Teenage pregnancies have often been reported to be associated with adverse pregnancy outcomes, specifically with low birth weight, small for gestational age (SGA) infants, prematurity, and higher rates of neonatal and postneonatal mortality. Some investigators have found that the youngest teenage mothers (aged less than 16 years) have particularly high risks. There is much controversy over whether the risks associated with teenage motherhood are attributable to biological factors, lifestyles or socioeconomic conditions. In this context, the latter would denote maternal health behaviour, poor diet, smoking, alcohol use, inadequate attendance to prenatal care and suffering from emotional stress.

Maternity care is provided free of charge in Finland and is used by virtually the entire pregnant population. We expected that the reportedly poor pregnancy outcomes associated with teenage pregnancy would not be observed in conditions of high standard maternity care.

Results: Teenage mothers smoked, were unemployed and had anaemia or chorioamnionitis more often than older mothers. On the other hand, they were overweight and had maternal diabetes less often than adults. Teenage mothers had as many instrumented deliveries (OR 0.70; 95% confidence interval 0.39–1.27) but fewer Caesarean sections (0.62; 0.39–0.97) than adults. We found no evidence for increased risk of preterm delivery, fetal growth restriction, low birth weight, or fetal or perinatal death in teenagers. Conclusions: These results suggest that increased risks for adverse pregnancy outcomes in teenage pregnancies can most probably be overcome by means of high-quality maternity care with complete coverage.

Keywords: outcome, pregnancy in adolescence, prenatal health care

Materials and methods

We investigated the total population who gave birth at the Kuopio University Hospital between January 1989 and December 2001. Our database includes information obtained using a self-administered questionnaire at 20 weeks of pregnancy and complemented by a nurse at later visits to the Kuopio University Hospital. The questionnaire consisted of over 50 questions about smoking and alcohol consumption, previous operations, illnesses and obstetric history, contraceptive use, employment, marital status and paternal characteristics. The information on pregnancy complications, pregnancy outcomes and neonatal period was based on clinical records, collected to the database by the team who took care of the delivery and neonatal care. The patient data were processed anonymously. Multiple pregnancies (n = 548) and pregnancies with major fetal structural anomalies (n = 261) were excluded before statistical analyses, because such pregnancies carry an unusually high risk of adverse outcome. The present study includes information on 26,976 pregnancies, of which 185 were pregnancies of teenage mothers under 18 years of age.

The following definitions were used to record pregnancy outcomes: preterm birth, delivery before 37 weeks of gestation; prolonged pregnancy, delivery after 42 weeks of gestation; preeclampsia, twice repeated blood pressure measurements exceeding 149/90 mmHg or 30/14 mmHg increase in blood pressure with proteinuria exceeding 0.5 g/day; and low birth weight, birth weight <2500 g. Infants were considered small for gestational age when the sex- and age-adjusted birth weight was below the tenth percentile according to the normal tables for our population. Smoking during pregnancy was defined as over five cigarettes smoked per day. The limit for low haemoglobin was 100 g/l in the third trimester of pregnancy. The pH limit used for fetal acidosis was 7.15 at birth. Overweight was defined by almost the entire pregnant population. We expected that the reportedly poor pregnancy outcomes associated with teenage pregnancy would not be observed in conditions of high standard maternity care.
as a BMI over 25 (weight in kg divided by the square of the height in m), calculated at the first visit to maternity care units. If a subject had two abnormalities, such as infant low birth weight and preterm delivery, each was considered an independent outcome and the subject was included in both categories. Unemployed status was clearly distinguishable from students or housewives not actively seeking a job or receiving unemployment benefits. Otherwise socio-economic status was not controlled, because teenage mothers are usually in a poor economic situation or dependent on their parents and information on the parents’ economic situation was not available. Differences in educational level or marital status were not considered relevant and were thus not taken into account.

