A National Study of Pregnancy Related Maternal and Fetal Outcomes in Women with Inflammatory Bowel Disease.

Zahid Ijaz Tarar (drzahidejaz@hotmail.com)
University of Missouri School of Medicine
Umer Farooq
Loyola Medicine/MacNeal Hospital
Muhammad Usman Zafar
Lehigh Valley Health Network
Saad Saleem
Sunrise Hospital and Medical Center
Ahmed Nawaz
Yale School of Medicine
Faisal Kamal
University of California
Ghulam Ghous
University of Missouri School of Medicine
Faisal Inayat
Allama Iqbal Medical College
Yezaz A. Ghouri
University of Missouri School of Medicine at Columbia

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Abstract

Background and Aims:

The incidence of Inflammatory bowel disease (IBD) among women is highest during their reproductive years and current estimates suggest that rate of conception is low in female IBD patients. The aim of our study was to assess the burden of adverse maternal and perinatal outcomes among female IBD patients.

Methods:

Using the national inpatient sample database from 2016 to 2018 we extracted data of all female patients above the age of 15 years admitted with a primary diagnosis of pregnancy and a secondary diagnosis of ulcerative colitis or Crohn's disease. Multivariable regression analysis was performed to determine the effect of IBD on maternal and fetal outcomes.

Results:

Pregnant women with IBD had greater odds of gestational diabetes (AOR 1.55, 95% CI 1.04-2.3, p= 0.02), hypertensive complications (adjusted odds ratio [AOR] 1.35, 95% CI 1.06-1.72, p= 0.01) and pre-term delivery (AOR, 1.41 95% CI 1.13-1.76, p= 0.003). Pregnancies with co-existent IBD were associated with fetal growth restriction (AOR 1.27, 95%CI 1-1.63, p= 0.04) and fetal death (AOR 3.21, 95% CI 1.72-6.00, p <0.01). Odds of experiencing postpartum hemorrhage or delivering large for gestational age infant were the same in IBD and general population.

Conclusions:

Women with IBD were associated with worse maternal and fetal outcomes as well higher resource utilization. We suggest that women who have moderate to severe disease should get pre-conceptional counselling and undergo appropriate treatment to achieve remission. This may reduce the fear associated with conception and decrease risk of maternal and fetal complications.

Introduction:

Inflammatory bowel disease (IBD) is a chronic relapsing and remitting disease of the gastrointestinal (GI) tract, mainly comprising of Crohn's disease (CD) and ulcerative colitis (UC). The pathogenesis of IBD is not well understood, although it is more prevalent among genetically susceptible individuals who are exposed to certain external factors including smoking, stress, microbial agents, drugs, diet, and appendectomy.[1, 2]

IBD mainly effects young individuals, which includes females who are at their peak reproductive years. IBD patients are usually anxious about conceiving due to incurable and relapsing-remitting nature of their disease and the fear of adverse pregnancy outcome following the use of immunosuppressive therapies. This can also result in stopping the treatment for IBD or poor compliance overall in these women.[3–5]

Several studies have been conducted to assess the impact of IBD on fertility and pregnancy outcomes, but the results compiled from these studies are conflicting and lack consensus.[6–10] The disease course during pregnancy is not significantly different from non-pregnant patients and if the disease is in remission before conception, then in majority of the cases it will remain quiescent during the period of gestation.[11] The overall rate of relapse during pregnancy is about 20–35%, but if the disease is not in remission before conception the chances of disease exacerbation while pregnant increases to 60%.[12–14] Due to the increasing concerns of IBD patients and their partners regarding pregnancy outcomes, it is highly recommended that IBD patients planning to get pregnant should undergo objective assessment of their disease status and it should be optimally controlled prior to conception.[15]

The aim of our study was to assess the burden of adverse maternal and perinatal outcomes in IBD patients using a large decentralized national inpatient sample (NIS). To our knowledge this is the first study using the NIS data to determine the impact of IBD on pregnancy outcomes.

