Laboratory work and adverse pregnancy outcomes

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Background Laboratory workers are commonly exposed to chemical, biological and physical agents. They also may adopt poor postures for long periods and be engaged in moving and handling. These factors may increase the risk of adverse pregnancy outcome in female laboratory workers.

Aims To assess whether laboratory work during pregnancy increases the risk of adverse pregnancy outcomes.

Methods The 1990–2006 Finnish Medical Birth Registry was used to identify all singleton newborns of all Finnish laboratory workers (n = 5425) and those of teachers (n = 21 438) as the reference population. The main outcomes were sexual differentiation (female gender), low birth weight, high birth weight, preterm delivery, post-term delivery, small-for-gestational age (SGA), large-for-gestational age and perinatal death. The generalized estimating equation (GEE) analysis was used to estimate odds ratios (ORs) adjusted for maternal age, parity, marital status and maternal smoking during pregnancy.

Results In the GEE analysis, the risk of low birth weight (adjusted OR: 1.27, 95% CI: 1.08–1.45) and SGA (adjusted OR: 1.27, 95% CI: 1.02–1.52) was higher in laboratory workers than in teachers. Correspondingly the prevalence of high birth weight (>4000 g) was lower in newborns of laboratory workers (adjusted OR: 0.90, 95% CI: 0.83–0.98). The prevalence of post-term deliveries was close to being significantly higher among newborns of laboratory workers (adjusted OR: 1.16, 95% CI: 1.00–1.31).

Conclusions This large population-based study provides evidence that laboratory work may be associated with reduced foetal growth.

Key words Laboratory workers; low birth weight; preterm delivery; small-for-gestational age; work exposure.

Introduction

Laboratory workers across industry are exposed to a wide range of hazards, including chemicals, biological agents and radioactive substances [1–3]. Some studies of pregnancy outcome in female laboratory workers report increased risks of spontaneous abortion, reduced fecundity, low birth weight, congenital malformations and preterm delivery [1–3].

A nationwide Danish [3] cohort study involving 82 149 women found elevated but non-significant risk of preterm delivery (adjusted OR: 2.20, 95% CI: 0.80–6.20) and major congenital malformations (adjusted OR: 2.10, 95% CI: 1.0–4.70) among female laboratory workers. Using nationwide Finnish Medical Birth Registry data, we extended the parameters to include low birth weight, high birth weight, small-for-gestational-age (SGA), large-for-gestational-age (LGA), perinatal death and gender differentiation to explore whether work as a female laboratory technician increased the risks compared with teachers.

Methods

The study population included all 5425 laboratory workers (code 012) and 21 438 teachers (codes 032, 0321, 0322, 0323, 0324, 033, 034, 0341 and 0342). More detailed descriptions of the source population, data source and study design have been published elsewhere [4,5].

The main health outcomes were low birth weight, high birth weight, SGA, LGA, preterm delivery and post-term...
delivery. The definitions were similar to that applied in a previous study [4].

The prevalence of the reproductive outcomes were estimated, with 95% confidence intervals (CIs), based on the binomial distribution. Odds ratio (OR) was the measure of effect. Logistic regression analysis was used to estimate adjusted ORs, adjusting for maternal age, parity, marital status and smoking during pregnancy. To account for women with several deliveries, we used generalized estimating equation analysis. SAS 9.1 was used for the statistical analyses.

Results

Table 1 displays the characteristics of the study population comprising singletons of all the Finnish laboratory workers (n = 5425), and teachers (n = 21438) who gave birth between 1990 and 2006. Laboratory workers were on average younger, had experienced fewer pregnancies, were more often single or cohabiting and more commonly smoked during pregnancy. The prevalence of girls was similar among the newborns of laboratory workers (48.9%) and the newborns of teachers (48.8%). The prevalence of low birth weight was higher among newborns of laboratory workers (3.1%) compared with newborns of teachers (2.4%).

The prevalence of high birth weight, post-term delivery and the other adverse pregnancy outcomes are shown in Table 2, together with the adjusted ORs.

Discussion

In the present study, the risk of low birth weight, post-term delivery and SGA was increased among singleton newborns of Finnish female laboratory workers compared with teachers. The risk of stillbirth was increased but not significant. The risk of high birth weight was reduced among the singleton newborns of laboratory workers compared with that of teachers.

The strength of the present study has been discussed elsewhere [4–6]. We acknowledge that teachers may differ from the laboratory workers on some unmeasured founders such as psychological stress and prolonged standing. Nevertheless, comparison groups were similar for socio-economic status. The reference group accorded with recent Finnish and Danish studies [3,4]. Thus, we considered teachers a suitable reference group. However, we could not control for all potential confounders such as pre-pregnancy body mass index and exposure to environmental tobacco smoke.

The only previous studies of the relation between maternal occupation as a laboratory worker and low birth weight reported similar results to ours [7–9]. Wennborg et al. [9] reported decreased birth weight among offspring in the subgroup of laboratory workers exposed to diethyl ether 155 (−356 to 46). A Bulgarian cohort study [10] also reported a higher prevalence of low birth weight for newborns of female laboratory employees before employment compared with during employment (5.2 versus 4.0%). None of the studies reported on high birth weight, but we observed a reduced risk of high birth weight among the newborns of the laboratory workers.

