

Women referred for occupational risk assessment in pregnancy have no increased risk of adverse obstetric outcomes

Signe Brøker Bidstrup¹, Linda Kaerlev^{2,3}, Ane Marie Thulstrup⁴ & Jens Peter Ellekilde Bonde¹

ABSTRACT

INTRODUCTION: Our aim was to study the association between pregnant women's referral status for occupational risk assessment, and their risk of preterm delivery (< 37 weeks), low birthweight (LBW) (< 2,500g) and small for gestational age (SGA).

METHODS: In a cohort study, 1,202 deliveries among pregnant women referred to two Danish clinics of occupational medicine (Copenhagen and Aarhus) from 1984 to 2010 were compared with the referred women's 1,077 non-referred pregnancy outcomes and with the pregnancy outcomes of 345,467 gainfully employed women from the same geographical areas and time period. Logistic regression was used to calculate odds ratios (OR) with 95% confidence intervals (CI). Calculations were adjusted for the mother's age at delivery, parity, ethnicity, socioeconomic status, smoking, and in supplementary analyses for year of birth.

RESULTS: Referred women gave birth to children with a higher birthweight than the average employee (difference 47.8 g; 95% CI: 19.9-75.6), but the outcomes did not differ with respect to gestational age (difference 0.05 weeks; 95% CI: -0.06-0.17), preterm delivery (OR: 0.8; 95% CI: 0.62-1.04), LBW (OR: 0.81; 95% CI: 0.52-1.26) or SGA (OR: 0.92; 95% CI: 0.72-1.17).

CONCLUSION: The women who are referred for occupational risk assessment at two large occupational university departments are not at an increased risk of preterm birth or of delivering low birthweight children. This may reflect that reproductive hazards in Danish workplaces are limited and/or that the occupational risk assessment and counselling of pregnant women are preventing these selected adverse pregnancy outcomes.

FUNDING: The Research Unit at Department of Occupational and Environmental Medicine at Bispebjerg Hospital supported the study financially.

TRIAL REGISTRATION: none. The study was conducted using systematically collected data including the referred women's occupational exposure codes, which were anonymised and linked to national registries at Statistic Denmark. The Danish Data Protection Agency approved the study (R. no. 2012-41-1267).

ample, among hospital employees 31% were on sick leave for at least 10% of their scheduled working time. Pregnancy-related medical disorders account only for a small part of the sick leave during pregnancy. On the other hand, discomfort related to strenuous work seems also to be important.

According to the Danish Executive Order on the Performance of Work (Executive Order No. 559 of 17 June 2004), the employer is responsible for ensuring a safe working environment. If a harmful reproductive hazard is present and if preventive measures or reassigning the worker to a safe job is not possible, healthy pregnant women may obtain social benefits. Some 3-4% of all cases of pregnancy leave in Denmark are due to such situations [2]. A manual from the Danish Working Environment Authority (AT-guidance A.1.8 of January 2009) describes the impacts that are likely to endanger pregnancy [3]. If the general practitioner or midwife assesses that the woman's working conditions may pose a risk to the pregnancy, the pregnant woman may be referred to the regional clinic of occupational health for occupational risk assessment. This usually happens between 8 and 12 weeks of gestation. The referred pregnant woman should be repositioned or be granted sick leave until the risk assessment has been carried out.

Several reproductive workplace hazards have been identified [4, 5]. Shift work, long working hours, heavy lifting, standing, and exposure to endocrine-disrupting chemicals and other chemicals have been associated with an increased risk of adverse pregnancy outcomes [6-8], although not with strong effects [9]. For example, there is increasing evidence that exposure to polychlorinated biphenyls (PCBs) is associated with inhibited foetal growth, even at low doses [10].

Assuming that women referred to counselling at an occupational health clinic have a more hazardous occupational work environment than pregnant women in general, we examined the risk of preterm birth, low birthweight, and small for gestational age in this group.

