

## Pregnancy Outcomes in Women With Inflammatory Bowel Disease: A Large Community-Based Study From Northern California

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**Background & Aims:** The aim of this study was to determine whether pregnancy outcomes differ between women with and without inflammatory bowel disease (IBD) and to determine what risk factors adversely affect outcomes. **Methods:** We conducted a cohort study of all pregnant women within the Northern California Kaiser Permanente membership between the years 1995 and 2002. We abstracted the records of all pregnancies in women with IBD (exposed cohort) and a random sample of pregnancies from age-matched women without IBD (unexposed cohort) and evaluated risk factors for spontaneous abortion, complications of pregnancy, and adverse newborn events. **Results:** A total of 461 pregnant women with IBD were matched to 493 unexposed pregnant women. Women with IBD were more likely to have an adverse conception outcome (odds ratio, 1.65; 95% confidence interval, 1.09–2.48), an adverse pregnancy outcome (odds ratio, 1.54; 95% confidence interval, 1.00–2.38), or a pregnancy complication (odds ratio, 1.78; 95% confidence interval, 1.13–2.81); however, the difference between the 2 groups in adverse newborn outcomes was not statistically significant (odds ratio, 1.89; 95% confidence interval, 0.98–3.69). Independent predictors of an adverse outcome included a diagnosis of IBD, a history of surgery for IBD, and non-Caucasian ethnicity. Severity of disease and medical treatments were not associated with an adverse outcome. **Conclusions:** Women with IBD are more likely to have an adverse outcome related to pregnancy. Disease activity and medical treatment did not predict adverse outcomes in a large, nonreferral population.

Inflammatory bowel disease (IBD) encompasses both Crohn's disease (CD) and ulcerative colitis (UC). The highest incidence rates for IBD overlap the peak reproductive years.<sup>1</sup> Women with IBD may be at increased risk for pregnancy complications owing to malnutrition, inflammation, and medication use. Infection and inflammation, in general, have been correlated with an increased risk of pregnancy complications such as preterm

birth and premature rupture of membranes.<sup>2</sup> Possible candidate genes in the cause of preterm birth include the tumor necrosis factor- $\alpha$  and tumor necrosis factor-receptor 1 and tumor necrosis factor-receptor 2 alleles,<sup>3</sup> suggesting another possible link with IBD.

In the past, women with IBD often were counseled by their physicians to avoid pregnancy<sup>4</sup>; however, advances in the medical treatment of IBD have allowed more women to enter symptomatic remission for longer periods of time, prompting many to consider pregnancy. Counseling these women on the likely success of their pregnancy, the impact of the pregnancy on their IBD, and the influence of their IBD and its medical treatment on pregnancy outcomes has been hampered by the paucity of detailed population-based data.

Prior studies have suggested an increased risk of an adverse pregnancy outcome in women with IBD; however, these studies largely were confined to the evaluation of administrative data sets. Analyses of the Scandinavian health care system have suggested that a maternal diagnosis of IBD was associated with an increased risk of low birth weight or small for gestational age infants, preterm births, and cesarean sections.<sup>5–7</sup> An administrative database study in the United States also showed higher rates of low birth weight, small for gestational age infants, and preterm births in the offspring of women with CD, and higher rates of congenital malformations in the offspring of women with UC.<sup>8</sup> These studies, however, were unable to directly evaluate the medical records to determine whether factors such as disease activity and medical treatment of IBD had an impact on outcomes or to adjust for multiple potential confounders not contained in the administrative data sets.

We evaluated the pregnancy outcomes of women with IBD in a large, nonreferral population. Our objective was to compare conception, pregnancy, and newborn outcomes between women with IBD and women without IBD and to assess for potential risk factors for an adverse outcome.

## Materials and Methods

### Study Design

We performed a cohort study of all pregnant women with IBD and a random selection of pregnant women without IBD who were frequency-matched by age at pregnancy and geographic center. The institutional review boards of the University of California San Francisco and the Kaiser Foundation Research Institute approved this study.

