

Depression in individuals who subsequently develop Inflammatory Bowel Disease: a population-based nested case-control study

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36 The POP-IBD study group is a collaboration between St George's, University of London,
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38 population based studies in the field of Inflammatory Bowel Disease. JB, SS, RP, CA, IP & MH
39 conceived and designed this study. JB prepared the data and carried out statistical analysis

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1 overseen by HC, IP and AB. JB and SS contributed equally to this project and are joint first
2 authors. All authors contributed to the development of the analysis, interpreting data and
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8 Psychological Stress, depression, antidepressants

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10

1 **Abstract**

2 **Objective**

3 Depression is a potential risk factor for developing inflammatory bowel disease (IBD). This
4 association may be related to gastrointestinal (GI) symptoms occurring before diagnosis. We
5 aimed to determine whether depression, adjusted for pre-existing GI symptoms, is associated
6 with subsequent IBD.

7 **Design**

8 We conducted a nested case-control study using the Clinical Practice Research Datalink
9 identifying incident cases of ulcerative colitis (UC) and Crohn's Disease (CD) from 1998-2016.
10 Controls without IBD were matched for age and sex. We measured exposure to prevalent
11 depression 4.5-5.5 years before IBD diagnosis. We created 2 sub-groups with prevalent
12 depression based on whether individuals had reported GI symptoms before the onset of
13 depression. We used conditional logistic regression to derive odds ratios for the risk of IBD
14 depending on depression status.

15 **Results**

16 We identified 10,829 UC cases, 4,531 CD cases and 15,360 controls.

17 There was an excess of prevalent depression five years before IBD diagnosis relative to
18 controls (UC: 3.7% vs 2.7%, CD 3.7% vs 2.9%).

19 Individuals with GI symptoms prior to the diagnosis of depression had increased adjusted risks
20 of developing UC and CD compared to those without depression (UC: OR 1.47, 95% CI 1.21-
21 1.79, CD: OR 1.41, 95% CI 1.04-1.92). Individuals with depression alone had similar risks of UC
22 and CD to those without depression (UC: OR 1.13, 95% CI 0.99-1.29, CD: OR 1.12, 95% CI 0.91-
23 1.38).

24 **Conclusions**

25 Depression, in the absence of prior GI symptoms, is not associated with subsequent
26 development of IBD. However, depression with GI symptoms should prompt investigation for
27 IBD.

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1 **Summary Box**

2

3 **What is already known about this subject?**

4 Depression has been associated with a two-fold risk of developing inflammatory bowel diseases
5 (IBD). However, Individuals often experience gastrointestinal (GI) symptoms for many years before
6 receiving a diagnosis of IBD. It is unclear whether the apparent association between prior depression
7 and subsequent IBD potentially represents reverse causation, where undiagnosed symptoms of IBD
8 result in depression.

9 **What are the new findings?**

10 Individuals with IBD have a higher prevalence of depression than matched controls as early as nine
11 years before diagnosis. Depression in the absence of prior GI symptoms, is not associated with a future
12 diagnosis of either UC or CD. However, those with depression diagnosed after already experiencing GI
13 symptoms are at increased risk of later being diagnosed with UC and CD. The excess prevalence of
14 depression prior to a diagnosis of IBD may be a consequence of diagnostic delay and untreated GI
15 symptoms.

16 **How might it impact on clinical practice in the foreseeable future?**

17 Depression in combination with persistent GI symptoms may represent undiagnosed IBD. NICE and
18 BSG guidelines recommend the use of the faecal calprotectin test, a non-invasive biomarker of
19 gastrointestinal inflammation, to evaluate such patients in primary care to determine whether
20 onward specialist referral is appropriate.