Statistical differences between subjects and controls were evaluated by using $\chi^2$-tests, and Fisher’s exact test was applied when the minimal estimated expected value was less than five. Continuous variables were analysed by using two-tailed, pooled $t$-tests. A $P$-value $<0.05$ was considered statistically significant. Multivariate analysis of significant or nearly significant effects ($P < 0.1$) of independent variables considered in this study (prepregnancy BMI $>25$ kg/m$^2$, unemployment, smoking during pregnancy, primiparity, previous miscarriages, surgically scarred uterus, diabetes, anaemia, and prior use of intrauterine device) on dependent outcomes was based on multiple logistic regression analysis (BMDP Statistical Software Inc., Los Angeles, CA). The variables were entered simultaneously. All independent variables were modelled as categorical terms as shown in tables 1 and 2. Confidence intervals (CIs) were evaluated at 95%.13

### Results

Table 1 shows the distribution of maternal risk factors in teenage and adult women. Teenage mothers were healthier: a pre-gravid overweight condition was seen in only 6.9% of the teenage mothers, which was much less frequent than the 20.7% observed

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Adult $(n = 26,782)$</th>
<th>Teenage $(n = 185)$</th>
<th>$P$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-gravid overweight</td>
<td>5256 (20.7%)</td>
<td>12 (6.9%)</td>
<td>$&lt;0.001$</td>
</tr>
<tr>
<td>Smoking $&gt;5$ cigarettes per day</td>
<td>1572 (5.9%)</td>
<td>35 (18.9%)</td>
<td>$&lt;0.001$</td>
</tr>
<tr>
<td>Alcohol consumption</td>
<td>909 (3.4%)</td>
<td>2 (1.1%)</td>
<td>0.08</td>
</tr>
<tr>
<td>Unemployed</td>
<td>4302 (16.9%)</td>
<td>65 (37.6%)</td>
<td>$&lt;0.001$</td>
</tr>
<tr>
<td>Maternal diabetes</td>
<td>705 (2.6%)</td>
<td>0 (0.0%)</td>
<td>0.007</td>
</tr>
<tr>
<td>Maternal pre-gravid hypertension</td>
<td>528 (2.0%)</td>
<td>2 (1.1%)</td>
<td>0.17</td>
</tr>
<tr>
<td>Primiparity</td>
<td>10,942 (40.9%)</td>
<td>171 (92.4%)</td>
<td>$&lt;0.001$</td>
</tr>
<tr>
<td>Previous miscarriage</td>
<td>1040 (3.9%)</td>
<td>5 (2.7%)</td>
<td>$&lt;0.001$</td>
</tr>
<tr>
<td>Prior fetal demise</td>
<td>524 (2.0%)</td>
<td>1 (0.5%)</td>
<td>0.54</td>
</tr>
<tr>
<td>Prior termination</td>
<td>2704 (10.1%)</td>
<td>15 (8.1%)</td>
<td>$&lt;0.001$</td>
</tr>
<tr>
<td>Prior Caesarean or surgically scarred uterus</td>
<td>2888 (10.8%)</td>
<td>1 (0.5%)</td>
<td>$&lt;0.001$</td>
</tr>
<tr>
<td>IUD</td>
<td>2691 (10.1%)</td>
<td>7 (3.8%)</td>
<td>0.005</td>
</tr>
</tbody>
</table>

BMI = body mass index, IUD = intrauterine device

<table>
<thead>
<tr>
<th>Table 2 Pregnancy characteristics</th>
<th>Adult $(n = 26,782)$</th>
<th>Teenage $(n = 185)$</th>
<th>$P$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low haemoglobin (&lt;100 g/l)</td>
<td>402 (1.6%)</td>
<td>10 (5.7%)</td>
<td>$&lt;0.001$</td>
</tr>
<tr>
<td>Obstetric cholestasis</td>
<td>172 (0.6%)</td>
<td>0 (0.5%)</td>
<td>0.36</td>
</tr>
<tr>
<td>Rh immunization</td>
<td>40 (0.2%)</td>
<td>0 (0.5%)</td>
<td>0.76</td>
</tr>
<tr>
<td>Preeclampsia</td>
<td>855 (3.2%)</td>
<td>6 (3.2%)</td>
<td>0.96</td>
</tr>
<tr>
<td>Late pregnancy bleeding</td>
<td>450 (1.7%)</td>
<td>1 (0.5%)</td>
<td>0.13</td>
</tr>
<tr>
<td>Chorioamnionitis</td>
<td>385 (1.4%)</td>
<td>7 (3.8%)</td>
<td>0.008</td>
</tr>
<tr>
<td>Prolonged gravidity</td>
<td>1,266 (4.6%)</td>
<td>8 (4.5%)</td>
<td>0.83</td>
</tr>
<tr>
<td>Induced delivery</td>
<td>4,557 (21.4%)</td>
<td>29 (20.4%)</td>
<td>0.77</td>
</tr>
<tr>
<td>Meconium-stained amniotic fluid</td>
<td>2,902 (11.1%)</td>
<td>14 (7.7%)</td>
<td>0.14</td>
</tr>
<tr>
<td>Bloody amniotic fluid</td>
<td>566 (2.1%)</td>
<td>1 (0.5%)</td>
<td>0.08</td>
</tr>
</tbody>
</table>