ORIGINAL ARTICLE

1) Department of Occupational and Environmental Medicine, Bispebjerg Hospital

2) Research Unit of Clinical Epidemiology, Institute of Clinical Research, Odense University Hospital

3) Centre for Clinical Epidemiology, Odense University Hospital

4) Department of Occupational Medicine, Aarhus University Hospital, Denmark

Dan Med J
2015;62(8):A5119

The prevalence of long-term absence from work during pregnancy is high in the Nordic countries [1]. For ex-

METHODS

The occupational medical database

An occupational medical database hosted by two re-

TABLE 1

Patient characteristics. The values are n (%).

	Referred pregnancies ^a , RWRP (N = 1,202)	Non-referred pregnancies ^a , RWNP (N = 1,077)	General population ^b , DKWORKPOP (N = 345,467)
<i>Age, yrs</i>			
16-24	221 (18.4)	162 (15.0)	44,273 (12.8)
25-34	839 (69.8)	792 (73.5)	242,526 (70.2)
≥ 35	142 (11.8)	123 (11.4)	58,668 (17.0)
<i>Parity</i>			
1	683 (56.8)	415 (38.5)	176,952 (51.2)
2	377 (31.4)	507 (47.1)	121,751 (35.2)
3	142 (11.8)	155 (14.4)	46,764 (13.5)
<i>Occupation^c</i>			
Higher salaried employees (D1-2)	94 (7.8)	102 (9.5)	49,781 (14.4)
Lower salaried employees (D3-5)	412 (34.3)	406 (37.7)	151,936 (44.0)
Skilled workers (D6-7)	153 (12.7)	129 (12.0)	5,002 (1.5)
Unskilled workers (D8-9)	327 (27.2)	206 (19.1)	39,927 (11.6)
Unknown	216 (18.0)	234 (21.7)	98,821 (28.6)
<i>Smoking</i>			
Yes	232 (19.3)	187 (17.4)	50,979 (14.8)
No	774 (64.4)	683 (63.4)	205,560 (59.5)
Unknown	196 (16.3)	207 (19.2)	88,928 (25.7)
<i>Nationality</i>			
Danish	1,057 (87.9)	999 (92.8)	312,278 (90.4)
Other	140 (11.7)	73 (6.8)	30,627 (8.9)
Unknown	5 (0.4)	5 (0.5)	2,517 (0.7)
<i>Year of child's birth</i>			
1984-1989	154 (12.8)	169 (15.7)	76,257 (22.1)
1990-1994	149 (12.4)	183 (17.0)	62,513 (18.1)
1995-1999	256 (21.3)	250 (23.2)	60,434 (17.5)
2000-2004	337 (28.0)	231 (21.5)	64,041 (18.5)
2005-2010	306 (25.5)	244 (22.7)	82,222 (23.8)
<i>BMI before pregnancy^d, kg/m²</i>			
< 18	7 (1.3)	8 (1.8)	2,875 (2.4)
18-24 (normal)	356 (66.2)	297 (66.3)	86,067 (70.4)
24.1-30	125 (23.2)	108 (24.1)	24,887 (20.3)
30.1-35	35 (6.3)	25 (5.6)	5,876 (4.8)
> 35	16 (3.0)	10 (2.2)	2,631 (2.2)
<i>Birthweight, g</i>			
< 2,500	44 (3.7)	35 (3.2)	16,312 (4.7)
≥ 2,500	1,158 (96.3)	1,042 (96.8)	329,155 (95.3)
<i>Gestational age, weeks</i>			
< 37	80 (6.7)	74 (6.9)	27,758 (8.0)
≥ 37	1,122 (93.3)	1,003 (93.1)	317,709 (92.0)
<i>Small for gestational age^e</i>			
Yes	92 (7.6)	81 (7.5)	27,640 (8.0)
No	1,110 (92.4)	996 (92.5)	317,827 (92.0)

