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Prevalence of, and Risk Factors for, Chronic Idiopathic Constipation in the Community: Systematic Review and Meta-analysis

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OBJECTIVES: **Chronic idiopathic constipation (CIC) is a common functional gastrointestinal disorder in the community, yet no previous systematic review and meta-analysis has estimated the global prevalence, or potential risk factors for the condition.**

METHODS: **MEDLINE, EMBASE, and EMBASE Classic were searched (up to December 2010) to identify population-based studies reporting the prevalence of CIC in adults (≥15 years), according to self-report, questionnaire, or specific symptom-based criteria. The prevalence of CIC was extracted for all studies, and according to country, age, gender, socioeconomic status, and presence or absence of irritable bowel syndrome (IBS) where reported. Pooled prevalence overall, and according to study location and certain other characteristics, as well as odds ratios (ORs), with 95% confidence intervals (CIs) were calculated.**

RESULTS: **Of the 100 papers evaluated, 45 reported the prevalence of CIC in 41 separate study populations, containing 261,040 subjects. Pooled prevalence of CIC in all studies was 14% (95% CI: 12–17%). The prevalence of CIC was lower in South East Asian studies, and in studies using the Rome II or III criteria. The prevalence of CIC was higher in women (OR: 2.22; 95% CI: 1.87–2.62), and increased with age and lower socioeconomic status. The prevalence was markedly higher in subjects who also reported IBS (OR: 7.98; 95% CI: 4.58–13.92), suggesting common pathogenic mechanisms.**

CONCLUSIONS: **Pooled prevalence of CIC in the community was 14%, and of similar magnitude in most geographical regions. Rates were higher in women, older individuals, and those of lower socioeconomic status. Presence of IBS was strongly associated with CIC.**

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INTRODUCTION

Constipation is characterized by the difficult or infrequent passage of stool, often accompanied by straining or a sensation of incomplete evacuation. It is a common complaint in the general population, and contributes considerably to physician visits and other costs to the health service (1). Chronic idiopathic constipation (CIC) is a functional gastrointestinal disorder (FGID), and although its symptoms are similar to the above definition, there is usually no demonstrable underlying physiological abnormality (2). It is thought to be more common in women, elderly people, and those of lower socioeconomic status (3,4), and sufferers report a degree of impairment in health-related quality of life that is comparable with that for some chronic organic conditions (5).

The prevalence of constipation has been reported in numerous population-based cross-sectional surveys (3,6,7), and the implicit assumption in studies such as these is that, as organic disease in the community is rare, the majority of individuals reporting symptoms compatible with constipation will have CIC. Many of these community surveys have used either self-report of symptoms or a questionnaire to diagnose the disorder. However, studies conducted over the last decade have increasingly used one of the three iterations of the Rome criteria (2,8,9), which were developed initially to aid recruitment of homogenous groups of patients into clinical trials, with the diagnosis of the various FGIDs reached via symptom-based criteria.

Another FGID with some symptoms that are common to CIC is constipation-predominant irritable bowel syndrome (IBS).

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Each of these is a distinct condition according to the Rome criteria (2), with the presence of either abdominal pain or discomfort, which are required to meet diagnostic criteria for IBS, used as the main features to distinguish between the two. Recently, however, there has been some evidence to suggest a degree of overlap between the two conditions, and a lack of stability in either diagnosis during follow-up, suggesting that IBS and CIC are not entirely separate conditions (10).

Despite a growing number of cross-sectional surveys examining the prevalence of CIC, some of which have been conducted across several countries worldwide (11,12), the prevalence of CIC according to geographical location has not been well studied to date. Nor has any single study synthesized all the available evidence to examine potential risk factors for CIC, or the degree of overlap between CIC and IBS. We have therefore conducted a systematic review and meta-analysis of the prevalence of CIC in the community to examine these issues.

METHODS

Search strategy and study selection

A search of the medical literature was conducted using MEDLINE (1950 to December 2010), EMBASE, and EMBASE Classic (1947 to December 2010) to identify population-based cohort studies, case–control studies, cross-sectional surveys, or randomized controlled trials that reported the prevalence of CIC in adults aged 15 years or over. Studies conducted among convenience samples, such as university students or hospital employees, were not eligible for inclusion. The diagnosis of CIC could be on the basis of symptoms self-reported by the individual, defined according to a questionnaire, based on the Rome I, II, or III criteria (2,8,9), or according to a physician's diagnosis. Studies were only eligible for inclusion if they contained ≥50 individuals. Detailed eligibility criteria for study inclusion, which were defined prospectively, are provided in **Box 1**.

