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Nørgård, Bente Mertz; Magnussen, Bjarne; Fedder, Jens; de Silva, Punyanganie S; Wehberg, Sonja; Friedman, Sonia
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The risk of elective abortion in women with Crohn’s disease and ulcerative colitis: A nationwide cohort study

Short running title: Elective abortion in inflammatory bowel disease

Bente Mertz Nørgård, MD, DMSc, PhD\(^1,2\), Bjarne Magnussen, MSc\(^1\), Jens Fedder, MD, DMSc, PhD\(^3\), Punyanganie S. de Silva, MD, MPH\(^2\), Sonja Wehberg, MSc, PhD\(^1,4\), Sonia Friedman, MD,\(^{1,2}\)

1) Center for Clinical Epidemiology, Odense University Hospital, and Research Unit of Clinical Epidemiology, Institute of Clinical Research, University of Southern Denmark, Odense, Denmark.

2) Crohn’s and Colitis Center, Brigham and Women’s Hospital, Boston, Massachusetts and Harvard Medical School, Boston.

3) Centre of Andrology and Fertility Clinic, Department D, Odense University Hospital, and Research Unit of Human Reproduction, Institute of Clinical Research, University of Southern Denmark, Odense, Denmark.

4) Research Unit for General Practice, Department of Public Health, University of Southern Denmark, Odense, Denmark

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**Correspondence to:** Bente Mertz Nørgård. Center for Clinical Epidemiology, Odense University Hospital. Sdr. Boulevard 29, entrance 216. DK-5000 Odense C. Denmark.

Mail: bente.noergaard@rsyd.dk  Telephone: (+45) 2133 3258
ABSTRACT

BACKGROUND

Women with inflammatory bowel disease (IBD) might have an increased tendency to choose an elective abortion due to a fear that their fetus could be harmed by use of medications, disease flares during pregnancy or for genetic reasons. We examined the risk of elective abortions in women with ulcerative colitis (UC) and Crohn’s disease (CD) compared to women without IBD.

METHODS

This nationwide cohort study, based on Danish health registries, comprises all registered pregnancies from 1996 through 2015. The two exposed groups constituted pregnancies of women with UC or CD, and the unexposed all pregnancies of women without IBD. Our outcome was elective abortion by maternal request up until the end of the 12th completed week of gestation. We used logistic regression models and calculated the odds ratio (OR) for an elective abortion, controlled for confounders.

RESULTS

The overall prevalence of elective abortions in women with UC and CD and without IBD was 12.4% (898 elective abortions/7,250 pregnancies), 14.9% (978 elective abortions/6,559 pregnancies), and 16.9% (285,251 elective abortions/1,691,857 pregnancies), respectively. In women with UC and CD, the adjusted OR for an elective abortion was 0.80 (95% CI 0.74–0.86) and 0.96 (95% CI 0.89–1.04), respectively.

CONCLUSIONS

Pregnant women with IBD are not more likely to choose an elective abortion compared to women without IBD. These results are reassuring as they suggest that women with IBD are not so worried
about a negative impact of their disease, disease activity or medications, that they would choose to terminate a pregnancy.

Keywords

ulcerative colitis, Crohn’s disease, elective abortion, abortion, pregnancy outcomes, clinical epidemiology

Abbreviations

CPR: The Central Personal Registration system

CD: Crohn’s disease

IBD: inflammatory bowel disease

ICD: the International Classification of Diseases

NPR: the National Patient Register

OR: odds ratio

UC: ulcerative colitis
Introduction

Reproduction issues related to ulcerative colitis (UC) and Crohn’s disease (CD) are a matter of constant concern as these chronic diseases mainly occur during the patient’s fertile years. In pregnant women with inflammatory bowel disease (IBD), existing literature has mainly focused on the short-term adverse birth outcomes of intrauterine growth retardation, low birthweight, preterm birth, and congenital malformations. Evidence regarding whether pregnant women with IBD are prone to choose an elective abortion is very limited. This is highly relevant to examine, as it might reflect the extent to which women with IBD are so worried about the viability of their fetus that they choose to terminate a pregnancy. Pregnant women with IBD often have a dilemma because on one hand disease activity might harm their fetus and therefore flares should be avoided during pregnancy, and on the other hand the women are reluctant to take the medications to control disease activity because they feel it might harm their fetus. This fear of a potential harmful impact of medications during pregnancy is an ongoing issue, and several papers have addressed the controversies surrounding the fetal safety of medications for IBD during pregnancy. Furthermore, pregnant women with IBD might also choose to terminate the pregnancy due to genetic reasons, i.e. due to a higher risk of IBD in their offspring.

