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## Original Research

# Joint effect of education and age at childbirth on the risk of caesarean delivery: findings from Germany 2008–2015

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## ABSTRACT

**Objectives:** This article aims at assessing the joint effect of maternal age and education on the risk of having a caesarean delivery. As high maternal education is often associated with lower caesarean-birth rates, but high-educated women tend to postpone motherhood, these effects may offset each other in traditional analyses.

**Study design:** Secondary analysis of the data from the German Family Panel pairfam.

**Methods:** The interview-based data refer to 1020 births between 2008 and 2015. We analyse only reports from mothers and calculate logistic regression models.

**Results:** The caesarean delivery rate differs strongly between education levels, and low-educated women are at higher risk of having a caesarean delivery when controlling for parity and age. A positive age gradient is found, indicating a higher risk of caesarean section for older mothers. Without controlling for age, the association of education and caesarean section risk is weaker, i.e., effects of age and education partially level each other out. A model including an interaction term between age and education confirms this result.

**Conclusions:** The risk of having a caesarean delivery does not differ between levels of education when maternal age is not taken into account. Lower maternal education and higher age are both positively associated with the risk of experiencing a caesarean section in Germany. However, as higher educated women tend to have their children later, effects of education and age weigh each other out. Preventive campaigns should target women with lower education and raise women's awareness on the risks associated with late motherhood.

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## Introduction

In the past century, radical changes have occurred in the way mothers give birth to their children, leading to a medicalisation

of childbirth.<sup>1</sup> Caesarean section rates have reached high levels in all industrialised countries, in most cases exceeding the 10–15% recommended in 1987 by the World Health Organisation (WHO).<sup>2</sup> In a European report from 2010,<sup>3</sup> Cyprus

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ranked highest in Europe with a caesarean delivery rate of 52.2%, and a large number of other European countries had rates above 30%. Only in the Nordic countries are caesarean section rates similar to those recommended by the WHO. Germany reports a caesarean section rate of 31.3%.<sup>3</sup>

Despite the undisputed beneficial effects of improvements in obstetric care, the rise in caesarean section rates, which may point to a potential overuse of medical interventions, is a continuing cause for concern.<sup>1</sup> Scholars argue that caesarean sections may carry risks and adverse effects for both mother and child. Women have a greater risk of short-term morbidities and mortality after a caesarean delivery, as well as complications in later pregnancies.<sup>4,5</sup> Children born by caesarean delivery are at an increased risk of respiratory problems such as asthma,<sup>6</sup> childhood-onset type 1 diabetes mellitus<sup>7</sup> and IgE-mediated sensitisation to food allergens.<sup>8</sup> Given these risks, the WHO recommends caesarean sections only in case of unambiguous benefits for mother and child.<sup>9</sup>

Moreover, an important aspect for public health researchers is that costs of caesarean sections are by far higher than vaginal births.<sup>10,11</sup> As an association between the rate of caesarean deliveries and pregnancy outcomes is not confirmed,<sup>9,12</sup> a lower caesarean section rate might reduce costs to the healthcare system without any negative consequences for population health.

Previous research has found many factors beyond clinical indications that contribute to women's risk of having a caesarean section. Correlations between social inequality and incidence of caesarean delivery have been uncovered in several countries, but the direction of the social gradient differs depending on healthcare systems in place. Although in middle-income countries such as Brazil and China where the socially disadvantaged have only limited access to health care, caesarean sections are more common among privileged women.<sup>13</sup> In high-income countries with an inclusive healthcare system (such as most European countries), caesarean delivery rates have been found to be higher among mothers with a lower socio-economic position.<sup>14–16</sup> In particular, research from several European countries has shown that mothers with lower levels of education are at an increased risk of caesarean delivery,<sup>16–20</sup> which may be due to poorer general health and higher risk of adverse health behaviours among mothers with lower socio-economic status.<sup>21,22</sup> Mothers with higher educational levels may be more able to understand the risks of certain health behaviours during pregnancy and adjust their behaviour accordingly. Moreover, higher education may ease communication between mothers and medical staff.<sup>19</sup>

On the other hand, women with higher education levels more often postpone motherhood,<sup>23</sup> and higher age is a risk factor for caesarean delivery.<sup>24</sup> In addition to greater general health problems with an increase in age, older mothers are more at risk of a caesarean delivery due to physiological factors such as, for instance, prior myectomy, malpresentation, and a decreasing functionality of the uterus.<sup>25,26</sup> In addition, attitudes and behaviours of mothers and medical professionals may play a role, as both mothers and healthcare staff may be more anxious with births classified as high risk.<sup>26,27</sup> It has been argued that effects of socio-economic status and age may compensate each other.<sup>28</sup> In the same

vein, this study sheds some light on the question as to whether effects of education and age on the risk of caesarean delivery level each other out.

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## Methods

Our research is based on secondary analyses of the first seven waves of the German Family Panel pairfam, Release 7.0.<sup>29</sup> The German Family Panel is a large scale panel study of initially more than 12,000 nationwide randomly sampled individuals from three birth cohorts (1991 and 1993, 1981 and 1983, and 1971 and 1973).<sup>30</sup> Respondents are surveyed in annual computer-assisted personal interviews on a wide range of topics covering, among others, partnership, relationships to parents and siblings, childbearing and parenting.<sup>31</sup>

We use pooled data from the seven existing panel waves, focussing on women who gave birth to a child during the observation period (2008–2015). Questions regarding the circumstances of the delivery were introduced in the second wave of the study: whenever respondents reported the birth of a child, they were asked about the circumstances of the delivery. All in all, the seven waves deliver information on 1083 births and 905 mothers. For the sake of our analyses, multiple births are excluded from the data set due to the small number of cases (37 children from 17 pregnancies). The remaining data include 888 women experiencing 1046 births.<sup>a</sup>

Respondents answer questions concerning the birth of a child in the first interview after the birth. Mode of delivery is assessed by the question ‘Was it a birth by caesarean section?’ with the response categories ‘Yes, caesarean section for medical reasons’, ‘Yes, caesarean section for other reasons’, and ‘No’.<sup>b</sup> We do not differentiate caesarean section for medical and for other reasons in our analyses, as the number of caesarean deliveries for non-medical reasons is low (29 cases of elective caesarean sections).

Educational level is determined using information on respondents' highest reported educational attainment, classified according to the Comparative Analysis of Social Mobility in Industrial Nations (CASMIN) scheme, in the version proposed by Brauns and Steinmann.<sup>32</sup> We define three categories based on the generated variable ‘casmin’ included in the pairfam data.<sup>33</sup> The lowest category, labelled as ‘low education’, includes respondents with no school degree, with completed compulsory education or with basic vocational training; the group ‘intermediate education’ encompasses respondents with a high school degree but no further qualification, or those with completed vocational training at a secondary level. The category ‘high education’ corresponds to tertiary education. Respondents enrolled in vocational training or studying toward a university degree at the time of the interview are not classified according to their school leaving

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<sup>a</sup> Some women gave birth more than once during the observation period and are thus included in the sample with each birth.

<sup>b</sup> The questionnaire also offers the possibility to refuse the question or reply that the respondent does not know the answer to this question. These answers were reported in only two cases relevant to our analyses (female respondents reporting about a biological child) and have been dropped.

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