BMI = body mass index; DKWORKPOP = non-referred women's non-referred pregnancies; RWNP = referred women's non-referred pregnancies; RWRP = referred women's referred pregnancies.

a) Pregnancies among women referred at least once to an occupational medicine clinic for counselling

b) Pregnancies in all women from the catchment area of the occupational medicine clinics.

c) According to DISCO 88, the Danish version of the International Standard Classification of Occupation

d) Only available for the 1997-2010 period.

e) Defined as a birthweight below the gestational week specific 10th percentile based on the reference population.

of Denmark included 1,358 pregnant women who were referred for risk assessment and management during the 26-year period from 1984 to 2010 (referred women's referred pregnancies, RWRP). An internal reference group consisted of the referred women's 2,042 non-referred pregnancies, RWNP (the women served as their own reference). Furthermore, an external reference group consisted of all births among women who were gainfully employed when pregnant in the period from 1984 to 2010 in the same geographical regions and who were not referred for risk assessment – in total 770,605 (Danish working population, DKWORKPOP). We introduced restrictions as to those who were working at the onset of their pregnancy, which left 1,273/1,683 and 610,873 in the RWRP/RWNP and DKWORKPOP groups, respectively. Further restrictions were: mother's age at delivery 16-45 years, birthweight 1,000-7,000 g and gestational age 154-310 days. These restrictions excluded 15/29/8,987 from the RWRP/ RWNP and DKWORKPOP groups, respectively. Since pregnancies of multiparae cannot be considered independent, one birth was chosen by random sampling among women with two or more deliveries in each of the three groups, which left 1,202 women in the RWRP group (261 from Copenhagen, 941 from Aarhus), 1,077 in the RWNP group (181 from Copenhagen, 896 from Aarhus) and 345,467 in the DKWORKPOP group. Data from the eastern region of Denmark were collected only from one out of three hospitals, so the number of patients from this region was relatively small compared with the number from the western region. The date of consultation and the physicians' registrations of occupational exposure, occupation and industry were extracted from the occupational medical database.

The Danish Civil Registration System

Persons with a permanent address in Denmark have a unique ten-digit personal identification number (PIN), which was used to link the occupational medical database to the Danish Civil Registration System, the Medical Birth Register, and to public registries developed by Statistics Denmark [11, 12].

Outcomes and confounders

Data on pregnancy outcomes in terms of birthweight, gestational age, previous pregnancies and smoking status were drawn from the Medical Birth Register. Data on pre-pregnancy body mass index (BMI), defined as the weight in kg divided by the squared height in meters, was available only for the period 1997-2010. Data on the country of origin and current home region were drawn from Statistics Denmark [11, 12].

Low birthweight (LBW) was defined as a birthweight below 2,500 g. Gestational age at the time of consulta-

gional occupational university departments located in the Eastern (Copenhagen) and Western (Aarhus) regions

tion was calculated as the date from conception to the date of consultation divided by 7. Small for gestational age (SGA) was defined as a birthweight below the gestational week-specific 10th percentile based on the reference population.

The mother's age and parity (number of children) was defined at delivery in the index pregnancy. Occupational status was job status at the time of pregnancy and it was classified according to DISCO 88, the Danish version of the International Standard Classification of Occupation (ISCO). Smoking was categorised as "yes" if the woman had smoked at any time during pregnancy, even though she stopped after her 1st trimester and regardless of the amount of smoking.

Statistical analysis

We compared the women referred to an occupational health clinic with an ongoing pregnancy with their non-referred pregnancies RWRP and the external DKWORKPOP reference group and computed the average difference with a 95% confidence interval (95% CI).