Only a few descriptive studies have estimated the proportions of women with IBD who choose an elective abortion and varying proportions have been reported. Kanis et al found 0.5% elective abortions in 413 IBD pregnancies, and Riis et al found 6.2% elective abortions in 177 IBD pregnancies, but these results were not compared to elective abortions in the background populations. In a large cohort study from Denmark, the proportions of elective abortions were much higher (approximately 13-15%) but the focus of that paper was ectopic pregnancy, and not elective abortions. A few other studies have examined abortions but did not distinguish between spontaneous and elective abortions.
To our knowledge, no studies have estimated the risk for elective abortion in women with IBD compared to women without IBD, especially taking into consideration the important impact of each woman’s former number of live born children. By law, since 1973, all Danish women aged 18 or above are allowed to receive an elective abortion upon maternal request up until the end of the 12th completed week of gestation. Based on data from Danish national registries, we estimated the risk for women with IBD to choose an elective abortion relative to women without IBD. Our outcome was elective abortion by maternal request up until the end of the 12th completed week of gestation.
Materials and Methods

Study population and setting

This cohort study was based on Danish nationwide health registries. For all women in Denmark, with a valid civil registration number and of child-bearing age (15–50 years), we obtained information on all pregnancy outcomes that was available in the National Patient Register (NPR) during the study period of 1 January 1996 until 31 December 2015. For all clinicians in Denmark it is mandatory by law to report diagnostic codes and procedures to the NPR. We thus obtained information on the following types of pregnancy outcomes: births, elective abortions, spontaneous abortions, abnormal pregnancy products, missed abortions, pregnancies without fetus, ectopic pregnancies, hydatiform moles. Women in the study population could contribute with more than one pregnancy. The basic population of all pregnancy outcomes has previously been described.19

All citizens in Denmark (population approximately 5.6 million inhabitants, > 90% Caucasians) have equal and free access to the tax-supported health care system. Also, in Denmark all women aged 18 or more are allowed to receive an elective abortion up until the end of the 12th week of gestational age. For women under the age of 18 a parental consent is required. Elective abortions are covered by the public tax system and therefore free of charge for the woman.

Data on exposure, outcome and confounders

Since 1977 the NPR has recorded information on all discharges from Danish hospitals and since 1995 extended to include all outpatient visits and emergency room contacts.21 Information in the NPR includes patients’ civil registration numbers, hospital, department, dates of admission and discharge, procedures performed, and discharge diagnoses based on the International Classification of Diseases (ICD). From 1994 onwards the classification in the NPR has used the ICD 10, while the ICD 8 was used prior to 1994. Furthermore, records maintained in the NPR include information on
all deliveries in Denmark, as well as miscarriage and all other pregnancy outcomes. Each Danish
resident is assigned a unique civil registration number from The Central Personal Registration
system (CPR) and is used in all Danish healthcare registries.\textsuperscript{22} All tables in the NPR are
unambiguously linked by using the civil registration number, and also information on vital status
was obtained from the CPR.

To investigate differences of elective abortions in our study population depending on maternal IBD,
we obtained for all women information on maternal UC or CD from the NPR, and identified for all
pregnancies maternal IBD (UC or CD) on the date of conception. For UC the codes ICD-8 563.19;
569.04; ICD-10 DK51 and all subgroups (except for DK51.9 for unspecified disease) were used,
and for CD the codes ICD-8 563.01; ICD-10 DK50 and all subgroups were used. We included ICD-
8 diagnostic codes to correctly identify IBD diagnosis dated from 1977 onwards.

To identify our outcome of interest, i.e. elective abortions up until the end of the 12th completed
week of gestation, we used ICD-10 DO04* [*= all subgroups]. All other pregnancy outcomes
constitute the reference group (we identified ICD codes for births (DO60-DO84*), other elective
abortions (DO05-DO06*), ectopic pregnancies (DO00*), hydatiform moles (DO01*), spontaneous
abortions (DO03*), and other abortions including abnormal pregnancy products, missed abortions
and pregnancies without fetus (DO02*)).