Studies on CIC were identified using the search terms: *constipation* or *gastrointestinal transit* (both as medical subject headings (MeSH) and as free text terms), as well as *functional constipation*, *chronic constipation*, or *idiopathic constipation* as free text terms. These were combined with the set operator AND with studies identified with the search term *prevalence* as both a MeSH and free text term. There were no language restrictions. All abstracts identified by the search were evaluated for appropriateness to the study question, and all potentially relevant papers were obtained and assessed in detail. A recursive search of the literature was conducted using the bibliographies of all eligible studies. Foreign language papers were translated where required. Studies were assessed independently by two investigators, using pre-designed eligibility forms, according to the eligibility criteria. All disagreements were resolved by consensus.

Data extraction

Data were extracted independently by two investigators onto a Microsoft Excel spreadsheet (XP professional edition; Microsoft, Redmond, WA), with discrepancies resolved by consensus. The following data were collected for each study: type of study, year(s) conducted, country and geographical region, method of data collection (postal questionnaire, interview-administered questionnaire, face-to-face interview, telephone interview), criteria used to define CIC, symptom duration used to define the presence of CIC, total number of subjects recruited, and number of subjects with CIC. We also extracted the number of subjects with CIC according to age group, gender, socioeconomic status, and IBS symptom status, in order to examine any effect of these factors on the prevalence of CIC.

Data synthesis and statistical analysis

The proportion of individuals with CIC in each study was combined to give a pooled prevalence of CIC for all studies. Heterogeneity between studies was assessed using the I^2 statistic with a cutoff of 50% (13), and the χ^2 test with a P value <0.10, used to define a statistically significant degree of heterogeneity. We planned to conduct sensitivity analyses according to geographical region, criteria used to define the presence of CIC, study publication year, validation status of the questionnaire (where used), symptom duration used to define the presence of CIC, age, gender, and IBS symptom status to examine whether this had any effect on the pooled prevalence of CIC. The prevalence of CIC was also compared according to age group, gender, socioeconomic status, and IBS symptom status using an odds ratio (OR), with a 95% confidence interval (CI).

Data were pooled using a random effects model (14), to give a more conservative estimate of the prevalence of CIC and the odds of CIC in these various groups. StatsDirect version 2.7.2 (StatsDirect, Sale, Cheshire, UK) was used to generate Forest plots of pooled prevalences and pooled ORs with 95% CIs. We planned to assess for the evidence of publication bias by applying Egger's test to funnel plots of ORs (15).

Box 1. Eligibility criteria

- Cohort studies, case–control studies, cross-sectional surveys, or randomized controlled trials
- Recruited adults (>90% of participants aged ≥15 years)
- Participants recruited from the general population/community (convenience samples excluded)
- Reported prevalence of chronic idiopathic constipation (according to self-report, questionnaire data, specific diagnostic criteria (Rome I, II, or III criteria), or a physician's opinion)
- Sample size of ≥50 participants

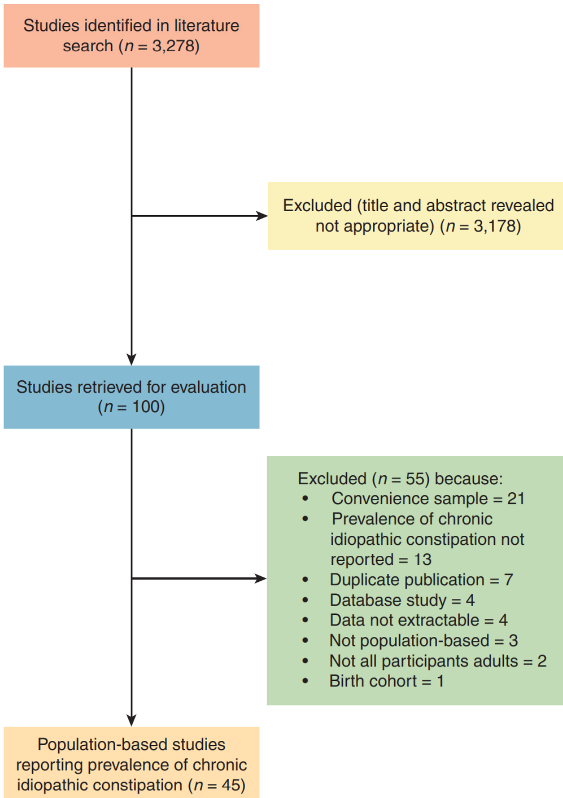

Figure 1. Flow diagram of assessment of studies identified in the systematic review and meta-analysis.