Thanks to the Danish registries with nearly complete data and follow-up, the short follow-up time and the low loss to follow-up due to emigration or death, the risk of the outcomes LBW, birth before 37th week of gestation, and SGA in the RWRP group compared with RWRP and with the DKWORKPOP group, respectively, were assessed by use of multivariate logistic regression. We calculated odds ratios (OR) with 95% confidence intervals (CI) for each outcome and adjusted for the following potential confounders: mother's age at delivery, parity, smoking, socioeconomic status (SES), ethnicity, and – in further analyses – for children's year of birth. Data were analysed at Statistics Denmark using SAS version 9.3.

Trial registration: none. The study was conducted using systematically collected data including the referred women's occupational exposure codes, which were anonymised and linked to national registries at Statistic Denmark. The Danish Data Protection Agency approved the study (R. no. 2012-41-1267).

RESULTS

As summarised in **Table 1**, women referred to an occupational health clinic had children earlier than women in the DKWORKPOP group. They were also generally at a lower SES level, and were more often unskilled. Smoking during pregnancy differed only slightly between the groups. During the 1997-2010-period, referred women had a slight tendency towards a higher BMI than the women in the DKWORKPOP group. Most women were referred after year 2000 (n = 643 (53.5%)).

Chemical exposure was the most frequent type of



TABLE 2

Type of workplace exposure.

	RWRP, n (%) (N = 1,202)	Birthweight, g, mean ^a (95% CI)	Gestational age, weeks, mean ^a (95% CI)
Chemical	670 (55.74)	3,533 (3,492-3,574)	39.8 (39.6-39.9)
Ergonomic	300 (24.96)	3,403 (3,333-3,473)	39.5 (39.2-39.7)
Psychological	27 (2.25)	3,776 (3,575-3,976)	40.0 (39.4-40.7)
Biological	23 (1.91)	3,713 (3,489-3,937)	40.0 (39.3-40.6)
Unknown	182 (15.14)	–	–

CI = confidence interval; RWRP = referred women's referred pregnancies.

a) Crude estimate with 95% CI.

work-related risk factor in the RWRP group (55.7%) followed by ergonomic exposure (25%), **Table 2**. Referred women on average received their counselling in week 12 of gestation. No significant difference in gestational age or birthweight between pregnancies with chemical, ergonomic, biological, or psychological workplace exposure was seen in crude analyses (Table 2) or when further adjusting the analyses for possible confounders. Women exposed to chemical factors had no increased risk for either LBW (OR: 0.8; 95% CI: 0.4-1.5), preterm birth (OR: 0.8; 95% CI: 0.5-1.1) or SGA (OR: 0.8; 95% CI: 0.6-1.2) compared with the DKWORKPOP group when adjusted for year of birth, mother's age at delivery, parity, SES, ethnicity and smoking. Similar findings were recorded for ergonomic exposure.

For the pregnant women who were referred to an occupational health clinic, seen as an entity and as a proxy for being more exposed to work-related risk factors, no association with LBW (OR: 0.81; 95% CI: 0.52-1.26), preterm delivery (OR: 0.8; 95% CI: 0.62-1.64) or SGA (OR: 0.92; 95% CI: 0.72-1.17) was found. Similar results were found when referred pregnancies were compared with the referred women's non-referred pregnancies. The referred women had children with a higher birthweight than the DKWORKPOP group (difference: 47.8 g; 95% CI: 19.9-75.6) when adjusted for year of birth, mother's age at delivery, parity, SES, ethnicity and smoking. An additional adjustment for BMI as a continuous variable in the 1997-2010-period, where BMI data were available, showed a non-significant difference (p = 0.07).

The group of RWRP did not differ from the DKWORKPOP group with respect to gestational age in weeks (difference: 0.05 g, 95% CI: -0.06-0.17). No differences were found between the referred and the non-referred pregnancies of the referred women, either in terms of mean birthweight or gestational age, **Table 3** and **Table 4**.

In sub-analyses, we found that smoking increased

TABLE 3

Mean birthweight and mean gestational age in the referred and non-referred pregnancies.