Data on confounders were obtained from the NPR. The NPR allowed linkage of maternal age at the
time of conception, and information on number of previous births with a live-born child and
maternal co-morbidity according to Charlson index.\textsuperscript{23} The Charlson co-morbidity index, covering
19 major disease categories weighted according to their prognostic impact, was calculated for each
woman based on all disease diagnoses recorded in previous hospitalizations since 1977.

Comorbidity was grouped into the three categories: none (Charlson index 0), some (Charlson index
1-2), and high (Charlson index ≥3). Maternal age at time of conception was categorized into four age groups (15-19, 20-24, 25-34, and 35-50 years). We estimated the date of conception for each pregnancy using, from the NPR, the available information on gestational age at the time of the end of pregnancy. The conception date was estimated by subtracting the gestational age from the date of the recorded end of pregnancy. The calendar period of conception date was divided into three groups (1996–2001, 2002–2008, and 2009–2015). Furthermore, we estimated the maternal age at time of each conception based on information on the maternal birthday.

Exposed cohort

In our study population of all pregnancies, the exposed cohort comprised all pregnancies by women diagnosed with either UC or CD before the estimated date of conception. In case a diagnosis of both UC and CD was registered on the same woman, then we used the last diagnosis of either UC or CD before the conception date to determine whether she was categorized into either UC or CD.

Unexposed cohort

The unexposed cohort comprised all pregnancies of women without a diagnosis of either UC or CD at the time of conception.

Outcome

Elective abortion registered as a pregnancy outcome in the NPR was the outcome. The elective abortion was performed upon maternal request up until the end of the 12th completed week of gestation.

Statistical Analysis
A contingency table was constructed for the main study variables according to women with and without IBD who chose an elective abortion. Also, the yearly proportions of women with UC and CD, and those without IBD, who chose an elective abortion were calculated and visualized by figure presentation. In this study, the pregnancy was the observation unit. Logistic regression was used to estimate crude and adjusted odd ratio (OR) on elective abortions (with 95% confidence intervals [95% CI]) for each pregnancy in women with IBD relative to women without IBD. Using robust cluster analysis, the logistic regression model accounted for multiple pregnancies of the same woman. Adjustments included maternal age at the time of estimated conception, calendar period of conception, co-morbidity index, and number of prior births with a live-born child.

Stratified analyses were done according to type of maternal underlying disease, i.e. UC or CD.

In a sub-analysis we included also the unspecified code for UC (DK51.9).

In another sub-analysis we examined only elective abortions among first time pregnancies.

All analyses were conducted using Stata 13 software (StataCorp LP, College Station, TX, USA).

**Ethical Considerations**

The study was approved by the Danish Data Protection Agency (j.nr. 2014-41-3466). According to Danish law, there are no ethical approvals of register-based studies necessary.
Results

The overall prevalence of elective abortions among all pregnancy outcomes in women with UC and CD was 12.4% (898 elective abortions among 7,250 pregnancies) and 14.9% (978 elective abortions among 6,559 pregnancies), respectively; and for women without IBD the prevalence was 16.9% (285,251 elective abortions among 1,691,857 pregnancies). The types of pregnancy outcomes in the study population are shown in Table 1.

Figure 1 shows the proportions of elective abortions by calendar year from 1 January 1996 for women with UC, CD, and without IBD. The fluctuations of the curves for UC and CD are much greater than the curve for those without IBD as the proportions of elective abortion in women with UC and CD are based on much lower numbers than the curve representing patients without IBD. For all three cohorts, the figure shows a decreasing tendency for elective abortions throughout the study period. Furthermore, for all calendar years since 2000, the yearly proportions of women with UC or CD choosing an elective abortion have been less than the proportions of elective abortions in women without IBD.