RESULTS

The search strategy identified 3,278 citations (**Figure 1**). From these we identified 100 papers that appeared to be relevant to the study question. Of these, 45 studies reported the prevalence of CIC in 41 separate adult study populations (3,6,7,11,12,16–55). Agreement between investigators for assessment of study eligibility was excellent (κ statistic = 0.88). Detailed characteristics of all included studies are provided in **Table 1**.

Most studies were cross-sectional surveys, but two were case–control studies conducted among diabetic patients and non-diabetic controls from the general population (33,41). For the purposes of the present analysis, only data for the non-diabetic controls were extracted from these two studies. Three of the studies were multi-national surveys (11,12,25), and two of these also provided data according to each individual country studied (11,12). The pooled prevalence of CIC in all 41 studies containing 261,040 participants, using the primary definition for CIC in each study, was 14.0% (95% CI: 12.0–17.0%), with statistically significant heterogeneity between studies ($I^2 = 99.7\%$, $P < 0.001$).

Global prevalence of CIC

The majority of studies were conducted in North America or Northern Europe. There were no identified studies conducted in South Asia, Africa, or Central America, and only a few studies from South America and the Middle East (11,12,18,40,44). The pooled prevalence of CIC according to geographical location of the study is provided in **Table 2**. There was statistically significant heterogeneity between studies in all of these analyses, but the prevalence was remarkably similar in all of the regions studied, with the lowest prevalence occurring in South East Asia (11.0%) and the highest in South America (18.0%). The prevalence according to individual country studied is shown in **Figure 2**.

Prevalence of CIC according to criteria used to define its presence

The majority of studies used a questionnaire to define the presence of CIC. Eleven studies used the Rome II criteria (18–20,23,26,28,32,34,35,37,43), 10 used self-report of symptoms (7,28–30,37,42–45,51), six used the Rome I criteria (3,7,24,28,38,43), and only two used the Rome III criteria (42,44). The pooled prevalence of CIC according to the various criteria used to define its presence is provided in **Table 3**. The prevalence of CIC was similar with all definitions, with the exception of when the Rome II or III criteria were used to define its presence, with a prevalence of 11.0 and 6.8%, respectively.

Prevalence of CIC according to study year

Of the identified and eligible studies, seven were conducted between 1981 and 1990 (3,6,16,29,30,33,50), 16 between 1991 and 2000 (17,20,22,24,25,27,28,31,36,38,40,43,45–48), and 18 between 2001 and 2010 (11,12,18,21,23,26,32,34,35,37,39,41,42,44,49,51,52,54). The prevalence of CIC was generally lower in studies conducted between 1981 and 1990 (11.0%), compared with those conducted from 1991 to 2000, and from 2001 to 2010 (15.0%) (**Table 3**).

Prevalence of CIC according to questionnaire validation status

Of the 41 studies, 40 used a questionnaire to capture CIC symptom data, and 27 of these used a validated instrument (3,6,16–18,20–27,31,32,34–37,39,42–44,46,47,49,50). The prevalence of CIC was almost identical in studies that used a validated, compared with a non-validated questionnaire (**Table 3**).

Prevalence of CIC according to duration of symptoms

Twenty-six studies reported the duration of symptoms required to meet diagnostic criteria for CIC, with eight using 3 months (3,16,17,20,21,25,37,45), 16 using 12 months (7,11,12,23,28,29,31,32,35,36,38,46–48,52,54), and two using both 3 and 12 months (42,43). The prevalence of CIC was only slightly higher, 15.0 vs. 13.0%, in studies that used 12 months compared with those that used 3 months (**Table 3**).