Methods:

Study Design and Data Source:

This is a retrospective cohort study of pregnant patients admitted to hospitals in the United States between the years 2016 to 2018. Patients were selected from the Healthcare Cost and Utilization Project (HCUP), which is a large publicly available, all-payer inpatient database. The NIS for the years 2016 to 2018 contains data from 48 states plus district of Columbia and represents more than 97% of US population. In this dataset, the hospitals are broadly divided based on teaching or non-teaching status, rural or urban location, bed size, control or ownership, and geographic regional location. The NIS contains 20% stratified sample of all discharges from more than 4,000 non-federal acute care hospitals in the US. These discharges are weighted making it nationally representative. Weight is the total number of discharges from all acute care hospital in the US divided by number of discharges included in the 20% sample. NIS is the nation's most comprehensive healthcare database, and its large size is ideal for assessing national and regional estimates. NIS contains both patient and hospital related information. Patient level data includes age, gender, zip code, race, range of annual income, principal diagnosis, secondary diagnosis, list of procedures performed, length of stay (LOS) at hospital, resource utilization and outcomes which are extracted by utilizing international classification of disease (ICD) codes. Hospital level data includes hospital location, teaching status and bed size. NIS from 2016 to 2018 contains a record of about 21 million hospital discharges.

Study Population:

Patients with a principal diagnosis of pregnancy were identified using ICD 10th revision codes. The inclusion criteria for the study were: all patients above the age of 15 years with a primary diagnosis of pregnancy including live or still births, which represents pregnancies that lasted beyond 20 weeks of gestation, and a secondary diagnosis of UC or CD. The patients with spontaneous or missed abortions,

miscarriage, extra-uterine pregnancy, and non-natural termination were excluded and only codes for final pregnancy outcomes were included to prevent duplication (Fig. 1). Pregnancy and UC or CD as primary and secondary diagnosis respectively were identified using their respective ICD-10 codes .

Study Outcomes:

The primary outcome was to study the effect of having a comorbidity like IBD on maternal and fetal outcomes. The analyzed primary maternal outcomes were gestational diabetes mellitus (DM) or abnormal glucose tolerance, hypertensive complications (gestational hypertension, pre-eclampsia, eclampsia and HELLP [hemolysis, elevated liver enzymes and low platelets] syndrome), and postpartum hemorrhage. Fetal outcomes that were studied included fetal growth restriction (FGR), large for gestational age (LGA) or access growth, preterm birth, and fetal death. Further sub-group analysis was performed separately in the UC and CD groups to determine the effect of these individual diseases on maternal and perinatal outcomes. The secondary outcomes were LOS, and total hospital charges.

Study variables:

The variables of interest were defined based on patient demographics including age, race, ethnicity, zip code and insurance status. The demographic data was extracted directly from the NIS database. Hospital characteristics included in the study were location, teaching status and bed size. The other variables of interest were pre-existing comorbidities, which included DM, hypertension, obesity, hyperlipidemia, history of smoking, history of alcohol use and malnutrition. Chronic inhaled or systematic corticosteroid use was also defined and added in the analysis. ICD-10 codes were used to define the variables for pre-existing diseases and comorbidities.

Statistical Analysis:

The statistical analysis was performed using STATA, version 16.1 (College Station, TX, USA). We calculated unbiased results which are nationally representative and in addition can produce variance estimates and p-values. Discharge level weights released from HCUP were used to estimate the total number of patients admitted with a principal diagnosis of pregnancy. Fischer exact test was used to compare proportions. Continuous variables were compared by using analysis of variance (> 2 variables) or t-test (2 variables). Univariable regression analysis was used to calculated unadjusted odd ratios (ORs) for primary and secondary outcomes. Multivariable regression analysis was performed to adjust for potential confounders and obtain adjusted odds ratios (AORs). Variables included in multivariate regression model were age, ethnicity, hospital teaching status, hospital bed size, hospital region, median household income, insurance status, Charlson's comorbidity index (CCI), chronic corticosteroid use, malnutrition, dyslipidemia, obesity, cigarette smoking and malnutrition. These variables were included as confounders in multivariable regression analysis based on significant association seen on univariate analysis with a cut-off p-value of 0.2. Linear regression was used for continuous outcomes (LOS, hospital charges) and logistic regression was used for binary outcomes (gestational DM, hypertensive complications, preterm birth, FGR, LGA, and fetal death).

