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Gastroenterology team members' knowledge and practices with fertility therapy for women with inflammatory bowel disease

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Abstract

Introduction: Fecundity may be reduced in women with active inflammatory bowel disease (IBD) or prior IBD-related surgery, and these women may require assisted reproductive technology (ART). There are no guidelines for women with IBD to outline referral criteria for ART.

Methods: We performed a prospective, multicentre, international questionnaire of gastroenterologists, gastroenterology trainees, and IBD nurses. The primary outcome was to establish clinical practices and fertility therapy referral patterns among gastroenterology team members. We hypothesised that the lack of knowledge and awareness may delay or prevent initiation of fertility consultation referrals.

Discussion: Of 182 participants, most had never initiated a referral for fertility therapy (69.8%), and of respondents who do initiate referrals, 50% wait until the patient has been unsuccessfully attempting conception for 12 months. Participants were significantly more likely to initiate a fertility therapy referral if they believed ART was effective ($p = 0.038$), not impeded by IBD-related surgery ($p = 0.053$), and if they had access to a dedicated IBD-pregnancy clinic ($p = 0.027$). Superior pregnancy knowledge was predictive of a greater likelihood of fertility therapy referrals ($p = 0.037$). All participants thought they had inadequate knowledge about ART in IBD, and 96.2% expressed desire to improve their knowledge.

Conclusion: Gastroenterology team members infrequently initiate referrals for fertility therapy consultation in women with IBD, increasing their risk of remaining childless. Implementation of dedicated IBD pregnancy clinics and targeted education programmes to increase awareness of ART in women with IBD might increase referral rates and reduce infertility.

Keywords: assisted reproductive technology, fertility therapy, *in vitro* fertilisation, infertility, inflammatory bowel disease

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Introduction

Inflammatory bowel disease (IBD) frequently affects women of reproductive age, many of whom desire to bear children. Fecundity (the physiological potential to bear children) may be reduced in women with active IBD or women with prior IBD-related surgery.[1–3] Fertility, or the actual production of offspring, may also be reduced in these subgroups. A recent study identified a 21% reduced live birth rate in women with active IBD compared to women without IBD, while no reduction was seen in women with

quiescent or mild IBD.[4] Deep pelvic surgery including ileal pouch-anal anastomosis (IPAA) can also hinder conception, particularly if performed open rather than laparoscopic, with infertility rates rising from 15–20% to 48–63% after IPAA.[5,6] This can be attributed to reproductive organ damage, scar tissue, adhesions as well as post-operative dyspareunia.[3,7,8] In addition to physiologic factors impacting fecundity, women with IBD also have an increased prevalence of voluntary childlessness, occurring in 13–26% of IBD patients compared to 6% of the general population.[4,9–12] Aside from methotrexate and tofacitinib, IBD medications are generally deemed safe for use in pregnant women, and none have been associated with reduced fecundity in women with IBD.[3,13–15]

Some women who are unable to conceive naturally may require assisted reproductive technology (ART) such as *in vitro* fertilisation (IVF). Although there is some controversy within the literature, current data suggest that the efficacy of ART in women with ulcerative colitis (UC) is comparable to women in the general population (live birth rates 34–48% *versus* 30–50% per cycle of ART); however, it may be slightly reduced in women with Crohn's disease (CD) (30–39%) particularly in those with prior CD-related surgery.[16–21] Younger age remains the most favourable factor predictive of ART success.[22] Women with UC and IPAA are at least three-fold more likely to require IVF compared to women with UC without IPAA, with comparable ART success rates between these groups.[23] There are no data indicating that ART increases the risk of disease flares or matero-foetal complications in women with IBD, or that IBD medications impact ART success.[18–20] There are no approved guidelines to dictate the timing of ART referrals in women with IBD; however, a common approach is to refer after 6 months of failure to conceive in a women aged $\geqslant$35 years or women with prior pelvic surgery, or after 12 months in women aged $<$35 years.[3,24]