Prevalence of CIC according to age

There were 12 studies reporting the prevalence of CIC according to age, which provided extractable data (3,11,12,16,17,21,23,28,29,32,42,43). However, due to different age bands used to report the prevalence of CIC, data available for pooling were limited. Three studies used identical age bands to report prevalence (11,12,42), and these studies were therefore pooled accordingly.

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Table 1. Characteristics of included studies

Study	Country	Method of data collection	Criteria used to define CIC	Sample size	Number with CIC (%)
Talley *et al.* (6)	USA	Postal questionnaire[a]	Questionnaire-defined	835	140 (16.8)
Talley *et al.* (7)			Self-reported	690	86 (12.5)
			Rome I	690	126 (18.3)
Jones and Lydeard (36)	UK	Postal questionnaire[a]	Questionnaire-defined	1,620	333 (20.6)
Walker *et al.* (50)	USA	Interview-administered questionnaire[a]	Questionnaire-defined	18,571	1,794 (9.7)
Drossman *et al.* (3)	USA	Postal questionnaire[a]	Rome I	5,430	197 (3.6)
Heaton *et al.* (30)	UK	Interview-administered questionnaire	Self-reported	1,892	452 (23.9)
Janatuinen *et al.* (33)	Finland	Postal questionnaire	Questionnaire-defined	588	107 (18.2)
Agreus *et al.* (16)	Sweden	Postal questionnaire[a]	Questionnaire-defined	1,156	92 (8.0)
Talley *et al.* (46)	Australia	Postal questionnaire[a]	Questionnaire-defined	99	23 (23.2)
Harari *et al.* (29)	USA	Interview-administered questionnaire	Self-reported	42,375	1,433 (3.4)
Frexinos *et al.* (27)	France	Postal questionnaire[a]	Questionnaire-defined	4,817	1,686 (35.0)
Ho *et al.* (31)	Singapore	Interview-administered questionnaire[a]	Questionnaire-defined	696	29 (4.2)
Talley *et al.* (47)	Australia	Postal questionnaire[a]	Questionnaire-defined	726	103 (14.2)
Enck *et al.* (25)	Multi-national	Interview-administered questionnaire[a]/ telephone interview	Questionnaire-defined	5,581	564 (10.1)
Stewart *et al.* (45)	USA	Telephone interview	Self-reported	10,018	1,466 (14.6)
Chen *et al.* (22)	Singapore	Interview-administered questionnaire[a]	Questionnaire-defined	271	16 (5.9)
Choo *et al.* (24)	South Korea	Interview-administered questionnaire[a]	Rome I	420	102 (24.3)
Koloski *et al.* (38)	Australia	Postal questionnaire	Rome I	2,910	227 (7.8)
Koloski *et al.* (53)					
Boyce *et al.* (19)			Rome II	762	22 (2.9)
Bytzer *et al.* (20); Bytzer *et al.* (55)	Australia	Postal questionnaire[a]	Rome II	8,608	313 (3.6)
Fang *et al.* (26)	China	Self-administered questionnaire[a]	Rome II	1,952	73 (3.7)
Pare *et al.* (43)	Canada	Postal questionnaire[a]	Self-reported	1,149	312 (27.2)
			Rome I	1,149	192 (16.7)
			Rome II	1,149	171 (14.9)
Tangen Haug *et al.* (48)	Norway	Postal questionnaire	Questionnaire-defined	60,998	2,248 (3.7)
Walter *et al.* (51)	Sweden	Postal questionnaire	Self-reported	1,610	232 (14.4)
Cheng *et al.* (23)	Hong Kong	Telephone interview with questionnaire[a]	Rome II	3,282	458 (14.0)
Mjornheim *et al.* (41)	Sweden	Postal questionnaire	Questionnaire-defined	242	76 (31.4)
Garrigues *et al.* (28)	Spain	Postal questionnaire	Self-reported	349	103 (29.5)
			Rome I	349	67 (19.2)
			Rome II	349	49 (14.0)
Wang *et al.* (52)	China	Interview-administered questionnaire	Questionnaire-defined	2,532	292 (11.5)
Locke *et al.* (39)	USA	Postal questionnaire[a]	Questionnaire-defined	643	109 (17.0)
Aro *et al.* (17)	Sweden	Self-administered questionnaire[a]	Questionnaire-defined	1,001	239 (23.9)
Howell *et al.* (32)	Australia	Postal questionnaire[a]	Rome II	1,673	514 (30.7)
Jun *et al.* (37)	South Korea	Interview-administered questionnaire[a]	Self-reported	1,029	170 (16.5)
			Rome II	1,029	95 (9.2)
Mendoza-Sassi *et al.* (40)	Brazil	Interview-administered questionnaire	Questionnaire-defined	1,259	268 (21.3)