	RWRP, mean (95% CI) (N = 1,202)	RWNP, mean (95% CI) (N = 1,077)	DKWORKPOP, mean (95% CI) (N = 345,467)
<i>Birthweight, g</i>			
Crude ^a	3,511 (3,479-3,542)	3,552 (3,519-3,586)	3,475 (3,473-3,477)
Adjusted ^b	3,500 (3,472-3,528)	3,482 (3,452-3,512)	3,452 (3,448-3,457)
<i>Gestational age, weeks</i>			
Crude ^a	39.7 (39.6-39.8)	39.8 (39.7-39.9)	39.6 (39.6-39.7)
Adjusted ^b	39.6 (39.5-39.7)	39.6 (39.5-39.8)	39.7 (39.5-39.7)

CI = confidence interval; DKWORKPOP = non-referred women's non-referred pregnancies; RWRP = referred women's non-referred pregnancies; RWNP = referred women's referred pregnancies.

a) Unadjusted.

b) Adjusted for mothers age at delivery, parity, smoking, socioeconomic status and ethnicity; the adjusted results are based on 256,057 observations because of missing values.

TABLE 4

Adjusted^a differences in mean birthweight and mean gestational age between the group of referred pregnancies of women referred to risk assessment at the Clinic of Occupational Medicine and the same women's non-referred pregnancies and between referred women's referred pregnancies and the pregnancies of never referred working women in the same admission area.

	RWRP – RWNP, difference (95% CI)	RWRP – DKWORKPOP, Difference (95% CI)
Birthweight, g	17.8 (–22.9-58.6)	47.8 (19.9-75.6)
Gestational age, weeks	0.05 (–0.06-0.17)	0.07 (–0.05-0.19)

CI = confidence interval; DKWORKPOP = non-referred women's non-referred pregnancies; RWRP = referred women's non-referred pregnancies; RWNP = referred women's referred pregnancies.

a) Adjusted for mother's age at delivery, parity, smoking, socioeconomic status and ethnicity; the adjusted results are based on 256,057 observations because of missing values.

the risk of having a child with LBW (OR 2.0, 95% CI 1.9-2.1), preterm delivery (OR: 1.4; 95% CI: 1.4-1.5) and SGA (OR: 2.3; 95% C: 2.2-2.4). Higher salaried employees had a lower risk of LBW, preterm delivery and SGA than unskilled workers.

Analyses with further restriction to primiparae in all three groups showed results consistent with the prior results as referred pregnancies were found to result in children with a significantly higher birthweight than pregnancies among women in the DKWORKPOP group (adjusted difference between means was 41.1 g; 95% CI: 4.7-77.5). No difference between mean gestational ages was found when adjusted for year of birth, mother's age at delivery, parity, SES, ethnicity and smoking. The birthweight of the children born after occupational counselling did not change across the study period which spanned 26 years. The average birthweight in children of mothers referred from 1984 to 1999 was 3,508 g (95% CI: 3,463-3,552; n = 562), while it was 3,507 g in children born in 2000-2010 (95% CI: 3,462-3,551; n = 640). Further adjustment for the year of birth of the children did not modify the association between birthweight and exposure group.

DISCUSSION

This large follow-up study shows that women receiving counselling at an occupational health clinic because of occupational reproductive hazards do not have an increased risk of LBW, preterm delivery or SGA. One interpretation of the findings is that the occupational counselling and risk management is adequate and given in time to prevent these adverse birth effects. Another interpretation is that the present working environment in Denmark is so well-controlled that even though risk factors do exist, the level of exposure is too low to result in detectable adverse effects. A pregnant woman is most often very concerned and another factor, which may contribute to the results, is that the women may avoid situations they fear may pose a risk.

The study indicated that referred women had children with a higher mean birthweight than the average employee in Denmark. Previous studies have shown that obesity and diabetes mellitus increase the risk of having large-birthweight children [13]. Our analyses with adjustment for BMI showed that the higher birthweight of the referred women's referred pregnancies can probably be ascribed to a higher BMI average in this group.