There are no guidelines specifically for women with IBD outlining referral criteria for ART, such as patient age and disease characteristics which should prompt a fertility therapy assessment. Consequently, fertility therapy referral practices among gastroenterologists, gastroenterology specialty registrars/fellows, and IBD specialist nurses/nurse practitioners are likely to vary significantly; although this has never been studied. While IBD nurses may be less likely to initiate *referrals* for fertility therapy, we anticipate that they may identifiy the need for such referrals during nurse consultations, which may subsequently be raised with the medical team. We performed a prospective questionnaire-based study of gastroenterology team members to assess their knowledge, beliefs, and practices with fertility therapy referrals in women with IBD. Our primary outcome was to establish clinical practices and fertility therapy referral patterns among gastroenterology healthcare professionals (HCPs) of various levels of training and experience, to identify factors predictive of fertility therapy referrals. We hypothesised that fertility therapy referrals may be delayed or not initiated, due to lack of knowledge and awareness among gastroenterology team members, particularly regarding the efficacy and safety of ART. We also hypothesised that adequate overall IBD pregnancy knowledge may not infer adequate fertility and ART knowledge, which is lacking in gastroenterology training. It is also likely that some IBD patients would receive fertility therapy referrals from other sources, such as general practitioners or obstetricians; however, by targeting gastroenterology team members, we aimed to highlight the importance of managing IBD patients holistically rather than focusing solely on their IBD care.

Materials and methods

We performed a prospective, multicentre, international study of HCPs in the gastroenterology team. This study was completed in accordance with the good practice guidelines for survey-based studies published by Kelley *et al.*[25] The anonymous email and text message-based online survey was distributed by RL, EL, CP, and JL among a subset of gastroenterology HCPs identified from national and regional gastroenterology and IBD networks in the United Kingdom (UK) and Australia. All members of these networks were invited to participate; however, these networks do not contain all gastroenterology HCPs. Invitations were sent a maximum of three times to each potential participant. Participants included IBD specialists as well as general and non-IBD specialist gastroenterologists. Completion of the questionnaire was taken as consent.

The questionnaire was reviewed prior to finalisation by three senior IBD physicians and piloted

by four gastroenterology consultants, four gastroenterology fellows, and two IBD nurses. Feedback from the pilot study prompted some modifications to the final questionnaire which were approved by the ethics committee prior to widespread survey distribution. Survey questions pertained to demographics and characteristics of the participant's clinical practice, frequency of caring for IBD patients and pregnant IBD patients, knowledge and beliefs about the efficacy and safety of ART in people living with IBD, personal practices with ART and fertility therapy referrals, and pregnancy-specific IBD knowledge, assessed by the previously validated Crohn's and Colitis Pregnancy Knowledge score (CCPKnow)[26] (Supplementary 1). We defined ART as including all methods of fertility therapy to circumvent human infertility, inclusive of intrauterine insemination and ovulation induction rather than limited to laboratory manipulation procedures.

Pregnancy-specific IBD knowledge (CCPKnow)

The CCPKnow is a 17-item questionnaire covering seven topic domains which has been validated to assess pregnancy-specific IBD knowledge in patients.[26] Scores range from 0 (*lowest knowledge*) to 17 (*highest knowledge*). Scores $\geqslant$14/17 are deemed to represent 'very good' knowledge, while scores $\leqslant$7 represent 'poor' knowledge.

Statistical analysis

Fertility referral rates were analysed as binary categorical outcomes using the chi-square test with other categorical variables. The CCPKnow, self-rated knowledge, and self-rated comfort scores were analysed as continuous variables, analysed against categorical variables using the Mann–Whitney and Kruskal–Wallis tests. Results were expressed as median scores with interquartile ranges and mean scores with standard deviations. Spearman's correlation was used for non-parametric continuous data. P-values of <0.05 were deemed statistically significant. Statistical analysis was performed with SPSS version 26.0 for Windows.

Ethical considerations

This study was approved by the Macquarie University Ethics Committee (reference number: 52020670919116). This ethics application incorporated all international sites involved in the project.