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Table 1. Continued

Study	Country	Method of data collection	Criteria used to define CIC	Sample size	Number with CIC (%)
Siproudhis *et al.* (54)	France	Postal questionnaire	Questionnaire-defined	7,196	1,611 (22.4)
Chang *et al.* (21)	USA	Postal questionnaire[a]	Questionnaire-defined	523	93 (17.8)
Johanson *et al.* (35)	USA	Self-administered questionnaire[a]	Rome II	24,090	4,680 (19.4)
Basaranoglu *et al.* (18)	Turkey	Interview-administered questionnaire[a]	Rome II	707	173 (24.5)
Jeong *et al.* (34)	South Korea	Interview-administered questionnaire[a]	Rome II	1,417	37 (2.6)
van Kerkhoven *et al.* (49)	Holland	Postal questionnaire[a]	Questionnaire-defined	1,616	230 (14.2)
Wald *et al.* (11)	Multi-national	Interview-administered questionnaire/ telephone interview	Questionnaire-defined	13,879	1,712 (12.3)
Papatheoridis *et al.* (42)	Greece	Self-administered questionnaire[a]	Self-reported	1,000	140 (14.0)
			Rome III	1,000	132 (13.2)
Sorouri *et al.* (44)	Iran	Interview-administered questionnaire[a]	Self-reported	18,180	1,145 (6.3)
			Rome III	18,180	445 (2.4)
Wald *et al.* (12)	Multi-national	Interview-administered questionnaire/ telephone interview	Questionnaire-defined	8,100	1,293 (16.0)

CIC, chronic idiopathic constipation.
[a]Validated questionnaire.

The prevalence of constipation increased modestly with increasing age in these three studies (**Table 4**).

We also dichotomized the reported age groups for all studies. Five studies provided data according to age <45 years, or ≥45 years (3,11,12,32,42). The prevalence of CIC in those aged ≥45 years was not significantly higher than in those aged <45 years (OR: 1.10; 95% CI: 0.93–1.29), with significant heterogeneity between studies (I^2=74.6%, *P*=0.003), but no evidence of funnel plot asymmetry (Egger test, *P*=0.59). Seven studies provided data according to an age threshold of ≥50 years compared with <50 years (16,17,21,23,28,29,43). Again, there was no significant difference detected between the prevalence of CIC in those aged ≥50 years compared with those aged <50 years (OR: 1.16; 95% CI: 0.87–1.54), with significant heterogeneity between studies (I^2=87.6%, *P*<0.001), and evidence of funnel plot asymmetry or other small study effects (Egger test, *P*=0.03).

Prevalence of CIC according to gender

There were 26 studies that reported the prevalence of CIC according to the gender of participants (3,11,12,16–19,21–24,28–34,37,42–45,47,49,51). Overall, the pooled prevalence of CIC was higher in women compared with men (17.4% (95% CI: 13.4–21.8%) vs. 9.2% (95% CI: 6.5–12.2%)). The OR for CIC in women was 2.22 (95% CI: 1.87–2.62) (**Figure 3**), with significant heterogeneity between studies (I^2=90.4%, *P*<0.001), but no evidence of funnel plot asymmetry (Egger test, *P*=0.83).

Prevalence of CIC according to socioeconomic status

There were six studies reporting the prevalence of constipation according to socioeconomic status (11,12,23,32,43,55). When data from these studies were pooled, there was a modest increase in the prevalence of CIC in those of lower socioeconomic status, compared with those of higher socioeconomic status, but no difference between those of medium socioeconomic status and those of higher socioeconomic status (**Table 5**).

Prevalence of CIC according to IBS symptom status

There were five studies that collected data on both IBS and CIC and that reported the prevalence of CIC according to the IBS symptom status of participants (6,36,39,44,53). Two studies used the Manning criteria to define IBS (6,36), two the Rome I criteria (39,53), and one the Rome II criteria (44). Overall, the pooled prevalence of CIC was higher in individuals with IBS (44.0%; 95% CI: 36.0–53.0%) compared with those without (9.0%; 95% CI: 7.0–12.0%). The OR for CIC in those with IBS was 7.98 (95% CI: 4.58–13.92) (**Figure 4**), with significant heterogeneity between studies (I^2=92.2%, *P*<0.001), but no evidence of funnel plot asymmetry (Egger test, *P*=0.95).