1 Introduction

2

3 Patients with Inflammatory Bowel Diseases (IBD), comprising Crohn's Disease (CD) and ulcerative
4 colitis (UC), are more likely to be diagnosed with depression in the years following diagnosis.¹⁻³ Studies
5 of the association between IBD and depression show a bi-directional relationship.^{4,5} This has led to a
6 hypothesis that depression is a risk factor for developing IBD and that treating it may reduce this risk.^{6,7}
7 Possible biological mechanisms for this are that persistent stress manifesting as depression drives a
8 neuro-enteric pathway through chronic activation of the hypothalamic-pituitary-adrenal axis inducing
9 systemic pro-inflammatory cytokines, which has been demonstrated in experimental models.⁸⁻¹¹

10 The lifetime risk of depression amongst individuals with IBD is twice that of matched controls.¹²
11 Similarly, in the opposite direction, there is a two-fold risk of IBD developing amongst people with
12 depression.⁷ The time between onset of gastrointestinal (GI) symptoms and diagnosis of IBD is
13 frequently prolonged.¹³ These symptoms, often characterised by pain and changes of bowel habit,
14 may cause distress and, potentially, depression. Furthermore, immune-dysregulation and the
15 inflammatory burden of IBD may be associated with the onset of depression, which can occur in a
16 range of immune-mediated inflammatory diseases.^{2,14,15} This indicates the apparent association
17 between prior depression and subsequent IBD potentially represents reverse causation, whereby
18 symptoms of IBD result in depression rather than the other way around.¹⁶ Previous studies have not
19 accounted for the ordering of such 'prodromal' GI symptoms, common in the years leading up to the
20 diagnosis of IBD, in relation to the emergence of depression.^{7,16,17} Thus, it remains uncertain whether
21 the higher rates of depression prior to IBD diagnosis reflect the effect of symptoms of undiagnosed
22 IBD.

23 Using a nationally representative population-based nested case-control study design we aimed to
24 test the hypothesis that the diagnosis of depression is associated with subsequent onset of IBD after
25 accounting for prior GI symptoms.

1 **Methods**

2

3 **Data source and Ethical approval**

4 We identified cases and controls from a previously defined population-based incident cohort using
5 the Clinical Practice Research Datalink (CPRD), one of the largest validated primary care research
6 databases in the world. It contains longitudinal, patient-level, anonymised electronic health records
7 of 18 million patients from more than 700 general practices and is broadly representative of the United
8 Kingdom (UK) population.¹⁸ Primary care physicians use Read codes to record symptoms, diagnoses
9 and prescriptions. Data are audited to ensure accuracy and completeness. The database has been
10 extensively validated and used for research of long term conditions including IBD and depression.^{19–24}
11 We obtained ethical and scientific approval for our study from the Independent Scientific Advisory
12 Committee (ISAC Protocol number: 15_018R).

13 **Study Part 1: Depression before the diagnosis of IBD**

14 We conducted a case-control study to determine the prevalence of depression in the 10 years
15 before the diagnosis of IBD compared to individuals without IBD.

16 **Incident case definition**

17 We defined incident IBD cases as individuals with a first ever diagnosis Read code for either CD or UC
18 at least one year after registering with an 'Up To Standard' practice for the period January 1st 1998 to
19 May 1st 2016 using a published and validated methodology by Lewis et al.¹⁹ We excluded individuals
20 if they had records indicating both CD and UC, or indeterminate codes. Cases contributed time to the
21 study from their date of registration on the database until the date of their IBD diagnosis, which was
22 used as their index date.

23 **Control Groups**

24 Each case of CD and UC was individually matched on age and sex to four controls without a recorded
25 diagnosis of either CD or UC at any stage of their follow-up. After stratification by age and sex, the
26 members of the control groups were selected at random. By definition, members of the control groups

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1 had no date for a diagnosis of IBD so each was assigned the IBD diagnosis date of their matched IBD
2 case as their index date.²⁵

3 **Statistical Analysis**

4 Baseline characteristics of the cases and controls were summarised using frequencies and
5 percentages. We determined the prevalence of depression in the year of IBD diagnosis and each of
6 the ten years before it. Individuals were included in the denominator for each year examined,
7 provided their follow-back covered that entire year. We defined prevalent depression as any individual
8 with a code for a diagnosis or symptoms of depression in that year, or a prescription for antidepressant
9 medication in that year and a previous code for depression in their clinical record. We estimated the
10 risk differences (95% CI) of prevalent depression between cases and controls (i.e. the absolute
11 difference in the prevalence of depression between these two groups).

12 **Study Part 2: Prior depression and the risk of IBD**

13

14 We conducted a nested case-control study to determine the risk of IBD based on exposure to
15 depression 4.5-5.5 years before the index date.