Results:

Patient Characteristics:

The study included 8,079,828 pregnancies between the years 2016–2018, out of which 14,129 had IBD (Fig. 1). Mean age of pregnant women with IBD was 30 years, as compared to 28 years in the non-IBD group. Majority of pregnant patients were white (76.92% vs 51.53%), followed by black (10.07% vs 16.04%) and Hispanic (7.43% vs 20.99%). Majority of the study population in both IBD and non-IBD groups had a low CCI i.e., category 0. Majority of the study population had private insurance (69.29% vs 49.93%), followed by Medicaid (24.38% vs 43.82) in IBD versus non-IBD groups respectively. More patients were admitted to large urban teaching hospitals in both IBD and non-IBD groups. All these results were statistically significant ($p < 0.05$). Baseline characteristics of the study population are summarized in Table 1.

Table 1
Baseline Characteristics of Pregnant patients with inflammatory bowel disease.

Baseline characteristics	Pregnancy with IBD (14129)	Pregnancy without IBD (8065699)	p-value
Age (Years)			
Race [n (%)]			< 0.01
White	10349 (76.92)	3973221(51.53)	
Black	1355(10.07)	1236550 (16.04)	
Hispanic	1000(7.43)	1618824(20.99)	
Asians	310(2.3)	465234(6.03)	
Native Americans	60(0.45)	55164(0.72)	
Others	380(2.82)	361619(4.69)	
Charlson Comorbidity Index			< 0.01
0	12270(86.84)	7504963(93.05)	
1	1635 (11.57)	518279(6.43)	
2	165 (1.17)	33990(0.42)	
> 3	60(0.42)	8465(0.1)	
Median Household Income (quartile) [n (%)]*			< 0.01
1st (0-25th)	2245(16.02)	2292503(28.7)	
2nd (26-50th)	3180(22.69)	2031008(25.43)	
3rd (51st -75th)	4050(28.9)	1950978(24.43)	
4th (76th -100th)	4540(32.39)	1712489(21.44)	
Insurance Status [n (%)]			< 0.01
Medicare	340(2.41)	62314(0.77)	
Medicaid	3445(24.38)	3534407(43.82)	

* Median household income for the patient's Zip Code :1st Quartile: $1-$42,999, $1–43,999, $1-45999 for NIS 2016,2017,2018 respectively. 2nd quartile: $43,000- $53,999, $44,000-$55,999, $46,000-$58,999 for NIS 2016,2017 and 2018 respectively. 3rd quartile: $54,000-$70,999, $56,000-$73,999, $59,000-$78,999 for NIS 2016,2017 and 2018 respectively.4th quartile: > $71,000,>74,000,> 79,000 for NIS 2016, 2017 and 2018 respectively.

Baseline characteristics	Pregnancy with IBD (14129)	Pregnancy without IBD (8065699)	p-value
Private	9790(69.29)	4027591(49.93)	
Uninsured	115(0.81)	209820(2.6)	
Hospital Region [n (%)]			< 0.01
Northeast	2925(20.7)	1327334(16.46)	
Midwest	3430(24.27)	1638724(20.32)	
South	4870(34.47)	3170094(39.29)	
West	2905(20.56)	1929546(23.92)	
Hospital bed size [n (%)]			< 0.01
Small	2340(16.56)	1459417(18.09)	
Medium	3565(25.23)	2469726(30.62)	
Large	8225(58.21)	4136555(51.29)	
Hospital Teaching status [n (%)]			< 0.01
Rural	880(6.23)	723392(8.97)	
Urban non-teaching	2285(16.17)	1758984(21.81)	
Urban teaching	10965(77.6)	5583322(69.22)	

* Median household income for the patient's Zip Code :1st Quartile: $1-$42,999, $1–43,999, $1-45999 for NIS 2016,2017,2018 respectively. 2nd quartile: $43,000- $53,999, $44,000-$55,999, $46,000-$58,999 for NIS 2016,2017 and 2018 respectively. 3rd quartile: $54,000-$70,999, $56,000-$73,999, $59,000-$78,999 for NIS 2016,2017 and 2018 respectively.4th quartile: > $71,000,>74,000,> 79,000 for NIS 2016, 2017 and 2018 respectively.