DISCUSSION

This is the first systematic review and meta-analysis of studies, to our knowledge, examining the global prevalence of CIC, risk factors for CIC, and relationship between CIC and IBS in the community. We have demonstrated a pooled prevalence of CIC across all included studies of 14%. The pooled prevalence of CIC was remarkably stable according to geographical location, though was slightly lower in South East Asian studies, and generally higher in South American studies. There were a paucity of data from the Middle East, Africa, and Central America. Similar pooled

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Table 2. Pooled prevalence of CIC according to geographical location

	Number of studies	Number of subjects	Pooled prevalence	95% Confidence interval	I^2 (%)	*P* value for I^2
All studies	*41*	*261,040*	*14.0*	*12.0–17.0*	*99.7*	*<0.001*
North American studies	10	105,634	14.0	9.0–20.0	99.8	<0.001
North European studies	14	88,615	16.0	10.0–24.0	99.8	<0.001
South European studies	3	3,349	16.0	7.0–27.0	98.1	<0.001
Middle Eastern studies	2	18,887	14.0	2.0–36.0	N/A	N/A
South East Asian studies	11	17,699	11.0	7.0–15.0	98.3	<0.001
South American studies	4	7,259	18.0	15.0–22.0	94.1	<0.001
Australasian studies	5	14,016	14.0	5.0–27.0	99.6	<0.001
Multinational studies	3	27,560	13.0	10.0–16.0	98.2	<0.001

CIC, chronic idiopathic constipation.
N/A, not applicable, too few studies to assess heterogeneity.

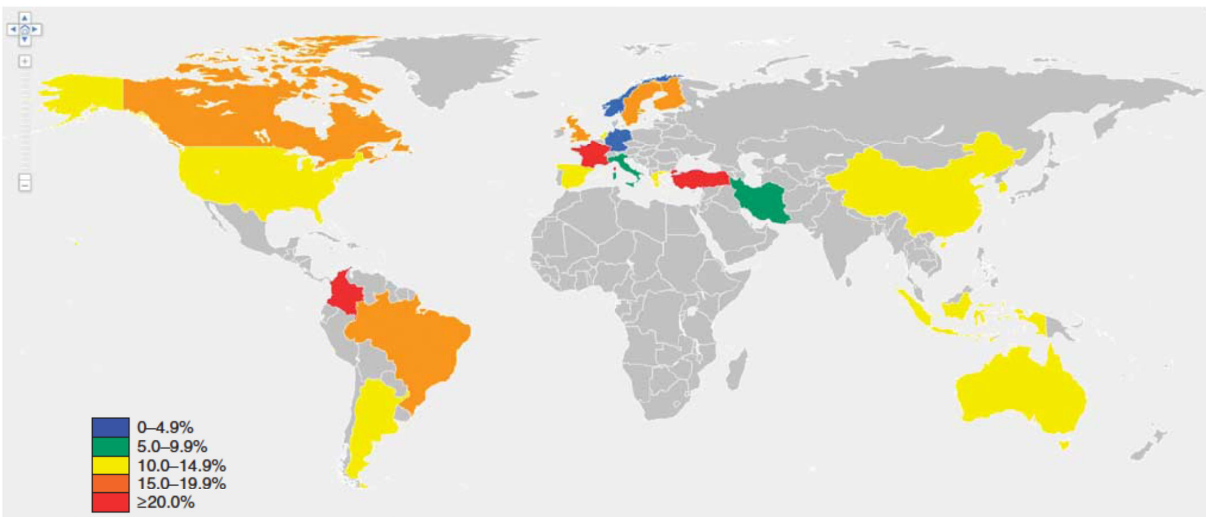

Figure 2. Prevalence of chronic idiopathic constipation according to country.

prevalence rates were also found according to definition of CIC, with the exception of the Rome III criteria, for which the prevalence was lower at around 7%. This lower prevalence with Rome III was driven by one study (44), which reported a prevalence of only 2.4%, compared with 13.2% in the other study that used these criteria (42). Studies performed in the 1980s demonstrated a slightly lower pooled prevalence of CIC, but duration of symptoms and validation status of the questionnaire used appeared to have little impact on pooled prevalence of CIC in our analyses. Data for pooled prevalence of CIC according to age, gender, and socioeconomic status support previous assertions that the condition is commoner in females, older individuals, and those of lower socioeconomic status, although ORs were only modestly increased in these groups. Finally, and most strikingly, the odds of CIC in those with IBS were almost eightfold greater than that of individuals without IBS.