Rh = Rhesus
Abnormal FHR during delivery 4179 17.6 32 18.7 0.69 0.71 0.47–1.07

FHR miscarriages, surgically scarred uterus, diabetes, anaemia, use of an IUD, amnionitis 2.7% versus 3.9% (P < 0.001). On the other hand, the underweight condition was more common, 37.7% versus 17.1% in teenagers (not shown). Teenage women smoked significantly more often than the adults, 5.9% versus 18.9% (P < 0.001). Unemployment was clearly more common in the group of teenage women than in the adults, 37.6% versus 16.9% (P < 0.001). Teenage mothers had a healthier reproductive history compared with adults, with 2.7% versus 3.9% (P < 0.001) previous miscarriages, and 0.5% versus 10.8% prior uterine scars, e.g. from Caesarean section (P < 0.001).

Table 2 summarises the frequencies of various pregnancy and delivery complications. The study groups were very similar in this regard and the teenagers experienced practically the same amount of pregnancy and delivery complications as the adults. Only low haemoglobin in the third trimester of pregnancy (P < 0.001) and chorioamnionitis (P = 0.008) were found more often in teenage mothers than in the reference population.

Table 3 shows pregnancy outcomes in the study groups after controlling for the obstetric risk factors investigated in this study. Small differences in risk estimates were seen between the groups in low Apgar scores, preterm delivery and low birth weight, in favour of the adult mothers, but none of these differences reached statistical significance. Teenage mothers underwent normal vaginal delivery at least as well as the adults: Caesarean section was carried out less often among teenage than adult mothers (odds ratio (OR) 0.62; 95% CI 0.39–0.97) and there was no statistically significant difference in the frequency of vacuum- or forceps-assisted deliveries between the study groups (OR 0.70; 95% CI 0.39–1.27). The mean birth weight (±SD) of newborns delivered at term (after 37 gestational weeks) were 3512 ± 622 g in adult and 3356 ± 574 g in teenage mothers (P < 0.001).

### Discussion

Overall, many maternal risk factors were more common in teenage than in older women. The unemployment rate in pregnant teenagers (37.6%) was much higher than the unemployment rate in adult women in the present study (16.9%), or the rate that has previously been described for all teenage women in Finland (11.8%).14 Also, smoking during pregnancy was more common in teenage women. On the other hand, the prevalence of overweight and diabetes was lower in teenage than in older women. Generally, the maternal risk profile in teenage pregnancies was found to be similar to the risk profiles in other studies.3,5,8,15,16

Teenage women were found to have a higher incidence of chorioamnionitis, which may be the result of several causes such as physiological immaturity of the cervix, specifically alkalinity of vaginal pH, prominence of the squamo-cornidal junction and shorter cervical length.22 In addition, serially monogamous relationships are more common in teenagers than in adults and thus sexually transmitted diseases such as chlamydia infection are more common in teenage mothers.21 Accordingly, anaemia during the third trimester of pregnancy was significantly more common in the teenage mothers, suggesting a poorer nutritional status in young mothers, as reported in a number of previous studies.18,19 However, only anaemia in the first or second trimester has been found to impair pregnancy outcome in previous studies.18,19