Results

Overall 182 responses were received (response rate 45.5%), 62.6% from the United Kingdom and 37.4% from Australia (Table 1). One quarter ($n=46$; 25.3%) were gastroenterology consultants, one quarter ($n=46$; 25.3%) gastroenterology registrars, nearly half ($n=82$; 45.1%) were IBD nurses and the remaining eight (4.4%) responders were other healthcare occupations (pharmacists, infusion nurses, and junior medical officers). There was a good variety of duration of clinical practice and average numbers of IBD patients seen per week. Almost all participants (92.3%) reported some experience caring for pregnant women with IBD, with 37.4% seeing these patients regularly (>3/year). A dedicated IBD pregnancy clinic was available to 41.4% of responders; however, only 19.2% of responders were personally involved in this clinic.

Fertility therapy referral practices

The majority of participants ($n=127$; 69.8%) had never previously referred a patient with IBD for fertility therapy consultation (Table 2). Of those who had referred patients in the past ($n=50$; 30.2%), most ($n=25$; 50.0%) waited until 12 months of unsuccessful conception; 15 (30.0%) participants referred after 6 months and 3 (6.0%) referred after 3 months of unsuccessful conception. Seven (14.0%) participants only referred patients for fertility assessment if the patient requested it.

The majority of participants ($n=97$; 53.3%) were uncertain about the efficacy of ART in women with IBD relative to women in the general population (Table 2). Most of the remaining participants ($n=43$; 23.6% of total cohort) thought that ART was equally effective in women with IBD compared to women without IBD. With respect to the effect of IBD-related surgery on the efficacy of ART, most participants were also uncertain about this impact ($n=102$; 56.0%), while the majority of the remaining participants ($n=38$; 20.9% of total cohort) thought that ART would be less effective after surgery for both CD and UC. Nearly half ($n=80$; 44.0%) of participants were uncertain about the safety of ART in women

Table 1. Participant demographics.

Characteristic	Number (%)
Location	
United Kingdom	114 (62.6)
Australia	68 (37.4)
Occupation	
Gastroenterology consultant	46 (25.3)
Gastroenterology registrar/fellow	46 (25.3)
Junior medical officer	6 (3.3)
IBD nurse/nurse practitioner	82 (45.1)
Other (gastroenterology pharmacist and infusion nurse)	2 (1.1)
Duration of clinical practice	
0 (still training)	43 (23.6)
<1 year	11 (6.0)
1–4 years	45 (24.7)
5–9 years	21 (17.0)
10–19 years	36 (19.8)
>20 years	14 (7.7)
Average number of IBD patients seen per week	
<5 patients	41 (22.5)
6–10 patients	30 (16.5)
11–15 patients	26 (14.3)
16–20 patients	24 (13.2)
>20 patients	61 (33.5)
Frequency of care for pregnant women with IBD	
Never	14 (7.7)
Very rarely (<5 patients ever)	48 (26.4)
Occasionally (at least 3 per year)	52 (28.6)
Regularly	68 (37.4)
Availability of specialised IBD pregnancy team	
Not available	106 (58.2)
Available and personally involved in the team	35 (19.2)
Available but not personally involved in the team	41 (22.5)

IBD, inflammatory bowel disease.

with IBD, while 78 (42.9%) participants thought it was equally safe compared to women in the general population. The remaining 24 (13.1%) responders thought ART would increase the risk of materno-foetal adverse events and/or increase the risk of an IBD flare.

Predictors of fertility therapy referral

Patient-related factors responsible for participants to consider fertility therapy referral are displayed in Table 3. The most frequent factors were patient request (69.8%), history of miscarriages (62.6%), prior IBD-related surgery (IPAA surgery: 45.6%; other IBD-related surgery: 40.7%), and age (36.3%). Of the participants for whom patient age was likely to prompt a referral for fertility therapy consultation, the median selected age was 35 (interquartile range (IQR): 30–35) years, with responses ranging from 20–40 years. All but three participants selected a minimum age above which they would consider fertility therapy referral, with the remaining three participants selecting a maximum age of 35 years. Quiescent IBD was more likely to trigger fertility therapy referral (33.0%), while some participants (19.2%) were more likely to initiate a fertility therapy referral in women with active IBD.