Incidence of maternal and perinatal complications:

Gestational DM or glucose intolerance, hypertensive complications and postpartum hemorrhage were more common in the IBD group when compared to non-IBD group. The incidence of gestational DM was 5.94% in IBD group when compared to 5.66% in non-IBD group, but this result was barely statistically significant ($p = 0.5$). Hypertensive complications were present in 2.83% of IBD group patients while only 2.06% of non-IBD group experienced it ($p < 0.01$). There was no difference in incidence of postpartum hemorrhage in pregnant women with IBD or without IBD (3.5% vs 3.25, $p = 0.55$). Pregnant women with IBD had a higher rate of pre-term delivery compared to those without IBD (2.97% vs 2.06%, $p < 0.01$).

Fetal growth restriction occurred more commonly in the IBD group when compared to non-IBD group (2.37% vs 1.82%, p = 0.02), as was fetal death (0.35% vs 0.12%, p < 0.01) [Table 2]. Although there were higher odds of having a newborn that was LGA in IBD group, the results did not achieve statistical significance (2.02% vs 1.64%, p = 0.12).

Table 2
Incidence of maternal and perinatal outcomes of pregnant patients with or without a co-diagnosis of inflammatory bowel disease.

Maternal outcomes	**Incidence, n (%)**		***P- values***
	IBD	**No IBD**	
Gestational Diabetes	5.94 (839)	5.66 (457085)	0.5
Gestational Hypertension	2.83 (400)	2.06 (166914)	< 0.01
Postpartum hemorrhage	3.5 (495)	3.27 (264580)	0.55
Perinatal Outcomes			
Preterm Birth	2.97 (420)	2.06 (166575)	< 0.01
Small for Gestational age	2.37 (335)	1.82 (147275)	0.02
Large for Gestational age	2.02 (287)	1.64 (132690)	0.12
Fetal death	0.35 (49)	0.12 (9425)	< 0.01
Preterm birth is defined as delivery before 37 weeks of gestation; IBD, inflammatory bowel disease.			

Adjusted Analysis of Maternal and Perinatal outcomes:

Multivariable regression analysis was conducted after adjusting for patient and hospital level confounders.. After adjusting for these confounders' pregnant women with IBD had higher odds of being diagnosed with gestational DM or glucose intolerance (AOR 1.55, 95% confidence interval [CI] 1.04–2.3, p-value = 0.02) and hypertensive complications (AOR 1.35, 95% CI 1.06–1.72, p-value = 0.01). On multivariate regression analysis of perinatal outcomes, worse fetal outcomes were observed in pregnant women with IBD. Pregnancies with a co-diagnosis of IBD led to poor fetal growth (AOR 1.27, 95% CI 1-1.63, p = 0.04), higher odds of pre-term delivery, i.e., delivery at < 37 weeks, (AOR 1.41, 95% CI 1.13–1.76, p = 0.003) and fetal death (AOR 3.21, 95% CI 1.72-6.00, p < 0.01). We observed that odds of post-partum hemorrhage and LGA were higher in pregnant IBD patient population, but this difference was not statistically significant. [Table 3]

Table 3
Pregnancy related maternal and perinatal adverse outcomes: adjusted analyses.

Maternal Outcomes	IBD vs. No IBD (AOR, 95% CI)	P-value
Gestational Diabetes Mellitus	1.55 (1.04–2.3)	0.02
Hypertensive Complications	1.35(1.06–1.72)	0.01
Postpartum Hemorrhage	1.04 (0.84–1.29)	0.68
Perinatal Outcomes		
Preterm Delivery (< 37 weeks).	1.41 (1.13–1.76)	0.003
Small for gestational Age	1.27(1 -1.63)	0.04
Large for gestational age	1.05(0.79–1.40)	0.69
Fetal Death	3.21(1.72-6.00)	< 0.01

Hypertensive complications include gestational hypertension, pre-eclampsia, eclampsia and HELLP syndrome. IBD, inflammatory bowel disease; AOR, adjusted odds ratio.