### Study Population

The underlying study population included all members of the Kaiser Permanente integrated health care delivery system between the years 1995 and 2002. The total membership during this period consisted of approximately 3 million persons in urban, suburban, and rural areas of northern California. The Kaiser Permanente population approximates the region's underlying census distributions of sex, ethnicity, and socioeconomic status (except at extremes of income); thus, investigations within this cohort approximate population-based studies. The final study population consisted of women who became pregnant between 1995 and 2002 and who were between the ages of 16 and 45 years at the time of their pregnancy.

### Data Acquisition

Trained chart abstractors reviewed the electronic and written medical records to extract the demographic information and outcome measures. A physician (U.M. or S.H.) reviewed the records of each IBD patient to confirm the diagnosis and to determine IBD activity. If the level of disease activity did not clearly fit into the categories outlined in Table 1, a final approximation was made (by U.M.). Patients were excluded from the study for the following reasons: (1) no clear documentation of a pregnancy after record review or (2) no clear documentation of IBD in the electronic or written medical record (among cases with IBD by International Classification of Disease, 9th edition codes). Patients for whom there were no data available on the outcome of the pregnancy or on individual variables were excluded from the analysis for that variable, but they were included in the total numbers for the study. There were 42 controls and 5 cases for which birth data were not available.

### Exposure Measurements

The exposure was a diagnosis of IBD as determined by standard endoscopic, histologic, or radiographic criteria.<sup>9,10</sup> We identified all pregnant women with a prebirth diagnosis of IBD using International Classification of Disease, 9th edition codes and abstracted their comprehensive electronic and written medical records for the following data: maternal variables; medical treatment for IBD; disease activity of IBD; complications of pregnancy, labor, and delivery; and newborn

**Table 1.** Determining Disease Activity

Remission	Asymptomatic or without inflammatory sequelae
Mild disease	Symptomatic ambulatory patients able to tolerate oral alimentation without manifestations of dehydration, toxicity (high fevers, rigors, prostration), abdominal tenderness, painful mass, obstruction, or >10% weight loss
Moderate disease	Patients who are steroid-dependent, have failed to respond to treatment for mild disease, or those with more prominent symptoms of fevers, significant weight loss, abdominal pain or tenderness, intermittent nausea or vomiting (without obstructive findings), or significant anemia
Severe disease	Patients requiring hospitalization or with persisting symptoms despite the introduction of steroids as outpatients, or individuals presenting with high fever, persistent vomiting, evidence of intestinal obstruction, rebound tenderness, cachexia, or evidence of an abscess

Data from Hanauer and Sandborn.<sup>9</sup>

outcomes. Maternal variables included age at conception, marital status, smoking status (current smoker vs not current smoker), current alcohol use, number of prenatal visits, diagnosis and duration of IBD, IBD disease activity at conception and per trimester, prior surgeries, and anatomic extent and location of IBD. Medical therapy for IBD was assessed at conception and first trimester and in the second and third trimesters. IBD disease activity was classified as remission, mild, moderate, or severe (Table 1) using modifications of the definitions used in the American College of Gastroenterology guidelines for the treatment of CD in adults<sup>9</sup> and the Truelove and Witts<sup>11</sup> criteria. The presence of perianal CD was noted.

Exposed patients were frequency-matched for their age at pregnancy diagnosis and the medical center of delivery to an equal number of pregnant women without IBD. A pregnancy was defined as a positive urine or blood  $\beta$ -human chorionic gonadotropin level in the appropriate clinical setting, an ultrasound documenting an intrauterine fetus, or a live birth.

### Outcomes Measurements

Adverse outcomes were separated into conception outcomes, pregnancy outcomes, pregnancy complications, and newborn outcomes. Adverse conception outcomes were spontaneous abortion and abortion for unknown reason. Adverse pregnancy outcomes were preterm birth (<37 wk), small for gestational age (birth weight <10th percentile for gestational age), and stillbirth (death of fetus after the 20th week of pregnancy). Adverse pregnancy complications were defined as abruptio placenta, placenta previa, pre-eclampsia/eclampsia, in-

fection, premature rupture of membranes, prolonged rupture of membranes, chorioamnionitis, fetal distress, urine group B streptococcus, maternal blood transfusion, or death of the mother. Adverse newborn outcomes were defined as neonatal intensive care unit admission, newborn seizure, or infant mortality. A low birth weight was defined as less than 2500 g. Because low birth weight and infants small for gestational age are related end points, only small for gestational age infants were included in the category of adverse pregnancy outcomes. Because therapeutic abortion and cesarean section may be elective, the analyses of these 2 variables are reported separately.