HCPs' beliefs about the efficacy of ART in women with IBD were significantly associated with their likelihood of referring patients for fertility therapy assessment. Compared to those who have never referred patients for fertility therapy or only do so upon patient request ($n = 134$; 73.6%), HCPs who do initiate fertility therapy referrals ($n = 43$; 23.6%) were significantly more likely to believe that ART was equally effective in women with IBD compared to women in the general population ($p = 0.038$). They were also significantly more likely to believe that IBD-related surgery does not affect the efficacy of ART ($p = 0.027$). There was a trend towards participants who believed ART to be safe in women with IBD also being more likely to refer for fertility therapy assessment ($p = 0.053$). Other participant factors associated with a significantly greater likelihood of initiating fertility therapy referrals were involvement in a dedicated IBD pregnancy clinic ($p = 0.027$), working in a teaching hospital ($p = 0.015$), and not working in a district hospital ($p = 0.037$). There was no association with participants who worked in private rooms ($p = 0.572$), duration of clinical practice ($p = 0.299$), or a

Table 2. Personal practice and belief regarding fertility therapy and ART in women with IBD.

Question	Number (%)
I usually consider referral for fertility therapy in women with IBD when:	
• 3 months of unsuccessful conception	3 (1.6)
• 6 months of unsuccessful conception	15 (8.2)
• 12 months of unsuccessful conception	25 (13.7)
• Only if the patient suggests it	7 (3.8)
• I have never made a fertility therapy referral	127 (69.8)
I believe the efficacy of ART in women with IBD is:	
• Equal to women without IBD	43 (23.6)
• Less effective for both CD and UC	24 (13.2)
• Less effective for CD only	17 (9.3)
• Less effective for UC only	1 (0.5)
• Unsure	97 (53.3)
I believe the efficacy of ART in women with prior IBD-related surgery is:	
• Equal to women with IBD who have not had IBD-related surgery	9 (4.9)
• Less effective for women with prior CD-related surgery	11 (6.0)
• Less effective for women with prior UC-related surgery (including IPAA)	22 (12.1)
• Less effective for women with prior CD and UC-related surgery	38 (20.9)
• Unsure	102 (56.0)
I believe the safety of ART in women with IBD is:	
• Equal to women without IBD	78 (42.9)
• Increased risk of adverse maternal and/or foetal outcomes	15 (8.2)
• Increased risk of IBD flare	6 (3.3)
• Increased risk of both adverse maternal/foetal outcomes and IBD flare	3 (1.6)
• Unsure	80 (44.0)
I believe my level of knowledge about ART in women with IBD is:	
• I have a low level of knowledge and would be interested to learn more	175 (96.2)
• I have a low level of knowledge but am not interested to learn more	7 (3.8)
• I have adequate knowledge	0 (0)

ART, assisted reproductive technology; CD, Crohn's disease; IBD, inflammatory bowel disease; IPAA, ileal pouch-anal anastomosis; UC, ulcerative colitis.

desire to learn more about ART in IBD ($p = 0.529$). There was no difference in referral rates between respondents from Australia and the United Kingdom ($p = 0.175$). The number of IBD patients seen per week ($p = 0.156$) or the frequency of seeing pregnant women with IBD

Table 3. Patient factors prompting fertility therapy referral.

Factor	Number (%)
Quiescent IBD	60 (33.0)
Active IBD	35 (19.2)
Prior IBD-related surgery (excluding IPAA)	74 (40.7)
Prior IPAA surgery	83 (45.6)
Nulliparity	42 (23.1)
Biological therapy	17 (9.3)
Not taking biological therapy	4 (2.2)
Prior miscarriages	114 (62.6)
Both parents with IBD	24 (13.2)
Patient concern	127 (69.8)
Public patient	1 (0.5)
Private patient	4 (2.2)
Patient age	66 (36.3)

IBD, inflammatory bowel disease; IPAA, ileal pouch-anal anastomosis.