Maternal and Perinatal Outcomes in Ulcerative Colitis and Crohn's Disease Sub-groups:

Pregnant women with either UC or CD had higher odds of gestational DM (AOR 1.13, 95% CI 0.57–2.26 and AOR 1.89, 95% CI 1.18–3.02 respectively) but only CD group achieved statistical significance, p = 0.007. Pregnancies with co-existent UC or CD also conferred higher odds of hypertensive complications independently (AOR 1.05, 95% CI 0.68–1.64 p = 0.82 and AOR 1.52, 95% CI 1.15–2.02 p = 0.004 respectively). Both UC and CD patient groups were associated with higher odds of pre-term delivery (AOR 1.19, 95% CI 0.81–1.74 and AOR 1.55, 95% CI 1.18–2.04, respectively) but only CD group results were statistically significant, p = 0.002. Higher odds of fetal death (AOR 3.35, 95% CI 1.25–8.98, p = 0.01) were seen in UC patient population. Pregnant patients with co-existent UC had comparable odds of postpartum hemorrhage and FGR to the pregnancies without UC (AOR 1.04, 95%CI 0.76–1.43, p-value 0.81and AOR 1.09, 95% CI 0.71–1.68, p = 0.67 respectively). CD was associated with higher odds of FGR (AOR 1.39, 95% CI 1.02–1.88, p = 0.04) and fetal death (AOR 3.11, 95% CI 1.39–6.99, p = 0.006) but similar odds of postpartum hemorrhage compared to general population (AOR 1.04, 95% CI 0.79–1.38, p = 0.75). Both UC and CD had similar odds of LGA infants compared to general population (AOR 1.33, 95% CI 0.88–1.99, p = 0.18 and AOR 0.88, 95% CI 0.59–1.31, p = 0.53, respectively). Table 4 delineates the adjusted analysis of maternal and fetal outcomes in UC and CD sub-groups.

Table 4
Subgroup analysis of pregnancy and perinatal outcomes in patients with ulcerative colitis and Crohn's disease: adjusted analysis.

Maternal Outcomes	Ulcerative Colitis (n = 5665) AOR, 95% CI	P-value	Crohn Disease (n = 8475) AOR, 95% CI	P-value
Gestational Diabetes Mellitus	1.13 (0.57–2.26)	0.71	1.89 (1.18–3.02)	0.007
Hypertensive Complications	1.05 (0.68–1.64)	0.82	1.52(1.15–2.02)	0.004
Postpartum Hemorrhage	1.04 (0.76–1.43)	0.81	1.04 (0.79–1.38)	0.75
Perinatal Outcomes				
Preterm Delivery (< 37 weeks).	1.19 (0.81–1.74)	0.36	1.55 (1.18–2.04)	0.002
Small for gestational Age	1.09 (0.71–1.68)	0.67	1.39 (1.02–1.88)	0.04
Large for gestational age	1.33 (0.88–1.99)	0.18	0.88 (0.59–1.31)	0.53
Fetal Death	3.35 (1.25–8.98)	0.01	3.11 (1.39–6.99)	0.006

Hypertensive complications include gestational hypertension, pre-eclampsia, eclampsia and HELLP syndrome. AOR, adjusted odds ratio.

Length of Stay and Total Hospital Charges:

Pregnant IBD patients showed increased mean LOS by 0.37 days (95% CI 0.25–0.49, $p < 0.01$) when compared to non-IBD patients. Based on our analysis, average duration of hospital stays for a pregnancy in the US between 2016–2018 was 2.72 days, whereas in pregnant women with concomitant IBD the average length of hospital stay was 3.27 days. Presence of IBD also showed increased mean total hospital charges by $2741 (95% CI $1699–3783%, $p < 0.01$) [Table 5].