### Statistical Methods

We evaluated potential predictors (eg, maternal age, ethnicity, smoking, alcohol use, and frequency of prenatal visits) of adverse maternal or fetal outcomes as potential confounders of the IBD–adverse-outcome relationship. We included in the final multivariate models variables used for the frequency matching (maternal age),<sup>12</sup> those whose inclusion altered the odds ratio by greater than 10% (eg, Caucasian ethnicity), and additional factors with a known or probable association with an adverse outcome (eg, smoking, alcohol use, and number of prenatal visits).<sup>12</sup> We evaluated for the presence of effect modification (eg, the influence of ethnicity) using cross-product terms in the logistic regression model and by evaluating stratum-specific ratios.<sup>13</sup>

Percentages are based on the number of patients with information available for the outcome of interest. Individual outcomes (ie, spontaneous abortion) were calculated based on the number of actual events in each category. Composite outcomes (ie, adverse conception outcomes) were calculated based on the number of patients with at least one event in any of the subcategories; because some patients had more than one event, the sum of the individual events provided was greater than the total number of individuals with an adverse event in the composite outcomes. The Stata statistical software package (version 8.0; College Station, TX) was used for analyses.

## Results

### Overview

A total of 493 pregnant women with IBD (exposed) were matched to pregnant women without IBD (unexposed). Thirty-two initially selected subjects were excluded because the medical record review failed to confirm either IBD or a pregnancy.

Because of matching on age, the mean age at conception was 30 years of age for both groups. There were 300 patients with UC and 154 patients with CD. Very few patients were exposed to biologics or immunosuppressants during pregnancy and conception (4%), whereas

**Table 2.** Patient Characteristics Among Pregnant Women With and Without IBD

	Patients without IBD	IBD patients	P value
N	493	461	—
Mean age at conception, y (SD)	30 (±6.0)	30 (±5.8)	—
Mean number of prenatal visits (SD)	8 (4.5)	6.9 (5.5)	<.01
Current smoker	14.4%	9.2%	.02
Current alcohol use	11.5%	3.9%	<.01
Mother's ethnicity			
Caucasian	52%	68%	
Asian	14%	5%	
Black	14%	13%	
Hispanic	13%	11%	
Other	7%	3%	
Type of IBD	—		
CD		154	
UC		300	
Indeterminate colitis		7	
Mean IBD duration, y (SD)	—	5.7 (±5.6)	
History of surgery for IBD	—	87 (15%)	
Any immunosuppressant use	2 (0.6%)	19 (4%)	<.01
CD		10 (6.6%)	
UC		9 (3%)	
Any salicylate use	1 (0.3%)	234 (51%)	<.01
Any steroid use	0	96 (21%)	<.01

21% had some corticosteroid exposure and 51% had some aminosalicylates exposure. The majority of patients were Caucasian. Eighty-seven (15%) patients with IBD had at least one prior surgery for IBD. This included 13 patients with colectomy and ileal pouch anal anastomosis, 9 patients with a colectomy and ileostomy, 37 patients with small-bowel resection, and 19 patients with prior perianal surgery. Table 2 summarizes the patient characteristics of both populations.