This study was strengthened by our rigorous methodology. The literature search, judging of study eligibility, and data extraction were carried out by two investigators independently, with discrepancies resolved by consensus. Foreign language papers were translated where required. Use of a random effects model to pool data provided a more conservative estimate of prevalence of CIC, and publication bias was assessed using funnel plots. We were careful to include only population-based studies conducted with participants recruited from the community, who were therefore representative of the general population in each study country, in order not to inflate the pooled prevalence of CIC. This was done to ensure that the results are generalizable to the general population.

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Table 3. Pooled prevalence of CIC according to criteria used to define its presence, study year, validation status of questionnaire, and duration of symptoms

	Number of studies	Number of subjects	Pooled prevalence	95% Confidence interval	I^2 (%)	*P* value for I^2
All studies	*41*	*261,040*	*14.0*	*12.0–17.0*	*99.7*	*<0.001*
Criteria used to define CIC						
Questionnaire-defined	22	132,949	15.0	11.0–20.0	99.7	<0.001
Rome II	11	45,018	11.0	6.0–18.0	99.6	<0.001
Self-reported	10	78,292	15.0	10.0–21.0	99.7	<0.001
Rome I	6	10,948	14.0	18.0–22.0	98.9	<0.001
Rome III	2	19,180	6.8	0.3–20.9	N/A	N/A
Study year						
1981–1990	7	70,847	11.0	6.0–16.0	99.7	<0.001
1991–2000	16	100,522	15.0	10.0–22.0	99.8	<0.001
2001–2010	18	89,671	15.0	12.0–19.0	99.5	<0.001
Validation status of questionnaire						
Validated	27	107,092	14.0	11.0–18.0	99.6	<0.001
Not validated	13	143,930	15.0	11.0–20.0	99.8	<0.001
Duration of symptoms						
3 months	10	35,495	13.0	8.0–18.0	99.4	<0.001
12 months	18	173,364	15.0	11.0–20.0	99.8	<0.001

CIC, chronic idiopathic constipation.
N/A, not applicable, too few studies to assess heterogeneity.

Table 4. Pooled prevalence of CIC according to age

Age band	Number of subjects	Pooled prevalence of CIC (95% confidence interval)	Odds ratio for CIC (95% confidence interval)
<29 years	7,153	12.0 (10.0–14.0)	1.0
30–44 years	7,092	15.0 (12.0–19.0)	1.20 (1.09–1.33)
45–59 years	5,314	16.0 (11.0–21.0)	1.31 (1.09–1.58)
≥60 years	3,443	17.0 (13.0–22.0)	1.41 (1.17–1.70)

CIC, chronic idiopathic constipation.

Limitations of this study arise from the available studies and the reporting of data within them. When calculating pooled prevalence, there was a notable absence of studies conducted in certain geographical regions making it difficult to accurately estimate true global prevalence. There was also considerable heterogeneity across all the analyses we conducted, which our pre-specified sensitivity analyses did not reveal any clear explanation for. The reasons for this, therefore, remain speculative, but may relate to individual inconsistencies and variations in the definition of constipation used in studies that defined CIC according to either self-report or on the basis of questionnaire data, differences in demographic characteristics of recruited individuals, or cultural differences.

There have been two previous systematic reviews of the epidemiology of constipation conducted (56,57). The earlier of these restricted its focus to population-based studies conducted in North America, and only included 10 English language publications (56). The authors reported prevalence rates between 2 and 27%, with an average of 14.8%, and a higher prevalence with self-reported symptoms than with either the Rome I or II criteria. They also reported a higher prevalence in females (median female-to-male ratio of 2.2:1) and those of lower socioeconomic status, while data according to age were conflicting across the various studies they identified. The second systematic review, conducted in 2008, included epidemiological studies conducted in Europe and Oceania (57). However, the authors employed less stringent inclusion criteria, accommodating convenience samples in their review. They reported a mean prevalence of constipation in all studies of 22%, while the mean prevalence in Europe was 17%, and that in Oceania was 15% and, as with our study, there was a female preponderance of symptoms. Other potential risk factors were not analyzed systematically by the authors.