No difference between the pregnant women who were referred to occupational risk assessments and the same women's non-referred pregnancies was found, either in terms of birthweight, gestational age or in terms of SGA. Still, it is possible that their pregnancies might differ in other aspects, e.g. a woman might have changed smoking habits, job or the father of her children. However, the similarity in birth outcomes points towards the conclusion that either the counselling given at the occupational health clinic is sufficient or that the women are not at an increased risk of delivering preterm or LBW children.

Even though only one third of the referred women are recommended leave [1] and most of the women are found not to be exposed to work-related physical or chemical risk factors during their pregnancy, it is likely that the consultation has a reassuring effect. A number of studies indicate that stress is related to adverse obstetric outcomes [14, 15], and it is therefore beneficial if the counselling helps the woman cope with stressors.

The strengths of this study include the relatively large reference group and reliable register-based data. Furthermore, the expected association between smoking and LBW was demonstrated which indicates the validity of the database [16, 17]. The gradients in birthweight, preterm delivery and SGA by the mother's working level were also consistent with earlier findings [18, 19].

The limitations of the study include limited statistical power to assess even broad dimensions of occupational exposure as for instance strenuous work and

heavy lifting (only 25% of the exposed), as well as subgroups of chemical exposures. The reassuring findings of our analysis are, however, in agreement with recent meta-analyses. Based upon a large body of high-quality prospective studies, these analyses conclude that the risk of low birthweight and preterm delivery in relation to occupational heavy lifting is limited if at all present [9]. Other limitations are lacking data on miscarriage, pregnancy complications such as preeclampsia and congenital malformations, as well as data on the association between possible exposure status and referral status. For instance, a study including Danish women who received occupational counselling indicated a slightly increased risk of cryptorchidism in sons of greenhouse workers who had been exposed to pesticides [20]. It is therefore important to acknowledge that this study is not informative with respect to risk for all adverse pregnancy outcomes, including specific malformations. All occupational clinics in Denmark were invited to provide data for this analysis. The reason why only two clinics contributed was mainly lack of systematic registration of relevant data in the majority of the clinics. This also explains the low number of pregnancies in the capital area compared with Aarhus, the second largest city in Denmark. Only one of the three clinics in Copenhagen re-

corded the relevant data except for the last four years. Thus, our data do not represent rural areas where working conditions and exposures for pregnant women may be different.

CONCLUSION

Pregnant women referred for consultation at two large clinics of occupational medicine in Denmark due to a suspected hazardous work environment did not have an increased risk of low birthweight and preterm delivery compared with pregnant women in general in Denmark. These reassuring findings may either reflect that reproductive hazards at the workplace are rare and/or that occupational counselling is effective in reducing risk factors. Since the study does not address miscarriage, pregnancy complications such as preeclampsia and congenital malformations, a continuous focus on potentially reproductive hazards in the work environment is appropriate.

CORRESPONDENCE: Linda Kaerlev, Research Unit of Clinical Epidemiology, Institute of Clinical Research, University of Southern Denmark, Sdr. Boulevard 29, entrance 101,4, 5000 Odense C, Denmark. E-mail: L.Kaerlev@dadlnet.dk

ACCEPTED: 19 May 2015

CONFLICTS OF INTEREST: Disclosure forms provided by the authors are available with the full text of this article at www.danmedj.dk