### Adverse Outcomes

Pregnant women with IBD were less likely to have a live birth (60% vs 68%,  $P = .01$ ) and more likely to have a cesarean section (13.8% vs 9.5%,  $P = .05$ ) than women without IBD. The rate of therapeutic abortion and congenital anomalies was similar between the 2 groups. There was no difference in the rate of congenital anomalies between children born to mothers with UC or CD ( $P = .45$ ). Women with IBD were also more likely to have an adverse conception outcome (23% vs 17%,  $P = .03$ ), an adverse pregnancy outcome (25% vs 19%,  $P = .058$ ), or a complication of pregnancy (25% vs 16%,  $P < .01$ ) compared with women without IBD. However, we did not observe a statistically significant difference in adverse newborn outcomes between the 2 groups (10% vs 7%,  $P = .18$ ). These results, as well as the individual components of each category, are summarized in Table 3. The bivariate results for each suboutcome are not adjusted for

**Table 3.** Summary of Outcomes Between Patients With IBD and Patients Without IBD

	Patients without IBD n (%) <sup>a</sup>	IBD patients n (%) <sup>a</sup>	P value
Live births	308 (68.3%)	274 (60%)	.01
Therapeutic abortion	79 (18%)	95 (21%)	.21
Congenital anomalies	30 (6%)	34 (7%)	.71
UC		25 (13%)	.45
CD		9 (10%)	
Cesarean section	37 (9.5%)	61 (13.8%)	.05
Adverse conception outcomes	62 (17%)	83 (23%)	.03
Spontaneous abortion	60 (14%)	79 (17%)	.09
Abortion (other)	2 (0.5%)	4 (0.9%)	.42
Adverse pregnancy outcomes	58 (19%)	70 (25%)	.058
Small for gestational age	31 (10%)	33 (12%)	.44
Preterm birth (<37 wk)	28 (9.6%)	36 (14.2%)	.09
Stillbirth	2 (0.4%)	4 (0.9%)	.42
Complications of pregnancy	47 (16%)	68 (25%)	<.01
Abruptio placenta	2 (0.4%)	3 (0.7%)	.75
Chorioamnionitis	7 (1.4%)	9 (1.9%)	.80
Eclampsia/pre-eclampsia	9 (1.8%)	11 (2.4%)	.87
Fetal distress	9 (1.8%)	14 (3.0%)	.44
Infection	0 (0%)	1 (0.2%)	.35
Maternal blood transfusion	2 (0.4%)	6 (1.3%)	.21
Maternal death	1 (0.2%)	0 (0%)	.28
Placenta previa	3 (0.6%)	5 (1.1%)	.59
Premature rupture of membranes	14 (2.8%)	20 (4.3%)	.48
Prolonged rupture of membranes	10 (2%)	9 (1.9%)	.61
Urine group B streptococcus	3 (0.6%)	9 (1.95%)	.12
Adverse newborn outcomes	22 (7%)	28 (10%)	.18
Neonatal intensive care unit care	20 (4%)	27 (6%)	.73
Newborn death	1 (0.2%)	1 (0.2%)	.79
Seizure	0 (0%)	1 (0.22%)	.40

NOTE. Forty-two controls and 5 cases had missing pregnancy outcomes, and thus were excluded from calculations.

<sup>a</sup>% represents percentage of all pregnancies (including pregnancies ending before delivery).

confounders given the small numbers for each category. Low birth weight, a metric reported in some pregnancy studies that is related directly to small for gestational age, was also more common among IBD patients than among non-IBD patients (20 [7.4%] vs 11 [3.6%], respectively;  $P = .04$ )

**Risk Factors for Adverse Outcomes**

Among all patients, predictors of an adverse conception outcome in a multivariable model included the presence of IBD, non-Caucasian ethnicity, a history of IBD surgery, and increasing maternal age (odds ratio per year of age, 1.10; 95% confidence interval, 1.05–1.14).

Predictors of an adverse pregnancy outcome were non-Caucasian ethnicity. The presence of IBD had an odds ratio of 1.54 (95% confidence interval, 0.996–2.38). Predictors of a pregnancy complication were a diagnosis of IBD, CD, and a history of IBD surgery. The only predictor of a newborn adverse outcome was a diagnosis of CD. These findings are summarized in Table 4. Current alcohol use, current tobacco use, and number of prenatal visits were not predictive in any category.

Among patients with IBD, predictors of an adverse outcome again included maternal age (odds ratio, 1.09; 95% confidence interval, 1.04–1.15). IBD surgery was a

predictor of adverse outcome when IBD patients with surgery were compared with controls, but not when IBD patients with surgery were compared with IBD patients without surgery.