16 **Selection of cases and controls**

17

18 We identified all cases and controls from part 1 of the study that were registered in CPRD for a
19 minimum of 5.5 years before their index date. Cases were matched to one control of the same age
20 and sex. Where there was more than one potential match the control was selected at random. Cases
21 who could not be matched to a control with follow-up covering the 5.5 years before their index date
22 were excluded from the study (Appendix A – Selection of cases and controls).

23 **Exposure to Depression**

24 We defined exposure to depression as prevalent depression five years (4.5-5.5 years, Appendix B)
25 prior to the index date. We defined prevalent depression as any individual with a code for a diagnosis
26 or symptoms of depression in that year, or a prescription for antidepressant medication in that year

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1 and a previous code for depression in their clinical record (Appendix C – code list).^{22,26} An initial analysis
2 revealed amitriptyline was used at a dose of 30mg or less per day in a large majority, below the dose
3 recommended for the treatment of depression, we therefore excluded tricyclic antidepressants from
4 the analysis.²⁷ We included codes for depressive symptoms, as well as diagnostic codes for depression,
5 since this has been shown to improve accuracy of depression estimation compared with the use of
6 diagnostic depression codes alone and accounts for a shift in temporal trends in coding for
7 depression.^{28,29}

8 Since some individuals report GI symptoms many years before IBD is diagnosed,¹³ some cases of
9 depression could develop after the onset of IBD-associated GI symptoms, but before their diagnosis.¹⁶
10 We therefore created 2 sub-groups among individuals with prevalent depression: i) those who had
11 already reported GI symptoms before the onset of their depression and ii) those who had not. We
12 defined individuals as having reported GI symptoms before the onset of their depression if they had
13 codes for relevant GI symptoms: abdominal pain, diarrhoea and per rectal bleeding (Appendix D), at
14 any time before their first code for depression or antidepressant medication prescription.

15 Covariates

16 We adjusted for the covariates of smoking and socio-economic status. Smoking status has been linked
17 to both depression and also the risk of developing IBD.^{30,31} We defined individuals as 'smokers', 'ex-
18 smokers' or 'non-smokers' based on codes for smoking status in the five years before the end of the
19 exposure period (4.5 to 9.5 years before the index date). Individuals whose most recent code indicated
20 active smoking were classed as 'smokers' and those with codes indicating previous but not current
21 smoking were classed as 'ex-smokers'. Individuals who had only 'non-smoker' codes were classified
22 as 'non-smokers'. Individuals without data on smoking have been shown to likely be either never-
23 smokers or non-recent smokers and were therefore classed as 'non-smokers'.³² We used the Index of
24 Multiple Deprivation (IMD), a postcode-linked measure of socio-economic deprivation, to assign
25 individuals to 1 of 5 groups using IMD quintiles, from IMD group 1 (least deprived) to 5 (most
26 deprived).

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1 **Statistical Analysis**

2 We used conditional logistic regression to calculate odds ratios (OR) and 95% confidence intervals for
3 the risk of CD and UC according to depression status. All models were conditional on matching of age
4 and sex.

5 We assigned patients with depression 4.5-5.5 years before the index date to 2 sub-groups, i) those
6 who had already reported GI symptoms before the onset of their depression and ii) those who had
7 not.

8 Model 1: We calculated the risk of CD and UC in the two sub-groups relative to individuals without
9 depression.

10 Model 2: We calculated the risk of CD and UC in the two sub-groups described above relative to
11 individuals without depression, adjusting for smoking and socio-economic status. In a sensitivity
12 analysis we replicated model 2 but altered the exposure period for depression to between two and
13 four years prior to the index date.

14 Model 3: Since coding for depression and depressive symptoms may underestimate the prevalence of
15 depression, and a tenth of our study sample were prescribed antidepressant medication without a
16 code for depression (Figure 1), we conducted a further analysis, adjusting for smoking and socio-
17 economic status but applying a broader definition of prevalent depression. In this model individuals
18 with antidepressant medication prescriptions but no code for depression or depressive symptoms
19 were also categorised as having prevalent depression.

20 All analyses were performed using STATA 16 (Statacorp LP, USA).

21

1 Results

2

3 Between 1st January 1998 and 1st May 2016, we identified 5,874 incident cases of CD, 13,681 incident
4 cases of UC and two control groups of 23,496 and 54,724 individuals without IBD respectively. Median
5 follow-back before the diagnosis date was 7.4 years.