In contradiction to our findings on preterm delivery, two previous studies [8,10] reported elevated risk among the newborns of laboratory workers, but the effect estimates were not statistically significant. Our findings on post-term delivery also contradict the early findings of Wennborg et al. [8] but concur with the subsequent findings of this Danish group [9].

Our findings on SGA did not concur with those of Zhu et al. [6] (adjusted OR: 0.9, 95% CI: 0.7–1.2) and Wennborg et al. [8] (adjusted OR: 0.5, 95% CI: 0.2–1.9). Neither was our finding on LGA in agreement with that of the Danish group [8], who reported 1.5 OR for LGA.
We found elevated risk of stillbirth for laboratory workers. This could have been explained by chance. The occurrence of female newborns was similar between the groups compared. Earlier studies have not reported on stillbirth or gender of offspring.

We selected teachers as referents comparable to Zhu et al. [6]. The other epidemiological studies used other reference populations [8–10]. Our definition of SGA and LGA was different to some previous studies [6,10], but similar to Wennborg et al. [9].

Although the strength of the effect estimates for adverse pregnancy outcomes appears to be contingent on the choice of referents, all five of the epidemiology studies together with the present findings suggest that laboratory work adversely affects the foetus by reducing the duration of pregnancy and reducing intrauterine growth.

Laboratory workers are exposed to a myriad of chemicals. Some of these are mutagenic, genotoxic or teratogenic in animal experimental laboratory studies. Occupational exposure for laboratory workers has also been associated with cancer [1], reduced fecundability ratio [3] and other adverse reproductive outcomes.

For the various outcomes studied, we found increased ORs between 1.16 and 1.27, supporting previous evidence that laboratory work during pregnancy may be harmful to foetal development. Our study is limited by residual confounders. More research on the risk of perinatal death, in particular due to stillbirth, is needed.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Laboratory workers</th>
<th>Teachers (referent)</th>
<th>Total</th>
<th>Adjusted OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>5425</td>
<td>21 438</td>
<td>26 863</td>
<td></td>
</tr>
<tr>
<td>Birth weight Mean (SD) n (%)</td>
<td>3555 (551) 167 (3.1)</td>
<td>3594 (553) 512 (2.4)</td>
<td>3586 (537) 679 (2.5)</td>
<td>PE 1.27 1.08–1.45</td>
</tr>
<tr>
<td>Low birth weight (&lt;2500 g) n (%)</td>
<td>167 (3.1)</td>
<td>512 (2.4)</td>
<td>679 (2.5)</td>
<td></td>
</tr>
<tr>
<td>Birth weight (2500–3999 g) n (%)</td>
<td>4231 (78.0)</td>
<td>16425 (76.6)</td>
<td>20 656 (76.9)</td>
<td></td>
</tr>
<tr>
<td>High birth weight (4000+ g) n (%)</td>
<td>1027 (18.9)</td>
<td>4501 (21.0)</td>
<td>5528 (20.6)</td>
<td>0.90 0.83–0.98</td>
</tr>
<tr>
<td>Preterm delivery (&lt;37 weeks) n (%)</td>
<td>244 (4.5)</td>
<td>885 (4.1)</td>
<td>1129 (4.2)</td>
<td>1.09 0.93–1.24</td>
</tr>
<tr>
<td>Post-term delivery (42+ weeks) n (%)</td>
<td>255 (4.7)</td>
<td>862 (4.0)</td>
<td>1117 (4.2)</td>
<td>1.16 1.00–1.31</td>
</tr>
<tr>
<td>SGA n (%)</td>
<td>90 (1.7)</td>
<td>291 (1.4)</td>
<td>381 (1.4)</td>
<td>1.27 1.02–1.52</td>
</tr>
<tr>
<td>LGA n (%)</td>
<td>174 (3.2)</td>
<td>693 (3.2)</td>
<td>867 (3.2)</td>
<td>1.06 0.87–1.26</td>
</tr>
<tr>
<td>Perinatal death of which stillbirths n (%)</td>
<td>29 (0.53)</td>
<td>86 (0.40)</td>
<td>115 (0.43)</td>
<td>1.26 0.78–1.63</td>
</tr>
<tr>
<td>Perinatal death of which early neonatal deaths n (%)</td>
<td>19 (0.35)</td>
<td>51 (0.24)</td>
<td>70 (0.26)</td>
<td>1.37 0.83–1.91</td>
</tr>
<tr>
<td></td>
<td>10 (0.18)</td>
<td>35 (0.16)</td>
<td>45 (0.17)</td>
<td>1.08 0.39–1.77</td>
</tr>
</tbody>
</table>

Key points
- Laboratory workers are exposed to a range of hazards that are linked to adverse pregnancy outcomes.
- Laboratory work during pregnancy may reduce foetal growth.
- Laboratory work may also increase the risk of post-term delivery.

Conflicts of interest
None declared.

References