Disease activity (as a categoric variable), any IBD medication use, and current alcohol and smoking status were not predictive in any category. The presence of moderate to severe disease activity also was not associated with an adverse outcome. The majority of patients with both UC and CD had inactive or mild disease throughout pregnancy. The percentages of patients with inactive, mild, moderate, and severe disease are shown in Figures 1 and 2.

**Supplemental Analyses**

**Medical comorbidity.** We contrasted the frequency of electronic diagnoses of major medical conditions (hypertension, pregnancy-induced hypertension, diabetes, or gestational diabetes) between patients with and without IBD. The prevalence of each condition was low overall, and the frequency of each was comparable between the 2 groups. Among IBD patients, 3% had a diagnosis of hypertension, 2.6% had a diagnosis of hypertension of pregnancy, 1.3% had a diagnosis of diabetes, and 3.3% had a diagnosis of diabetes of pregnancy. Among non-IBD patients, the prev-

**Table 4.** Predictors of Adverse Outcomes by Category

	Conception outcome <sup>a</sup>	Pregnancy outcome <sup>b</sup>	Pregnancy complication <sup>b</sup>	Newborn outcome <sup>b</sup>
IBD	1.65 (1.09– 2.48)	1.54 (1.00–2.38)	1.78 (1.13–2.81)	1.89 (0.98–3.69)
UC	2.78 (0.68–11.3)	1.48 (0.91–2.39)	1.51 (0.90–2.53)	1.42 (0.66–3.10)
CD	2.53 (0.24– 27.2)	1.40 (0.75–2.63)	2.33 (1.24–4.37)	3.20 (1.33–7.73)
Ethnicity				
Caucasian	1.28 (0.75–2.17)	0.98 (0.57–1.71)	1.71 (0.97–3.03)	2.07 (0.83–5.15)
Non-Caucasian	2.42 (1.28–4.55)	2.90 (1.45–5.78)	1.95 (0.90–4.20)	1.54 (0.54–4.40)
IBD surgery (vs controls)	2.26 (1.12–4.55)	1.28 (0.57–2.86)	2.99 (1.39–6.43)	2.82 (0.98–8.13)
IBD surgery (among IBD patients)	1.30 (0.65–2.61)	1.17 (0.051–2.66)	1.94 (0.91–4.14)	1.64 (0.58–4.64)
Medication use (among IBD patients)	0.03 (0.00–1.39)	1.41 (0.73–2.72)	1.26 (0.67–2.38)	1.47 (0.58–3.74)
Any disease activity (among IBD patients)	0.07 (0.003–1.62)	1.38 (0.76–2.53)	1.02 (0.56–1.87)	1.92 (0.81–4.55)
Moderate-high disease activity (among IBD patients)	0.00 (0.00–3.65)	1.85 (0.88–3.91)	1.48 (0.68–3.18)	1.64 (0.60–4.51)

<sup>a</sup>Multivariate odds ratio adjusted for maternal age, current alcohol use, current smoking status, and Caucasian ethnicity.

<sup>b</sup>Multivariate odds ratio adjusted for maternal age, current alcohol use, current smoking status, Caucasian ethnicity, and number of prenatal visits.

alence was 3.5%, 3.5%, 4%, and 1%, respectively. There was no evidence from logistic modeling that any of these medical conditions confounded any of the primary associations between IBD and each major outcome.