Table 4. Pregnancy-specific IBD knowledge assessments.

Score	Median (IQR)
CCPKnow (0–17)	15.0 (14.0–17.0)
Self-rated knowledge about pregnancy in IBD (0–10)	5.0 (5.0–7.0)
Self-rated comfort managing pregnancy in IBD (0–10)	5.0 (4.0–7.0)

CCPKnow, Crohn's and Colitis Pregnancy Knowledge score; IBD, inflammatory bowel disease; IQR, interquartile range.

($p = 0.823$) also was not associated with likelihood of referring for fertility therapy. Higher CCPKnow score was significantly associated with a greater likelihood of fertility therapy referrals ($p = 0.037$); however, self-rated IBD knowledge and self-rated comfort managing pregnant women with IBD was not.

Pregnancy-specific IBD knowledge

The median CCPKnow score was 15/17 (IQR 14–17), correlating with excellent pregnancy-specific IBD knowledge. However, self-rated pregnancy-specific IBD knowledge was only moderate (median score 5/10; IQR 5–7), as was self-rated comfort managing pregnant women with IBD (median score 5/10; IQR 4–7) (Table 4). All participants thought they lacked adequate knowledge about ART in IBD, and almost all (96.2%) expressed interest in learning more about this (Table 2).

Participants who had been practicing in their specialty for $\geqslant$10 years had significantly higher CCPKnow scores compared to participants practicing for $<$10 years ($p = 0.009$). CCPKnow scores significantly correlated with both self-rated knowledge score (correlation coefficient = 0.379; $p < 0.001$) and self-rated comfort score (correlation coefficient = 0.344; $p < 0.001$). There was a significant positive correlation between self-rated knowledge and self-rated comfort scores (correlation coefficient = 0.947; $p < 0.001$).

Discussion

This is the first study to assess fertility referral patterns among gastroenterology HCPs. We found that initiation of fertility therapy referrals for women with IBD is low among gastroenterology/IBD teams. Less than one quarter of respondents initiated fertility therapy referrals for women with IBD who were failing to conceive naturally. Of those who did initiate referrals, half waited until the patient had been unsuccessfully attempting conception for 12 months. Therefore, over three quarters of women may not be referred for fertility therapy assessment, subsequently increasing their risk of remaining childless. This was largely related to inadequate knowledge and awareness of ART among gastroenterology team members. Data on ART in IBD patients have emerged over the last decade but have often been overlooked in medical education concerning IBD and reproduction.[16–18,20–23,27–29] Respondents who were more optimistic about the efficacy of ART in women with IBD, including in the subgroup with prior IBD-related surgery, were significantly more likely to refer for ART compared to those who thought ART was less effective or were uncertain about its efficacy. Although data are limited, a recent meta-analysis identified ART success rates in women with UC to be comparable to the general population and women with CD to have 33% reduced live birth rates but comparable pregnancy rates.[16–23,27–29] The reduced live birth rates in women with CD was largely contributed to by women with prior CD-related surgery, which was associated

with a 49–71% reduced live birth rate. ART efficacy was not reduced in women with IPAA overall; however, live birth rates were 64% lower in women with a failed IPAA.[16,17,19–23,27–29] We found no difference in fertility therapy referral rates between participants from the United Kingdom and Australia, which may reflect the relatively good access to government-subsidised ART in both jurisdictions.