In our study population no excess risk of adverse pregnancy outcome in teenage mothers was found after controlling for the confounding factors in logistic regression. So far, studies concerning teenage pregnancy outcomes have had somewhat differing results. Some studies have suggested increased risks for poor pregnancy outcome, especially preterm birth (relative risk (RR) from 1.28 to 1.79),3,4,8,13–15,20,24 but also for SGA infants (RR 1.3–1.89),3,5,13,15,16 low birth weight infants (RR 1.29–1.77),20,22,25 and fetal or perinatal death (RR 1.2–1.77).20,22,25 In other studies, however, no risk increases have been reported.7,9,10,19 Teenagers have also been reported to undergo normal vaginal delivery more often than adults and to have a lower proportion of Caesarean deliveries or instrumented vaginal deliveries.2,4,5,8,10,15,16

There are several possible explanations for the reported differences concerning obstetric outcome of teenage pregnancies. First, the age group ‘teenagers’ varies between studies from
under 17 to under 20 years of age. In the present study, only nine teenage mothers were less than 16 years old and the effects of very young age could thus not be studied separately. However, one may speculate the effects of young age per se should be more clear in the youngest age groups.

Secondly, the teenage pregnancy rate varies greatly between countries. The teenage birth rate in Finland is 9.8 births per 1000 women (aged 15–19 years), being similar to the rates in Sweden (7.7) and Denmark (8.5)12–14 and low compared with the rates in many other countries, e.g. the UK (28.4), Germany (12.5) Canada (24.2) or USA (54.4).14–28

Thirdly, there are many differences in maternity care systems worldwide. In some countries maternity care systems are based on insurance19 and the availability of these services depends on the economic circumstances of the mother, which are likely to be worse in teenage mothers than in adults. In some countries maternity care is provided free of charge and special attention is focused on mothers considered to be at greater psychosocial risk. Poor attendance by teenagers has been reported at some perinatal clinics.3,7,8,20 Finally, the effects of chance as a (partial) source of controversy about outcomes of teenage pregnancies cannot be ruled out.

Hence our positive results may at least partly stem from the high quality of maternity care system in Finland: free of charge,11 attended early in the pregnancy,12 used by almost the entire pregnant population,11 early, consisting of numerous visits, minimum six antenatal visits for normal multigravidas and eight to 10 visits for primiparous women and an average of 17 visits to maternity care units,2,3,2,33 using high technology, and having low rates of maternal and perinatal mortality.34 Also, the incidence of mortality caused by suboptimal care in Finland has been reported to be the lowest in the Europe.34

This study raised some questions that could not be investigated, partly due to the limited number of teenage women, and further studies are required. Presumably, the higher incidence of chorioamnionitis together with inadequate prenatal care in teenage women might explain the excess preterm births found in previous studies. Thus the number of sexual partners prior to teenage pregnancy might be of interest in future studies.

Maternity care is likely to be of importance in screening for biological risks of adolescent pregnancy such as cervical shortness, infections, inadequate nutrition and abuse. The issues of teenage pregnancy concern hundreds of thousands of women and children in Europe yearly and the public health implications of this study are in preventive measures. Maternity care will also be of importance in terms of offering psychosocial support in the difficult and stressful the situation in which teenage mothers find themselves. Emotional stress has been reported to cause endocrine disturbances and preterm delivery35,36 and relieving this stress could lead to a more favourable outcome. Psychosocial support of teenage mothers may prevent economical, educational and social marginalization and does not underrate the medical attendance needed.37 Furthermore, as teenage women giving birth are much more often unemployed than other women of their age, their children may need additional support and surveillance.

To conclude, some maternal and pregnancy risk factors were more common in teenage than older women. However, we found no evidence for major impairments of pregnancy outcome among teenage mothers in conditions of high-quality maternity care with complete coverage. This study does not reveal what would have happened without free maternity care and our results may not apply to other populations with a different health care system. In any case, the maternity care system faces a challenge in opposing the adverse pregnancy outcomes either via preventive measures or clinical practice.

### Key points

- We studied risk factors and outcome of pregnancies of teenage women who attended high quality maternity care.
- Smoking, unemployment, anaemia and chorioamnionitis were found to be risk factors of teenage pregnancies.
- After multiple logistic regression analyses obstetric outcome of teenage pregnancies was as good as for adults.
- Increased risks of adverse pregnancy outcomes in teenage reported in earlier studies can probably be overcome by means of maternity care.

### References


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