Table 5
Adjusted odds of resource utilization in pregnant women with inflammatory bowel disease.

Outcomes	Pregnancy with IBD	Pregnancy without IBD	P-value
Mean LOS (days)	3.27 days	2.72 days	< 0.03
Adjusted Analysis	**Co-efficient**	**95% CI**	**P-value**
Adjusted mean deference in Length of hospital stay (days)	0.37	(0.25–0.49)	< 0.01
Adjusted mean difference in Total hospital Charges ($)	2741$	(1699-3783)	< 0.01

IBD, inflammatory bowel disease; LOS, length of stay.

Discussion:

In the current study we used the NIS, which is the largest all payer US healthcare database, to analyze the effect of IBD on maternal and fetal outcomes. Overall, pregnant women with IBD experienced worse maternal and perinatal outcomes when compared to their counterparts without IBD. Even after adjusting for pre-existing maternal metabolic conditions and harmful lifestyle habits, IBD remained associated with greater odds of gestational diabetes, gestational hypertension associated complications including pre-eclampsia, eclampsia, HELLP syndrome and post-partum hemorrhage. Perinatal outcomes were also adversely affected in pregnant women with IBD when compared to non-IBD pregnant group. We observed higher odds of FGR, pre-term birth and fetal death, after adjusting for maternal metabolic conditions and lifestyle habits.

In subsequent sub-group analysis of pregnant women with UC and CD, we found that more women with CD conceived when compared to women with UC. Both groups showed higher adjusted odds of worse maternal and fetal outcomes, except that CD was not associated with higher risk of LGA infants. This was true even after adjusting for maternal metabolic diseases and lifestyle habits including smoking and alcohol abuse. Furthermore, even after adjusting for long term use of inhaled and systemic corticosteroids, IBD in general and CD and UC independently, were associated with poor maternal and perinatal outcomes. We also found that pregnant women with IBD have prolonged mean LOS and increased resource utilization.

Previous studies on IBD affecting pregnancy showed conflicting evidence. Lee et al., studied the effect of IBD on pregnancy in a Korean cohort and concluded that women with moderate to severe IBD are associated with worse maternal and fetal outcomes, but with mild disease there was no difference in outcomes between the IBD and control group.[3] These results were further reinforced by Kammerlander et al., who studied the effect of disease severity on pregnancy outcomes and concluded that moderate to severe disease was associated with increased odds of low birth weight and preterm delivery.[16]

Baird et al., reported that women diagnosed with IBD had low pregnancy and fertility rates, but this low fertility rate was not secondary to disease effect rather it was a voluntary childness resulting from fear of worse pregnancy outcome.[17] Selinger et al., studied the rate of fertility in IBD patients and found that 17% of women chose not to conceive and the most important factor behind this decision was poor knowledge of disease and disease burden.[5] Contrary to this Mayberry et al., documented that women with IBD had low fertility, regardless of the bowel segment involved. [18] Based on these results it is evident that women with IBD are fearful of having children or suffering from subfertility. Hence, better counselling and guidance is needed in this potentially high-risk pregnancy population.

In our analysis we found that IBD in general as well as UC and CD independently were associated with increased odds of gestational diabetes and glucose intolerance as compared to non-IBD control group. Tandon et al., performed a meta-analysis to study the risk of pregnancy outcomes in IBD patients and documented that gestational diabetes was more common in the IBD group. They reported no increased odds of developing gestational diabetes in pregnant IBD patients on long term corticosteroids.[19] Another study by Leung et al., showed that IBD is independently associated with increased risk of gestational diabetes regardless of corticosteroid use, which further strengthens our findings.[20] We also found increased odds of gestational hypertension associated complications like pre-eclampsia, eclampsia and HELLP syndrome in IBD as well UC and CD patient sub-groups. This is in consensus to previous findings reported by Boyd et al., that showed increased incidence of pre-eclampsia in IBD patients, but Boyd et al., labelled oral corticosteroid use as major contributing factor for the development of these complications.[21] Interestingly in our study we demonstrated that even after adjusting for long term corticosteroid use, these pregnancies still carry a high risk for developing these complications.