Access to a dedicated IBD-pregnancy clinic was also predictive of an increased likelihood of fertility therapy referrals, especially if the participant was a member of that team. This may reflect greater awareness about obstetric healthcare, or fewer barriers to referral if established pathways already exist to connect patients with obstetric and fertility specialists. This creates a strong argument for the implementation of dedicated IBD-pregnancy clinics in IBD centres, which deliver pre-conception counselling and holistic healthcare to increase the likelihood of natural conception, improve patient disease knowledge, and optimise materno-foetal pregnancy outcomes.[10,30–32] Participants were more likely to refer for fertility therapy consultation in women with quiescent IBD (33%) than active IBD (19%), indicating an awareness of the strong recommendation for women to have quiescent disease prior to conception to optimise materno-foetal outcomes.[3,4] Furthermore, there was a trend towards a significant correlation between fertility therapy referrals and beliefs about ART safety. Participants who did not think ART would increase the risk of materno-foetal adverse events or IBD flares were more likely to initiate fertility therapy referrals compared to participants who thought it may increase the rate of complications. Although current data are limited, there is no evidence that ART increases the risk of IBD flares, preterm birth, low birth weight, congenital abnormalities, or spontaneous abortions.[18–20] This suggests that greater education of gastroenterology team members about the safety of ART in women with IBD may increase their initiation of fertility therapy referrals.

Pregnancy-specific IBD knowledge among gastroenterology healthcare team members in our study was excellent, with a median CCPKnow score 15/17. Despite this, participants' self-rated knowledge and comfort managing pregnant women with IBD was only moderate (median score 5/10 for both). There was a strong correlation between objective and self-rated scores for both knowledge and comfort, suggesting that they are all reliable measures of these attributes. However, this disparity between objective and self-rated knowledge, together with the high proportion of 'uncertain' responses about the efficacy and safety of ART, suggests that gastroenterology team members lack confidence in their knowledge and abilities for managing obstetric and fertility issues. As the CCPKnow score was validated for patients and measures overall pregnancy-specific IBD knowledge without containing questions explicitly about ART, this finding also reflects an isolated knowledge deficit regarding ART despite adequate overall pregnancy knowledge. This lack of confidence and deficit in specific ART knowledge likely result from insufficient clinical exposure and education during training and contribute to the low initiation of fertility therapy referrals observed in this study.

None of the 182 respondents in our study thought they possessed adequate knowledge about ART in IBD, yet, all but seven expressed interest in furthering their education on this topic. This feeling of inadequate knowledge is reflected in the low self-rated knowledge and confidence scores, and the high rate of 'uncertain' responses to questions about ART and efficacy. Together with the disparity between objective and self-rated pregnancy-specific IBD knowledge, this suggests that it is unlikely that measures to increase overall pregnancy-specific IBD knowledge among gastroenterology team members would be either necessary or effective in increasing fertility therapy referrals. Education programmes aiming to increase fertility and ART knowledge among gastroenterology team members may increase fertility therapy referrals, and this should be assessed in future studies. As fertility therapy becomes more widespread and with the trend towards reproduction at older ages, this is likely to become even more clinically relevant for gastroenterologists to be aware of in the future. Incorporating obstetric and fertility teaching into gastroenterology training programmes and conferences is likely to increase awareness, knowledge, and engagement with fertility services, subsequently reducing infertility in IBD patients.

The main strength of this study is that it is the first population assessment of gastroenterology HCP clinical practices. As a multicentre international study, we were able to include participants from a wide range of clinical settings, of varying levels of training and patient exposure. We

acknowledge some significant limitations in our study. Given the large proportion of participants who responded as 'uncertain' for questions about ART, the strength of the data analysis for the other responses was restricted. In addition, due to the method of survey distribution to groups and individual HCPs, a response rate per HCP profession was unable to be calculated. Current literature on ART in IBD is limited by the paucity of original data, with the few available studies referring to overlapping retrospective datasets.[6–8,18,19,21–23,26,29] Further data are urgently needed to better understand the efficacy and predictors of success of ART in women with IBD, particularly the impact of IBD-related surgery. Further data are also required to assess attitudes of HCPs to fertility preservation in males with IBD, particularly those taking sulfasalazine or methotrexate.