Table 2 shows the descriptive characteristics for the 898 elective abortions in women with UC, the 978 in women with CD, and the 285,251 in women without IBD. In all three cohorts, most women who chose an elective abortion were in the age group 25-34 years (Table 2). The mean age at conception in women with UC who chose an elective abortion was 31.2 years (SD 6.7), and the corresponding mean age in women with CD was 29.3 (SD 6.8), and 27.9 (SD 7.3) in women without IBD. The median age at conception in women with UC who chose an elective abortion was 32 years (25-75% percentile: 26-37), and the corresponding median age in women with CD was 29 years (25-75% percentile: 24-35), and 27 years (25-75% percentile: 22-34) in women without IBD. For the majority of women with and without IBD who chose an elective abortion, there were no other maternal co-morbidities present (UC 86.7%, CD 80.6%, non-IBD 92.1%), Table 2.
In women with IBD who chose an elective abortion, 44.6% had no prior live-born children, and the corresponding number in those without IBD was 56.6%. A total of 24.8% of women with UC who chose an elective abortion had two prior live-born children, and the corresponding proportion in women with CD was 19.8%, and in women without IBD 15.0% (Table 2).

The duration of IBD at the time of elective abortion was evenly distributed (some women had a disease duration of < 1 year while others ≥ 8 years). For women with UC, 30.4% had a disease duration of ≥ 8 years, and the corresponding proportion was 28.8% in women with CD (Table 2).

In women with UC, the mean duration of IBD preceding each elective abortion was 6.2 years (SD 5.8), and in women with CD the mean duration of IBD was 5.6 years (SD 4.7).

The overall number of pregnancy outcomes and elective abortions, and the crude and adjusted ORs for elective abortions, are shown in Table 3. For pregnancies of women with IBD in general, the crude OR for elective abortions was 0.78 (95 % CI, 0.73–0.82) and the adjusted OR=0.87 (95 % CI, 0.83–0.92). The most important confounder in the regression model was calendar year where the OR was 0.73 (95 % CI, 0.72 –0.74) for the period of 2009-2015 compared to the period of 1996-2001.

Stratified by type of underlying disease we found that for women with UC and CD, the adjusted ORs for elective abortions were 0.80 (95 % CI, 0.74–0.86) and 0.96 (95 % CI, 0.86–1.04), respectively (Table 3).

In the sub- analysis where we included the unspecified code for UC (DK51.9) our results were unchanged.

In the sub-analysis using only first time pregnancies, our results were virtually unchanged (for women with IBD the adjusted OR was 0.83 (95% CI, 0.73-0.91)).
Discussion

In this nationwide study, our data suggest that women with UC and CD were not more likely to choose an elective abortion compared to women without IBD; in fact they were less likely to choose an election abortion. These results are reassuring as they suggest that women with IBD are not so worried about a negative impact of their disease, or the medications used to treat it, that they would choose to terminate a pregnancy.

To our knowledge, this is the first study, based on nationwide data, analysing the risk of elective abortion in women with UC and CD. Earlier reports on the proportion of elective abortions in women with IBD have been based on case series, and the proportion of elective abortions also appears as descriptive numbers in a large Danish study reporting the risk of ectopic pregnancy (based on a similar data as this study). The proportions of elective abortions across these few studies thus varies widely, from 0.5% - 15.6%, and the reason is related to several factors. First, compared to data from case series, data based on nationwide information give a much more precise estimate of elective abortions and an estimate that applies to the whole Danish population of women with IBD. Second, the low proportion found in the study by Kanis et al and Riis et al might be related to the specific small cohorts from different European counties (with different political and ethical approaches to elective abortion), data susceptible for recall bias as data were based on questionnaires, and in the study by Riis et al the cohort of patients with IBD was gathered back in the early 1990’s. Our relatively high overall reported proportion of elective abortions of 12.4-16.9% is entirely in accordance with a recent publication describing overall trends and proportions of elective abortions in Denmark.