6 Depression before the diagnosis of IBD – Study Part 1

7

8 The prevalence of depression in cases who developed UC and CD was similar to that of the control
9 groups 10 years before diagnosis (cases vs. controls UC: 1.7% vs. 1.5%, CD: 1.7% vs. 1.6%).

10 However, as early as nine years before diagnosis, UC cases had a higher prevalence of depression
11 compared with the control group, increasing to 5.9% of UC cases vs. 4.7% of controls in the year before
12 diagnosis (Risk difference: 1.2%, 95% CI 0.7%-1.7%). In CD, a similar divergence was seen from seven
13 years before diagnosis, eventually increasing to 6.1% of CD cases having prevalent depression
14 compared with 4.5% of controls in the year before diagnosis (Risk difference: 1.6%, 95% CI 0.8%-2.3%,
15 see Figure 2 and Appendix E).

16 Prior depression and the risk of ulcerative colitis and Crohn's Disease – Study Part 2

17

18 We identified 10,829 cases of UC and 4531 cases of CD with follow-up covering the exposure period 5
19 years (4.5 – 5.5 years) before their diagnosis date and matched 1:1 to controls without IBD. Cases of
20 UC and CD were more likely to have prevalent depression during the exposure period than their
21 respective control groups (Table 1).

22 Model 1: Relative to those without depression, individuals with depression alone had an increased
23 risk of developing UC (OR 1.25, 95%CI 1.03-1.52). We found a similar pattern for CD (OR 1.21, 95%CI
24 0.90-1.63). The risk estimates were higher for those with depression and previous GI symptoms (UC:
25 OR 1.58, 95%CI 1.24-2.02; CD: OR 1.36, 95%CI 0.94-1.99, Appendix F).

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1 Model 2: After additionally adjusting for smoking status and socio-economic status, individuals with
2 depression alone had a similar risk of developing UC and CD relative to those without depression (UC:
3 OR 1.21, 95% CI 0.99-1.47, CD: OR 1.05, 95% CI 0.78-1.42). The risk estimates were higher for those
4 with depression and previous GI symptoms (UC: OR 1.52, 95% CI 1.19-1.94, CD: OR 1.21, 95% CI 0.82-
5 1.77, Table 2).

6 A sensitivity analysis replicated model 2 but changed the exposure period for depression to between
7 two and four years prior to the index date. Individuals with depression alone had an increased risk of
8 developing UC but not CD relative to those without depression (UC: OR 1.23, 95% CI 1.05-1.45, CD: OR
9 1.08, 95% CI 0.84-1.39). Individuals with depression and previous GI symptoms had higher risk
10 estimates for developing UC and CD (UC: OR 1.29, 95% CI 1.08-1.53, CD: OR 1.29, 95% CI 0.98-1.71).

11 Model 3: Using a broader definition of prevalent depression to account for under reporting in primary
12 care we found, after adjustment for all covariates, individuals with depression alone without prior GI
13 symptoms, had a similar risk of UC and CD compared with individuals without depression (UC: OR
14 1.13, 95% CI 0.99-1.29, CD: OR 1.12, 95% CI 0.91-1.38). Individuals with depression and previous GI
15 symptoms were at increased risk of both UC and CD compared with those who were not depressed
16 (UC: OR 1.47, 95% CI 1.21-1.79, CD: OR 1.41, 95% CI 1.04-1.92, Table 2).

17 Discussion

18

19 Main findings

20

21 We found individuals with UC and CD had a higher prevalence of depression than their matched
22 control groups in the years prior to IBD diagnosis. Depression rates diverged, as early as nine years
23 before diagnosis, with the largest excess in the year before diagnosis. After adjusting for relevant
24 covariates, individuals diagnosed with depression after already experiencing GI symptoms were at
25 increased risk of later being diagnosed with UC and CD. However, depression alone was not associated
26 with a future diagnosis of either UC or CD.