Conclusion

Gastroenterology team members infrequently initiate referrals for fertility therapy consultation in women with IBD, increasing their risk of remaining childless. Implementation of dedicated IBD pregnancy clinics and targeted education programmes to increase awareness of ART in women with IBD among gastroenterology team members might increase referral rates and reduce infertility.

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Author contributions

Robyn Laube: Conceptualisation; Data curation; Formal analysis; Investigation; Methodology; Project administration; Validation; Writing – original draft; Writing – review & editing.

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Conflict of interest statement

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Data availability

The data underlying this article will be shared on reasonable request to the corresponding author.

Supplemental material

Supplemental material for this article is available online.

References

1. Ban L, Tata LJ, Humes DJ, *et al.* Decreased fertility rates in 9639 women diagnosed with inflammatory bowel disease: a United Kingdom population-based cohort study. *Aliment Pharmacol Ther* 2015; 42: 855–866.
2. Druvefors E, Landerholm K, Hammar U, *et al.* Impaired fertility in women with inflammatory bowel disease: a National Cohort Study from Sweden. *J Crohns Colitis* 2021; 15: 383–390.
3. Laube R, Paramsothy S and Leong R. Review of pregnancy in Crohn's disease and ulcerative colitis. *Therap Adv Gastroenterology* 2021; 14: 1–18.
4. Lee HH, Bae JM, Lee BI, *et al.* Pregnancy outcomes in women with inflammatory bowel disease: a 10-year nationwide population-based

cohort study. *Aliment Pharmacol Ther* 2020; 51: 861–869.

5. Rajaratnam SG, Eglinton TW, Hider P, *et al.* Impact of ileal pouch-anal anastomosis on female fertility: meta-analysis and systematic review. *Int J Colorectal Dis* 2011; 26: 1365–1374.
6. Waljee A, Waljee J, Morris AM, *et al.* Threefold increased risk of infertility: a meta-analysis of infertility after ileal pouch anal anastomosis in ulcerative colitis. *Gut* 2006; 55: 1575–1580.
7. Cornish J, Tan E, Teare J, *et al.* A meta-analysis on the influence of inflammatory bowel disease on pregnancy. *Gut* 2007; 56: 830–837.
8. Oresland T, Palmblad S, Ellstrom M, *et al.* Gynaecological and sexual function related to anatomical changes in the female pelvis after restorative proctocolectomy. *Int J Colorectal Dis* 1994; 9: 77–81.
9. Huang V, Chang H, Kroeker K, *et al.* Does the level of reproductive knowledge specific to inflammatory bowel disease predict childlessness among women with inflammatory bowel disease? *Can J Gastroenterol Hepatol* 2015; 29: 95–103.
10. Laube R, Yau Y, Selinger CP, *et al.* Knowledge and attitudes towards pregnancy in females with inflammatory bowel disease – an international, multi-centre study. *J Crohns Colitis* 2020; 14: 1248–1255.
11. Marri SR, Ahn C and Buchman AL. Voluntary childlessness is increased in women with inflammatory bowel disease. *Inflamm Bowel Dis* 2007; 13: 591–599.
12. Selinger CP, Ghorayeb J and Madill A. What factors might drive voluntary childlessness (VC) in women with IBD? Does IBD-specific pregnancy-related knowledge matter? *J Crohns Colitis* 2016; 10: 1151–1158.
13. Gubatan J, Nielsen OH, Levitte S, *et al.* Biologics during pregnancy in women with inflammatory bowel disease and risk of infantile infections: a systematic review and meta-analysis. *Am J Gastroenterol* 2021; 116: 243–253.
14. Laube R, Paramsothy S and Leong RW. Use of medications during pregnancy and breastfeeding for Crohn's disease and ulcerative colitis. *Expert Opin Drug Saf* 2021; 20: 275–292.
15. Nielsen OH, Gubatan JM, Juhl CB, *et al.* Biologics for inflammatory bowel disease and their safety in pregnancy: a systematic review and meta-analysis. *Clin Gastroenterol Hepatol* 2022; 20: 74–87.e3.
16. Friedman S, Larsen PV, Fedder J, *et al.* The reduced chance of a live birth in women with IBD receiving assisted reproduction is due to a failure to achieve a clinical pregnancy. *Gut* 2017; 66: 556–558.
17. Friedman S, Larsen PV, Fedder J, *et al.* The efficacy of assisted reproduction in women with inflammatory bowel disease and the impact of surgery– a nationwide cohort study. *Inflamm Bowel Dis* 2017; 23: 208–217.
18. Hernandez-Nieto C, Sekhon L, Lee J, *et al.* Infertile patients with inflammatory bowel disease have comparable in vitro fertilization clinical outcomes to the general infertile population. *Gynecol Endocrinol* 2020; 36: 554–557.
19. Laube R, Tran Y, Paramsothy S, *et al.* Assisted reproductive technology in Crohn's disease and ulcerative colitis: a systematic review and meta-analysis. *Am J Gastroenterol* 2021; 116: 2334–2344.
20. Norgard BM, Larsen PV, Fedder J, *et al.* Live birth and adverse birth outcomes in women with ulcerative colitis and Crohn's disease receiving assisted reproduction: a 20-year nationwide cohort study. *Gut* 2016; 65: 767–776.
21. Oza SS, Pabby V, Dodge LE, *et al.* In vitro fertilization in women with inflammatory bowel disease is as successful as in women from the general infertility population. *Clin Gastroenterol Hepatol* 2015; 13: 1641–1646.e3.
22. Oza SS, Pabby V, Dodge LE, *et al.* Factors associated with the success of in vitro fertilization in women with inflammatory bowel disease. *Dig Dis Sci* 2016; 61: 2381–2388.
23. Pachler FR, Toft G, Bisgaard T, *et al.* Use and success of in vitro fertilisation following restorative proctocolectomy and ileal pouch-anal anastomosis. a nationwide 17-year cohort study. *J Crohns Colitis* 2019; 13: 1283–1286.
24. Mahadevan U, Robinson C, Bernasko N, *et al.* Inflammatory bowel disease in pregnancy clinical care pathway: a report from the American Gastroenterological Association IBD Parenthood Project Working Group. *Gastroenterology* 2019; 156: 1508–1524.
25. Kelley K, Clark B, Brown V, *et al.* Good practice in the conduct and reporting of survey research. *Int J Qual Health Care* 2003; 15: 261–266.
26. Selinger CP, Eaden J, Selby W, *et al.* Patients' knowledge of pregnancy-related issues in inflammatory bowel disease and validation of a