The precision and the validity of our results depend on the size of the study, accurate classification of exposure and the outcome data, and the ability to take into account the influence of confounders. According to these aspects, our study has several strengths. First, the results are based
on nationwide data and unselected study populations. The data from the health registries have a very high completeness and validity. Second, according to the exposure assessment (diagnoses of IBD), the completeness of diagnoses of UC and CD has been examined in a Danish study – showing that of all patients with a confirmed diagnosis of UC or CD, 94% were included in the NPR. In the NPR we thus had access to mandatory registration of UC and CD diagnoses from both hospitals and outpatient clinics. Furthermore, the overall validity of diagnosis of UC in the NPR was 94% and for CD 97% in patients diagnosed at specialized departments. Third, regarding our outcome (elective abortion) the data have both very high completeness and validity as such data are registered in the medical birth registry and transferred to the NPR. As elective abortions are free of charge in Denmark and not stigmatized politically, our registers have a complete coverage of elective abortions across all sociodemographic geographies. Also, our outcome data were obtained independently of the hypothesis examined and the exposure assessment, preventing differential misclassification of our outcome measurement. Fourth, we had information on several important confounders, including comorbidity, women’s age at conception, calendar period, and number of prior births of a live-born child.

Our study also has limitations. We lacked information on each person’s ethnicity and on socioeconomic data, factors that we cannot rule out might have an impact on our results. However, it is not very likely that our results are severely confounded by such factors. First, the population in Denmark is homogeneous with >90% of citizens being Caucasians. Second, for socioeconomic status to exert a confounding effect this factor must be unequally distributed between those with IBD and no IBD, and in a recent review it was concluded that there was no clear association between socioeconomic status and IBD incidence or prevalence, with various literature showing a positive, negative or no association at all. In our study it was impossible to have information on all thinkable underlying reasons that prompted the women to choose an elective abortion.
abortion, a condition that applied to both our exposed and unexposed cohorts. However, given all the different worries that pregnant women with and without IBD might have, we focused on whether women with IBD were more likely to choose an election abortion than women in general, i.e. regardless of the reasons for termination of the pregnancy.

In our study we had no information on medical therapies, but the value of such information would only be of limited interest for several reasons. First, in this study we did not look into the women’s reasons for choosing an elective abortion. Second, if we had information on medications we would not know what kind of medications to focus on, as women in our exposed and unexposed cohorts would have been treated with numerous different groups of medications, and we would not know which groups of medications that might have caused worries, if any, for each individual. Third, even if we had information on medication for our exposed cohorts of women with IBD, we would not know whether use of medication was associated with the decision to terminate a pregnancy. Fourth, and most importantly, if our study had revealed, that women with IBD were more likely to choose an elective abortion than women in general, the question regarding medication could have been relevant, but our study suggested the opposite, i.e. women with IBD were less likely to choose an elective abortion.

There have been many studies examining the safety of IBD medications during pregnancy, and of course an introduction of new medications on the market (such as biologics, licensed in Denmark in 1999) draws special attention to the fetal safety. The fetal safety of IBD medication is for several reasons a matter of constant interest, and at present there is a large ongoing US-wide prospective study examining biologics, thiopurines and small molecule therapy during pregnancy (the PIANO study). The majority of evidence favors the safety of biologics such as infliximab, adalimumab and certolizumab pegol during pregnancy, although US and European guidelines differ as to when to stop infliximab and adalimumab during the pregnancy period. There is still very
little safety data on compounds such as vedolizumab, ustekinumab, and small molecule therapies (tofacitinib and other Janus Kinase Inhibitors). Additionally, many women are still taking thiopurines which have been used for IBD for more than 50 years and have shown to be safe during pregnancy.\textsuperscript{12, 16} Despite the plethora of studies on the most commonly used medications many patients are still very worried about the effect of these drugs during pregnancy. It is not unusual for a pregnant patient to tolerate a mild to moderate amount of IBD activity rather than take biologics or thiopurines during pregnancy. This scenario is quite common despite that it is generally agreed that increased disease activity has a greater negative impact upon a pregnancy outcome than most IBD medications used to treat it.\textsuperscript{7, 9}

In this paper, we examined whether women with IBD chose elective abortions more often than fertile women in general, and a similar question could be asked for other maternal chronic diseases that are common during the fertile years. Women with, for example, rheumatoid arthritis, thyroid disease, epilepsy, diabetes and multiple sclerosis have to struggle with similar questions to women with IBD, namely questions about a possible negative impact of their disease on the fetus, and the fear that the medications used to treat the disease might harm the fetus. There are no robust data on elective abortions when it comes to the most frequent diseases during the fertile years \textsuperscript{33}, i.e., rheumatoid arthritis, thyroid disease, epilepsy, and diabetes. Only for patients with multiple sclerosis, one study (based on 303 patients) suggests a higher proportion of elective abortions than among controls.\textsuperscript{34}