LITERATURE

1. Kaerlev L, Jacobsen LB, Olsen J et al. Long-term sick leave and its risk factors during pregnancy among Danish hospital employees. *Scand J Public Health* 2004;32:111-7.
2. Tophøj A, Mortensen JT. Pregnancy-related and work-related sick leave of pregnant women. *Ugeskr Læger* 1999;161:5009-13.
3. Ahlborg G, Jr., Bonde JP, Hemminki K et al. Communication concerning the risks of occupational exposures in pregnancy. *Int J Occup Environ Health* 1996;2:64-9.
4. Burdorf A, Figà-Talamanca I, Jensen TK et al. Effects of occupational exposure on the reproductive system: core evidence and practical implications. *Occup Med (Lond)* 2006;56:516-20.
5. Snijder CA, Brand T, Jaddoe V et al. Physically demanding work, fetal growth and the risk of adverse birth outcomes. *The Generation R Study. Occup Environ Med* 2012;69:543-50.
6. Bonde JP, Jørgensen KT, Bonzini M et al. Miscarriage and occupational activity: a systematic review and meta-analysis regarding shift work, working hours, lifting, standing, and physical workload. *Scand J Work Environ Health* 2013;39:325-34.
7. Morales-Suarez-Varela MM, Toft GV, Jensen MS et al. Parental occupational exposure to endocrine disrupting chemicals and male genital malformations: a study in the Danish National Birth Cohort study. *Environ Health* 2011;10:3-10.
8. Morales-Suarez-Varela M, Kaerlev L, Zhu JL et al. Risk of infection and adverse outcomes among pregnant working women in selected occupational groups: A study in the Danish National Birth Cohort. *Environ Health* 2010;9:70.
9. Palmer KT, Bonzini M, Harris EC et al. Work activities and risk of prematurity, low birth weight and pre-eclampsia: an updated review with meta-analysis. *Occup Environ Med* 2013;70:213-22.
10. Govarts E, Nieuwenhuijsen M, Schoeters G et al. Birth weight and prenatal exposure to polychlorinated biphenyls (PCBs) and dichlorodiphenyldichloroethylene (DDE): a meta-analysis within 12 European Birth Cohorts. *Environ Health Perspect* 2012;120:162-70.
11. Pedersen CB. The Danish Civil Registration System. *Scand J Public Health* 2011;39:22-5.
12. Knudsen LB, Olsen J. The Danish Medical Birth Registry. *Dan Med Bull* 1998;45:320-3.
13. Cnattingius S, Villamor E, Lagerros YT et al. High birth weight and obesity – a vicious circle across generations. *Int J Obes (Lond)* 2012;36:1320-4.
14. Dole N, Savitz DA, Hertz-Picciotto I et al. Maternal stress and preterm birth. *Am J Epidemiol* 2003;157:14-24.
15. Lobel M, Cannella DL, Graham JE et al. Pregnancy-specific stress, prenatal health behaviors, and birth outcomes. *Health Psycho* 2008;27:604-15.
16. Salmasi G, Grady R, Jones J et al. Environmental tobacco smoke exposure and perinatal outcomes: a systematic review and meta-analyses. *Acta Obstet Gynecol Scand* 2010;89:423-41.
17. Nilsen ST, Sagen N, Kim HC et al. Smoking, hemoglobin levels, and birth weights in normal pregnancies. *Am J Obstet Gynecol* 1984;148:752-8.



Women referred for occupational risk assessment in pregnancy have not increased risk of preterm delivery or low birth weight suggesting that occupational counselling is preventive or that reproductive hazards at the Danish workplaces are rare.

18. Bonde JP, Frost P, Thomsen G et al. Arbejdsmedicinsk svangererådgivning i Danmark – en et-års opgørelse af 321 graviditetsrådgivninger. Aarhus: Arbejdsmedicinsk Klinik, Aarhus Universitetshospital, 1998.
19. Mortensen LH, Diderichsen F, Arntzen A et al. Social inequality in fetal growth: a comparative study of Denmark, Finland, Norway and Sweden in the period 1981-2000. *J Epidemiol Community Health*. 2008;62:325-31.
20. Jørgensen KT, Jensen MS, Toft GV et al. Risk of cryptorchidism among sons of horticultural workers and farmers in Denmark. *Scand J Work Environ Health* 2014;40:323-30.