novel assessment tool ('CCPKnow'). *Aliment Pharmacol Ther* 2012; 36: 57–63.

27. Norgard BM, Larsen MD, Friedman S, *et al*. Corticosteroids prior to embryo transfer in assisted reproduction in women with Crohn's disease and ulcerative colitis – a nationwide cohort study. *Clin Epidemiol* 2020; 12: 317–326.
28. Pabby V, Oza SS, Dodge LE, *et al*. In vitro fertilization is successful in women with ulcerative colitis and ileal pouch anal anastomosis. *Am J Gastroenterol* 2015; 110: 792–797.
29. Pachler FR, Bisgaard T, Mark-Christensen A, *et al*. Impact on fertility after failure of restorative proctocolectomy in men and women with ulcerative colitis: a 17-year cohort study. *Dis Colon Rectum* 2020; 63: 816–822.
30. Bixenstine PJ, Cheng TL, Cheng D, *et al*. Association between preconception counseling and folic acid supplementation before pregnancy and reasons for non-use. *Matern Child Health J* 2015; 19: 1974–1984.
31. de Lima A, Zelinkova Z, Mulders AG, *et al*. Preconception care reduces relapse of inflammatory bowel disease during pregnancy. *Clin Gastroenterol Hepatol* 2016; 14: 1285–1292.e1.
32. van der Woude CJ and Kanis SL. Preconceptional counselling of IBD patients. *J Crohns Colitis* 2016; 10: 871–872.