The rationale behind this present study is that women with IBD might be so worried about the impact of their disease in general, possible genetic transfer of the disease to the fetus, negative impact of disease flares and medications, that they might choose the option of an elective abortion. It is reassuring that pregnant Danish women with IBD are so confident with factors related to their disease that they do not choose an elective abortion with a higher frequency than the general
pregnant population. In fact our results suggest that women with IBD were less likely to choose an election abortion, compared to women without IBD, and this might indicate that pregnancies in women with IBD are desired and well-planned. We believe that our results can be generalized to western countries with similar legislation regarding elective abortions, and our result helps complete the overall picture related to reproductive outcomes in women with IBD.

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Specific author contributions: Nørgård: funding, conception of study, design, data collection, supervision of data analysis, interpretation of data, drafting manuscript, manuscript writing, critical revision of the manuscript for important intellectual content, manuscript editing, approved the final version. Magnussen: data analysis, interpretation of results, manuscript editing, critical revision of the manuscript for important intellectual content, approved the final version. Friedman: funding, conception of study, interpretation of data, manuscript editing, critical revision of the manuscript for important intellectual content, approved the final version. Wehberg: study design, data collection, interpretation of results, critical revision of the manuscript for important intellectual content, approved the final version. De Silva: data collection, interpretation of results, critical revision of the manuscript for important intellectual content, approved the final version. Fedder: interpretation of results, manuscript editing, critical revision of the manuscript for important intellectual content, approved the final version.
References


Table 1 The distribution of types of pregnancy outcomes in the study population (1 January 1996 through December 31, 2015)

<table>
<thead>
<tr>
<th></th>
<th>UC pregnancies, total 7,250</th>
<th>CD pregnancies, total 6,559</th>
<th>Non IBD pregnancies, total 1,691,857</th>
</tr>
</thead>
<tbody>
<tr>
<td>Births(^a)</td>
<td>5,272 (72.7)</td>
<td>4,564 (69.6)</td>
<td>1,177,297 (69.6)</td>
</tr>
<tr>
<td>Elective abortions(^b)</td>
<td>898 (12.4)</td>
<td>978 (14.9)</td>
<td>285,251 (16.9)</td>
</tr>
<tr>
<td>Spontaneous abortions(^c)</td>
<td>422 (5.8)</td>
<td>395 (6.0)</td>
<td>95,900 (5.7)</td>
</tr>
<tr>
<td>Other elective abortions(^d)</td>
<td>60 (0.8)</td>
<td>39 (0.6)</td>
<td>11,476 (0.7)</td>
</tr>
<tr>
<td>Ectopic pregnancies(^e)</td>
<td>106 (1.5)</td>
<td>126 (1.9)</td>
<td>22,331 (1.3)</td>
</tr>
<tr>
<td>Molar pregnancy(^f)</td>
<td>15 (0.2)</td>
<td>4 (0.1)</td>
<td>1,488 (0.1)</td>
</tr>
<tr>
<td>Other abnormal pregnancy products(^g)</td>
<td>477 (6.6)</td>
<td>453 (6.9)</td>
<td>98,114 (5.8)</td>
</tr>
</tbody>
</table>

\(^a\) births (DO60-DO84*, *= all subgroups), \(^b\) elective abortions ICD-10 DO04*. \(^c\) spontaneous abortions (DO03*), \(^d\) other elective abortions (DO05-DO06*), \(^e\) ectopic pregnancies (DO00*), \(^f\) hydatiform moles (DO01*), \(^g\) other abortions including abnormal pregnancy products, missed abortions and pregnancies without fetus (DO02*).