1 Findings in relation to previous studies

2 We found individuals with IBD had an excess of prevalent depression five years before diagnosis
3 relative to controls. This supports a recent study, using the Danish national registries, which
4 demonstrated mood disorders as a whole, including depression and bipolar affective disorder, were
5 associated with subsequent diagnoses of IBD.³³

6 However, after accounting for GI symptoms that pre-dated the onset of depression we found that
7 depression alone was not associated with developing UC or CD. Our findings differ from two previous
8 studies that attempted to account for diagnostic delay of IBD.^{34,35} Ananthakrishnan et al. (2013) found
9 women with depressive symptoms were more likely to develop CD (HR 2.36, 1.40-3.99) but not UC
10 (HR 1.14, 0.68-1.92).³⁵ Frolkis et al. (2018) found individuals with depression were at increased risk of
11 developing both CD (HR=2.11; 95% CI 1.65 to 2.70) and UC (HR 2.23, 95% CI 1.92 to 2.60).³⁴ However,
12 neither study was able to determine whether GI symptoms were already present before the onset of
13 depression. This may have confounded their results as one in ten individuals with IBD present to their
14 doctor with GI symptoms 5 years before diagnosis and these symptoms could lead to depression.³⁶

15 The importance of determining the temporality between the onset of depression and GI symptoms in
16 establishing the associated risk of premorbid depression on subsequently developing IBD has been
17 highlighted.¹⁶ To address this issue, we identified all individuals with depression 4.5-5.5 years before
18 the index date who had previously visited their primary care physician for GI symptoms before the
19 onset of their depression. We found these individuals were at increased risk of later being diagnosed
20 with UC and CD but not those who had depression alone. We found similar results when a broader
21 definition of depression was used to account for under-reporting of depression in primary care. We
22 also carried out a sensitivity analysis using an exposure period closer to the index date, two to four
23 years before IBD diagnosis, which indicated no increased risk in CD amongst individuals with
24 depression alone and a small increase in the risk of UC. This contrasts with the findings of

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1 Ananthakrishnan et al. (2013) who found an increased risk in CD but not UC using a similar time frame,
2 though the reason for this difference is unclear.³⁵

3 Both depression and IBD often have a gradual and subtle onset making it difficult to determine which
4 condition developed first. This may mean that, therefore, previously described associations between
5 depression and subsequent IBD may, at least in part, be the consequence of reverse causation with
6 undiagnosed GI symptoms of IBD resulting in depression.

7 **Strengths and Limitations**

8 To our knowledge this is the first population-based study to examine the association of premorbid
9 depression with the later development of IBD while also accounting for pre-existing GI symptoms.

10 Data were drawn from a large nationally representative validated research database, free of referral
11 centre bias. Data were recorded at the time of consultation and are therefore not subject to recall
12 bias.

13 In common with all observational studies using routinely collected data, inaccuracies in coding and
14 completeness may occur. Previous studies suggest up to 50% of depression is not detected in primary
15 care.³⁷ This may explain why the prevalence of depression in our study population was lower than in
16 national surveys, however most missed cases of depression are mild.^{24,38} As with previous studies, we
17 were unable to determine the severity of depression using a standardised psychiatric tool since these
18 are not routinely used by UK primary care health professionals.^{34,39} While our findings suggest
19 depression, in the absence of GI symptoms, is not associated with subsequent development of IBD,
20 formal testing of directionality and causality between depression and IBD was not possible in this
21 study. We acknowledge GI symptoms are not specific to IBD and may have been due to other
22 conditions. We adjusted for socio-economic status, using the index of multiple deprivation data from
23 2015, this is a cross-sectional marker of socio-economic status which we acknowledge is dynamic and
24 may have changed during our study period. Finally, given cases were not matched to controls from
25 the same primary care practice it is possible different practice patterns may have affected our results.

1 **Implications**

2 Our findings suggest depression, in the absence of GI symptoms, is not associated with the subsequent
3 development of either UC or CD. However, our findings of an excess of depression in the years before
4 IBD diagnosis support a holistic approach when individuals present with GI symptoms, including
5 screening for depression.

6 We found individuals who experienced GI symptoms before the recorded onset of depression were at
7 an increased risk of eventually receiving a diagnosis of IBD. This suggests depression may arise
8 secondary to GI symptoms experienced during the period prior to the diagnosis of IBD. Our findings
9 may relate to diagnostic delay in IBD and further research is needed to ascertain the burden of such
10 delays and their relationship with other co-morbidities including poor mental health.

11 **Conclusions**

12 Individuals with UC and CD have a higher prevalence of depression than matched control groups in
13 the years prior to IBD diagnosis. Depression rates diverge, as early as nine years before diagnosis, with
14 the largest excess in the year before diagnosis. Depression, in the absence of prior GI symptoms, is
15 not associated with subsequent development of IBD. However, depression with GI symptoms should
16 prompt investigation for IBD.