Our analysis showed worse perinatal outcomes in pregnant women with IBD when compared to non-IBD controls. We included preterm birth, FGR, LGA and fetal death as our outcomes of interest. Similar results were seen in many of the previous studies. [3, 8, 9, 22–24] In contrast, Bortoli et al., conducted a prospective study and found that IBD had similar perinatal outcomes when compared to non-IBD controls[25] and a study from Nogard et al., seconds these results.[7] It is still ambiguous if active disease results in worse fetal outcomes, and the effect of IBD therapy can have on fetal outcomes. The studies performed earlier have not reached a clear conclusion. Baiocco et al., reported that active disease is associated with worse perinatal outcomes and treatment medications are not the central reason for these poor outcomes.[26] These results were reinforced by the study conducted by Oron et al., who found that active disease at conception is associated with adverse birth outcomes.[27] Contrary to these findings, a study performed by de Lima et al., showed that disease relapse was not associated with adverse birth outcomes in IBD patients.[28] Based on our analysis we suggest that IBD is associated with worse fetal outcomes irrespective of the disease activity status. Corticosteroids are usually prescribed in active disease, in our analysis even after adjusting for long term corticosteroid use, pregnancy outcome remained the same.

Our study has certain limitations, first it is a retrospective study performed using administrative and claims-based datasets, which are susceptible to misclassification, missing codes, and inaccurate coding.

Secondly, our study did not have randomization and blinding which limits the interpretation of results. In addition, NIS does not provide information about all the medications and laboratory values which limits us in analyzing the effect of various medications on patients' outcomes.

Despite these limitations our study has many strengths. To our knowledge this is the most up to date and recent study performed using the US inpatient database to determine the effect of IBD on maternal and fetal outcomes. Around 48 states share their data with NIS which increases the sample size and makes it nationally representative. Moreover, NIS eliminates the commonly encountered limitation of single-center studies by allowing the use of a nationally representative large sample size. The other striking feature of our study is that we adjusted our result for long term inhaled and oral corticosteroid use which is associated with worse maternal and fetal outcomes.

Conclusions:

IBD is an incurable disease, and its relapsing and remitting nature is stressful for the patients. It is a disease mainly seen in young population, majority of whom are diagnosed in their 20's and 30's which coincides with the peak fertility period. Pregnant women with IBD experience worse maternal and fetal outcomes regardless of prolonged corticosteroid use. There are higher odds of gestational DM, hypertensive complications, preterm births, and fetal deaths among IBD patients. Mothers with a history of IBD stay longer in hospitals and utilize more resources after delivery. Women with IBD voluntarily avoid pregnancy due to the fear of complications. We suggest that women who have moderate to severe disease should get pre-conceptional counselling and be treated aggressively to achieve remission prior to getting pregnant. Due to limited knowledge regarding pregnancy outcomes in IBD patients, large multi-center prospective studies are needed to develop a consensus on IBD management and conception guidelines.

Declarations:

Author Contribution: ZT, UF, FK, SS, YG: Concept and design of the study, data collection, data analysis, interpretation of results, writing of manuscript and final revision. GG, UZ, FI, AN interpretation of results and manuscript writing. All authors approved the final version of manuscript.

Data Availability: Study data can be shared on request.

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Ethics approval: This research study was conducted retrospectively from data obtained for clinical purposes. We consulted extensively with the IRB at the University of Missouri School of Medicine who determined that our study did not need ethical approval. An IRB official waiver of ethical approval was granted from the IRB.

Consent to participate: It is a retrospective study and consent is not required.

Consent to publish: It is a retrospective study and consent is not required.

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Figures

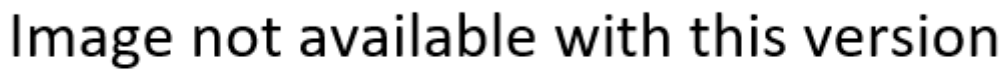

Figure 1

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