Table 2 Descriptive characteristic of the study cohorts of women with IBD and without IBD who had an elective abortion during the study period of 1 January 1996 through December 31, 2015

<table>
<thead>
<tr>
<th></th>
<th>IBD(^a)</th>
<th>Non IBD(^a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UC</td>
<td>898</td>
<td>978</td>
</tr>
<tr>
<td>CD</td>
<td>285,251</td>
<td></td>
</tr>
</tbody>
</table>

Elected abortions before end of 12 weeks of gestational age*
### Age at conception in years, N (%)

<table>
<thead>
<tr>
<th>Age Range</th>
<th>15 – 19</th>
<th>20 – 24</th>
<th>25 – 34</th>
<th>35 – 50</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (%)</td>
<td>34 (3.8)</td>
<td>137 (15.3)</td>
<td>407 (45.3)</td>
<td>320 (35.6)</td>
</tr>
<tr>
<td>Age at conception in years</td>
<td>75 (7.7)</td>
<td>207 (21.2)</td>
<td>439 (44.9)</td>
<td>257 (26.3)</td>
</tr>
<tr>
<td>N (%)</td>
<td>40,866 (14.3)</td>
<td>66,632 (23.4)</td>
<td>115,790 (40.6)</td>
<td>61,963 (21.7)</td>
</tr>
</tbody>
</table>

### Calendar period, N (%)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>N (%)</td>
<td>195 (21.7)</td>
<td>330 (36.7)</td>
<td>373 (41.5)</td>
</tr>
<tr>
<td>Age at conception in years</td>
<td>210 (21.5)</td>
<td>332 (33.9)</td>
<td>436 (44.6)</td>
</tr>
<tr>
<td>N (%)</td>
<td>96,904 (34.0)</td>
<td>104,720 (36.7)</td>
<td>83,627 (29.3)</td>
</tr>
</tbody>
</table>

### Co-morbidity at each pregnancy, N (%)

<table>
<thead>
<tr>
<th>Co-morbidity</th>
<th>None (0)</th>
<th>Some (1-2)</th>
<th>High (≥3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (%)</td>
<td>779 (86.7)</td>
<td>112 (12.5)</td>
<td>7 (0.8)</td>
</tr>
<tr>
<td>Age at conception in years</td>
<td>788 (80.6)</td>
<td>179 (18.3)</td>
<td>11 (1.1)</td>
</tr>
<tr>
<td>N (%)</td>
<td>262,774 (92.1)</td>
<td>21,389 (7.5)</td>
<td>1,088 (0.4)</td>
</tr>
</tbody>
</table>

### Prior births with a live-born child, N (%)

<table>
<thead>
<tr>
<th>Prior Births</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>≥4</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (%)</td>
<td>376 (41.9)</td>
<td>237 (26.4)</td>
<td>223 (24.8)</td>
<td>49 (5.5)</td>
<td>13 (1.4)</td>
</tr>
<tr>
<td>Age at conception in years</td>
<td>460 (47.0)</td>
<td>263 (26.9)</td>
<td>194 (19.8)</td>
<td>50 (5.1)</td>
<td>11 (1.1)</td>
</tr>
<tr>
<td>N (%)</td>
<td>161,437 (56.6)</td>
<td>68,345 (21.0)</td>
<td>42,800 (15.0)</td>
<td>10,474 (3.7)</td>
<td>2,195 (0.8)</td>
</tr>
</tbody>
</table>

### Duration IBD at conception in years, N (%)

<table>
<thead>
<tr>
<th>Duration</th>
<th>0 – 1</th>
<th>2 – 3</th>
<th>4 – 7</th>
<th>≥8</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (%)</td>
<td>191 (21.3)</td>
<td>178 (19.8)</td>
<td>256 (28.5)</td>
<td>273 (30.4)</td>
</tr>
<tr>
<td>Duration at conception in years</td>
<td>211 (21.6)</td>
<td>190 (19.4)</td>
<td>295 (30.2)</td>
<td>282 (28.8)</td>
</tr>
</tbody>
</table>

¤ Represents 741 women with UC and 788 women with CD

¤¤ Represents 207,945 women without IBD

* Elected abortions before end of 12 weeks of gestational age: DO04
Table 3: Crude and adjusted ORs, with 95% confidence intervals (CI), for elective abortions in the study cohorts of women with inflammatory bowel disease (IBD) compared with women without IBD (pregnancies from 1 January 1996 - December 31, 2015)