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1 **Table 1: Baseline characteristics of cases and controls in study part 2**

IBD Status	Crohn's Disease	Control Group (CD)	Ulcerative Colitis	Control Group (UC)
n=	4,531	4,531	10,829	10,829
Demographics				
Male (%)	2,137 (47)	2,137 (47)	5,832 (54)	5,832 (54)
Age at diagnosis (%)				
<17	406 (8)	406 (8)	266 (2)	266 (2)
17-39	1,640 (36)	1,640 (36)	2,812 (26)	2,812 (26)
>39	2,485 (55)	2,485 (55)	7,751 (72)	7,751 (72)
Social deprivation (%)				
IMD 1-3	1,632 (36)	1,674 (37)	4,428 (41)	4,135 (38)
IMD 4-5	957 (21)	871 (19)	1,868 (17)	2,071 (19)
Unknown	1,942 (43)	1,986 (44)	4,533 (42)	4,623 (43)
Smoking Status (%)				
Non Smoker	3,413 (75)	3,769 (83)	8,063 (74)	8,581 (79)
Smoker	644 (14)	440 (10)	1,142 (11)	1,073 (10)
Ex-Smoker	474 (10)	322 (7)	1,624 (15)	1,175 (11)
Depression Status (%)				
No Depression	4,365 (96)	4,399 (97)	10,431 (96)	10,533 (97)
Depression Alone	101 (2.2)	84 (1.9)	230 (2.1)	188 (1.7)
Depression & GI symptoms	65 (1.4)	48 (1.1)	168 (1.6)	108 (1.0)

2 **Smoking and depression status refer to the period 5 years before the index date**

3 **IMD** – Index of Multiple Deprivation. IMD 1 represents the least deprived and IMD 5 the most deprived. Index of multiple
4 deprivation data are available only in England.

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1 **Table 2: Risk of Crohn's Disease and ulcerative colitis by depression status**

2

Conditional Logistic Regression	Crohn's Disease				Ulcerative colitis			
	Model 2 n=9,062		Model 3 n=9,062		Model 2 n=21,658		Model 3 n=21,658	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Depression Status								
No Depression	1	-	1	-	1	-	1	-
Depression Alone	1.05	0.78-1.42	1.12	0.91-1.38	1.21	0.99-1.47	1.13	0.99-1.29
Depression with previous GI symptoms	1.21	0.82-1.77	1.41	1.04-1.92	1.52	1.19-1.94	1.47	1.21-1.79
Smoking Status								
Non-Smoker	1	-	1	-	1	-	1	-
Smoker	1.67	1.46-1.91	1.65	1.44-1.89	1.13	1.04-1.24	1.14	1.04-1.25
Ex-Smoker	1.69	1.44-1.97	1.68	1.44-1.96	1.48	1.36-1.61	1.49	1.37-1.61
Social deprivation (%)								
IMD 1-3	1	-	1	-	1	-	1	-
IMD 4-5	1.08	0.96-1.21	1.08	0.96-1.21	0.83	0.77-0.90	0.83	0.77-0.90
Unknown	1.03	0.90-1.08	0.99	0.90-1.09	0.91	0.86-0.97	0.91	0.86-0.97

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4

5 **Cases and controls were matched by age and sex and therefore conditional logistic regression was used.**

6 **Statistically significant results highlighted in bold.**

7

8 **Model 2** - We calculated the risk of CD or UC adjusting for all variables in the table conditional on matching for age and sex.

9 **Model 3** - We calculated the risk of CD or UC adjusting for all variables in the table conditional on matching for age and sex. In this model individuals with antidepressant medication prescriptions but no code for depression or depressive symptoms were also categorised as having prevalent depression.

10 **No Depression** - No depression in the exposure period

11 **Depression Alone** - Prevalent depression in the exposure period but no gastrointestinal symptoms preceding the onset of depression

12 **Depression with previous GI symptoms** – Prevalent depression in the exposure period with gastrointestinal symptoms preceding the onset of depression

13 **IMD** – Index of Multiple Deprivation, 1 represents the least deprived and 5 represents the most deprived.

14 Index of multiple deprivation data are only available in England.

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