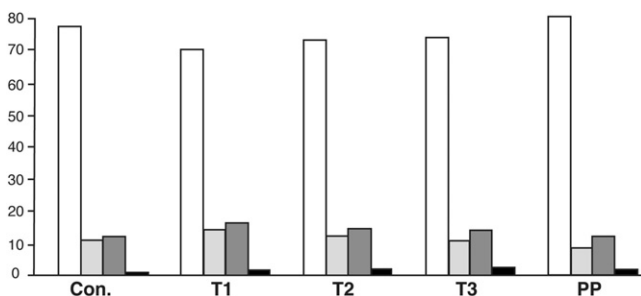
## Discussion

Women with IBD are less likely to have a live birth and more likely to have an adverse outcome related to gestation than women without IBD. In particular, adverse conception outcomes (spontaneous or abortion unknown) and pregnancy complications were more likely in women with IBD. However, we did not observe a statistically significant difference in newborn outcomes between the 2 groups. Having IBD, and a history of surgery for IBD, were strong predictors of an adverse outcome when compared with patients without IBD. When looked at separately, patients with CD had an increased risk of pregnancy complications and newborn complications compared with non-IBD patients. IBD disease activity, either any activity or moderate to high activity, was not predictive of poor outcome. IBD medication use also was not predictive of adverse outcomes. This may reflect the community setting of this study in which the majority of

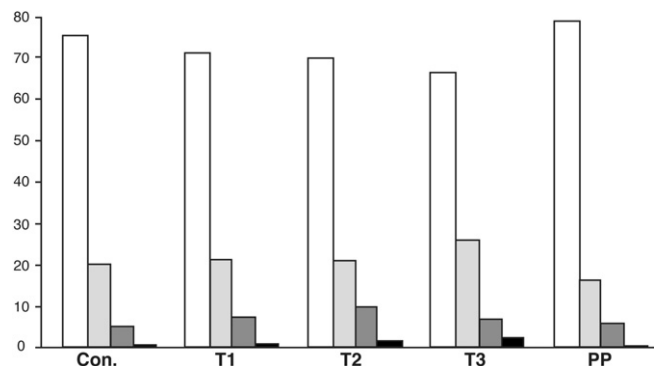
patients had inactive disease and were not on immunosuppressive medication.

The national vital statistics report of all births in the United States provides a marker for comparison of the results of this study. In 2000,<sup>14</sup> the rate of live births was 65.9% and the rate of induced abortions was 21.3% nationally, nearly identical to the rates noted in this study. In 2004,<sup>15</sup> 10% of mothers nationally reported smoking during pregnancy, compared with 14.4% of non-IBD patients and 9.2% of IBD patients in this study. The rate of cesarean delivery nationally was 29.1%, much higher than the 9.5% of controls and 13.8% of IBD patients. The rates of preterm birth (12.5%) and low birth weight (8.1%) also were higher nationally than in this cohort. These numbers may reflect the fact that all members of the Northern California Kaiser Permanente cohort had access to health care throughout their pregnancy, in contrast to the national population.

Our findings on pregnancy outcomes in women with IBD are consistent with and extend those of other population-based studies. Scandinavian studies showed an



**Figure 1.** Level of disease activity at conception (CON), trimester (T1, T2, T3), and in the post-partum (PP) period among patients with CD. From left to right, the bars represent inactive, mild, moderate, and severe disease activity.



**Figure 2.** Level of disease activity at conception (CON), trimester (T1, T2, T3), and in the post-partum (PP) period among patients with UC. From left to right, the bars represent inactive, mild, moderate, and severe disease activity.

association between IBD and an increased risk of preterm birth, small for gestational age infants, low birth weight, and cesarean sections.<sup>5-7</sup> The increased occurrence of cesarean section may be elective for multiple reasons associated with IBD (ie, prior surgery or prior perianal disease), but not necessarily medically indicated because of the underlying IBD itself. A population-based cohort study by Dominitz et al<sup>8</sup> that used the computerized birth records of Washington State and an administrative data set to compare pregnancy outcomes in 107 UC and 155 CD patients with 1308 patients without IBD, showed that women with CD had significantly higher rates of preterm delivery, low birth weight, and small for gestational age infants compared with controls. Women with UC, on the other hand, had similar rates to women without IBD, but a significantly higher rate of congenital malformations (7.9% vs 1.7%); however, the study did not adjust for medical therapy of IBD and the increased rate of fetal malformation has not been reproduced in other studies, including our own.