<table>
<thead>
<tr>
<th>All pregnancies</th>
<th>Elective abortions</th>
<th>Crude OR (95% CI)</th>
<th>Adjusted OR* (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non IBD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,691,857</td>
<td>285,251 (16.9)</td>
<td>1 (Ref)</td>
<td>1 (Ref)</td>
</tr>
<tr>
<td>All with IBD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13,809</td>
<td>1,876 (13.9)</td>
<td>0.78 (0.73–0.82)</td>
<td>0.87 (0.83–0.92)</td>
</tr>
</tbody>
</table>

| Crohn’s disease |                     |                   |                      |
|                | 6,559               | 978 (14.9)        | 0.86 (0.80–0.93)     | 0.96 (0.89–1.04) |

| Ulcerative colitis |                     |                   |                      |
|                   | 7,250               | 898 (12.4)        | 0.70 (0.64–0.75)     | 0.80 (0.74–0.86) |

*Adjusted for Charlson comorbidity, age at conception date (15-19, 20-24, 25-34, 35-50), calendar period (1996-2001, 2002-2008, 2009-2015) and number of prior births with a live-born child (0, 1, 2, 3, 4+)

Figure 1, figure legend

Shows the proportions of elective abortions by calendar year from January 1, 1996 for women with ulcerative colitis (UC), Crohn’s disease (CD), and women without inflammatory bowel disease (non-IBD)
STROBE Statement—Checklist of items that should be included in reports of *cohort studies*

<table>
<thead>
<tr>
<th>Item No</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Title and abstract</strong></td>
<td></td>
</tr>
</tbody>
</table>
| 1 | (a) Indicate the study’s design with a commonly used term in the title or the abstract  
Yes, done  
(b) Provide in the abstract an informative and balanced summary of what was done and what was found  
Yes, done  |
| **Introduction**  |  |
| 2 | Explain the scientific background and rationale for the investigation being reported  
Yes, done  |
| **Objectives**  |  |
| 3 | State specific objectives, including any prespecified hypotheses  
Yes, done  |
| **Methods**  |  |
| 4 | Present key elements of study design early in the paper  
Yes, done  |
| 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection  
Yes, done  |
| 6 | (a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up  
Yes, done  
(b) For matched studies, give matching criteria and number of exposed and unexposed  
Not relevant in this study  |
| 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable  
Yes, done  |
| 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group  
Yes, done  |
| **Bias**  |  |
| 9 | Describe any efforts to address potential sources of bias  
Yes, done  |
| **Study size**  |  |
| 10 | Explain how the study size was arrived at  
Based on all available nationwide data from health registries  |
### Quantitative variables

11. Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why

- Yes, done

### Statistical methods

12. (a) Describe all statistical methods, including those used to control for confounding

- (b) Describe any methods used to examine subgroups and interactions

- (c) Explain how missing data were addressed

- (d) If applicable, explain how loss to follow-up was addressed

- (e) Describe any sensitivity analyses

All relevant items have been addressed

### Results

#### Participants

13*. (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed

- (b) Give reasons for non-participation at each stage

- (c) Consider use of a flow diagram

All relevant steps have been addressed

#### Descriptive data

14*. (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders

- (b) Indicate number of participants with missing data for each variable of interest

- (c) Summarise follow-up time (eg, average and total amount)

Yes, done

#### Outcome data

15*. Report numbers of outcome events or summary measures over time

- Yes, done

#### Main results

16. (a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included

- (b) Report category boundaries when continuous variables were categorized

- (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period

All appropriate steps have been addressed

#### Other analyses

17. Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses

- Yes, done
**Discussion**

<table>
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<th>Number</th>
<th>Description</th>
</tr>
</thead>
</table>
| Key results                 | 18     | Summarise key results with reference to study objectives  
|                             |        | Yes, done                                                                                                                                                                                                       |
| Limitations                 | 19     | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias  
|                             |        | Yes, done                                                                                                                                                                                                       |
| Interpretation              | 20     | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence  
|                             |        | Yes, done                                                                                                                                                                                                       |
| Generalisability            | 21     | Discuss the generalisability (external validity) of the study results  
|                             |        | Yes, according to other diseases than IBD                                                                                                                                                                      |

**Other information**

<table>
<thead>
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<tbody>
<tr>
<td>Funding</td>
<td>22</td>
<td>Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not relevant in this study</td>
</tr>
</tbody>
</table>

*Give information separately for exposed and unexposed groups.