in this cohort. Further, the use of SMS questionnaires enabled fast and easy response and presents the possibility to collect information of the fluctuation of both workload and pregnancy discomforts throughout pregnancy. Although we saw a small decrease in participation of weekly questionnaires at the end of pregnancy, an overall high proportion participated, providing robust data for future studies.

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In conclusion, the PRECISE Occupational Cohort provides unique repeated measurements with comprehensive and time-accurate information of pregnant women's OPA and presents high levels of pregnancy-related discomforts and sick leave throughout pregnancy. Further, the cohort contributes with novel objective measurements with detailed information on OPA. However, the cohort is no exception from the common challenge of overrepresenting participants of higher socioeconomic position, which must be considered when using data from this cohort.

Future studies using the PRECISE Occupational Cohort may help improve guidelines and preventive strategies, thereby potentially contributing to less pregnancy-related discomforts, sick leave during pregnancy and adverse pregnancy outcomes impacting both pregnant women and society.

Data Sharing Statement

Upon request, it may be possible to gain access to the relevant data from the PRECISE Occupational Cohort and the developed JEMs obtained from this cohort. Further information can be found at https://doc-x.dk/ or by request at kontakt@doc-x.dk. Data will be retained for a minimum of 10 years.

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Disclosure

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