Our study is population-based, and additionally had access to primary data to study predictors of an adverse pregnancy outcome. Prior referral center studies have noted higher rates of adverse pregnancy outcomes with patients with ileal CD and previous bowel resection (consistent with our findings),<sup>16</sup> as well as disease activity. In the prior studies, IBD activity at conception was associated with a higher rate of fetal loss and preterm birth<sup>17,18</sup>; and disease activity during pregnancy was associated with low birth weight and preterm birth.<sup>19,20</sup> In our study, we did not show an association between disease activity and adverse outcomes. Potential explanations for this difference may include the presence of fewer high-risk patients, lower disease activity, and less comorbidity in a community-based cohort than in patients seen at referral centers.

Medical therapy of IBD was not associated with adverse outcomes in our study, but it must be noted that few patients (4%) were receiving immunomodulators or biologics. The majority of patients were receiving aminosalicylates or no medical treatment for IBD immediately before and during the pregnancy.

Our study had a number of important strengths. First, the comprehensive nature of the electronic and paper medical records permitted a complete ascertainment of the details of pregnancy and IBD. Second, the Northern California Kaiser Permanente population approximates the ethnic, sex, and socioeconomic census distributions of the underlying population in northern California (except at extremes of income); thus, the results of this study can be generalized more readily to the general population than results from a referral population. This population would be expected to approximate the community patterns for IBD and pregnancy care and the IBD disease activity patterns before and during pregnancy. Finally, the availability of individual medical records for this study allowed us to determine the association between

adverse pregnancy outcomes in a population-based setting and potential risk factors for these outcomes.

There were also several potential limitations of this study. First, relatively few patients were on immunosuppressant and biologic agents. This makes it difficult to definitively evaluate the safety of these agents in pregnancy. Second, the retrospective nature of the study made it dependent on what was recorded in the medical record, which may introduce bias. It is possible that medical therapy of IBD, disease activity of IBD, and adverse pregnancy outcomes were not documented adequately. However, although it is possible that a retrospective chart review did not capture all mild disease relapses, we likely captured most moderate and severe relapses. Patients who are insured through Kaiser Permanente typically obtain all their care within the system, including prescription drugs. The prenatal visit log noted any complications the patient experienced since their last visit. It is thus unlikely for a pregnant patient to have had a moderate to severe flare during her pregnancy and not have this reflected in any phone call or visit to a primary care provider, gastroenterologist, or obstetrician. We also made efforts to minimize errors in data abstraction by using trained chart abstractors, by having the physician re-abstract a portion of the charts for accuracy, and by having a physician separately review all data on IBD for extent and location of disease and for IBD activity. This ensured that a physician made the important decisions regarding the classification of IBD extent and activity. Third, the evaluation of multiple end points may lead to the finding of associations by chance. We sought to minimize this possibility by selecting a few clinically relevant compound end points a priori (before analysis); these are represented by the columns in Table 4. Caution should be exercised in the interpretation of comparisons among smaller subgroups of individual outcomes. Fourth, complete pregnancy outcome data were available for 95% of all subjects, 99% of persons with IBD (456 of 461), and 91% of persons without IBD (451 of 493). We cannot exclude the possibility that differences between persons without outcome data contributed to portions of the results described. Finally, patients with IBD may differ from patients without IBD (eg, susceptibility to other autoimmune diseases) in ways that may not be captured in medical histories.

In summary, women with IBD in this population-representative cohort had a higher risk of adverse outcomes associated with pregnancy than their age-matched counterparts without IBD. The risk of adverse outcomes in a community setting was independent of disease activity or medical treatment for IBD. This study does not refute the current practice of continuing maintenance medical therapy for IBD during pregnancy to control disease, but it does identify that the presence of IBD itself is a risk factor for an adverse outcome, even in patients in clinical remission or with minimally active disease. Fur-

ther studies on the effects of immunosuppressant medications and biologic therapy on pregnancy outcomes in a population-based setting are needed to better define the risk of their use in this setting and their impact on the rate of adverse outcomes.

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Received April 25, 2006. Accepted July 12, 2007.

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Supported by the Crohn's Colitis Foundation of America First Award and supplemental funding, the Foundation for Clinical Research in IBD, the Schoenberg Foundation, the Permanente Medical Group, and the National Institutes of Health (K08 DK002697-05).