While relatively few of the studies identified in our literature search collected data on prevalence of CIC according to IBS symptom status, the five studies that did report these data showed a marked increase in prevalence of CIC in those with IBS compared with those without (6,36,39,44,53). The issue of overlap between constipation-predominant IBS and CIC has been examined in

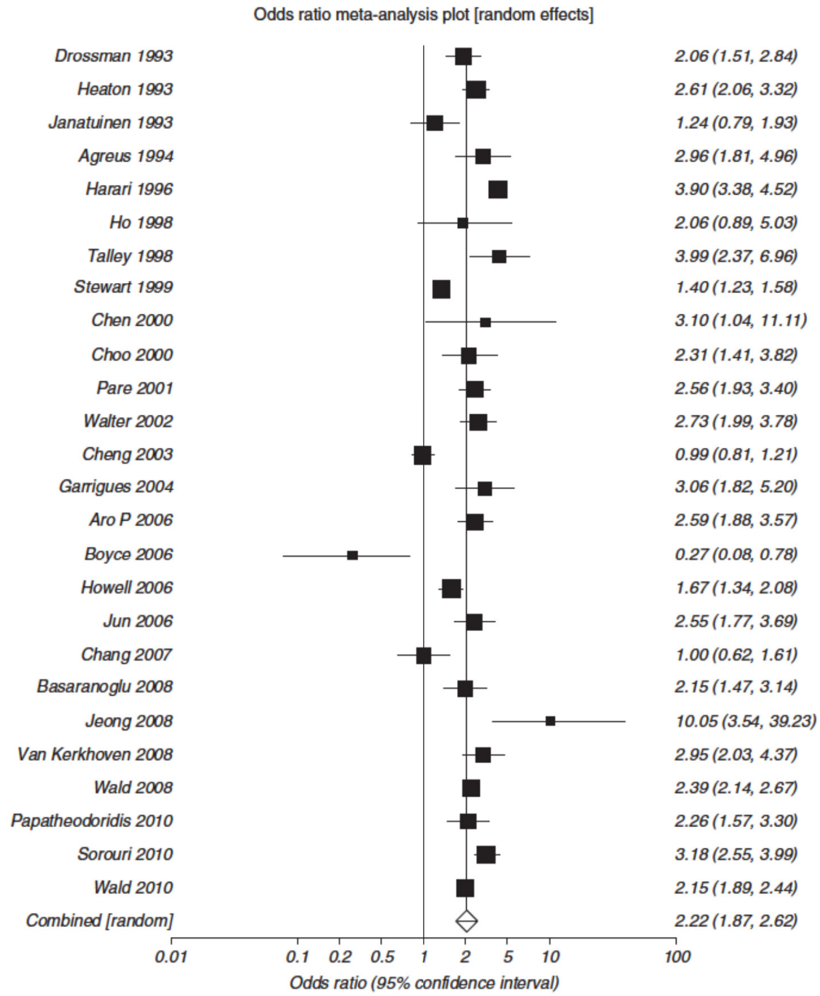

Figure 3. Pooled odds ratio for chronic idiopathic constipation in women compared with men.

Table 5. Pooled prevalence of CIC according to socioeconomic status

Socio-economic status	Number of subjects	Pooled prevalence of CIC (95% confidence interval)	Odds ratio for CIC (95% confidence interval)
High	8,054	14.0 (8.0–22.0)	1.0
Medium	14,515	15.0 (8.0–23.0)	1.01 (0.92–1.10)
Low	10,719	18.0 (12.0–25.0)	1.32 (1.11–1.57)

CIC, chronic idiopathic constipation.

detail recently, in a study that evaluated the ability of the Rome II criteria to distinguish between the two disorders (10). The authors suspended the mutual exclusivity of the two sets of diagnostic criteria, and reported that this led to significant overlap between them, implying that constipation-predominant IBS and CIC may be different subgroups within the same disorder. Our data support this theory, as do the fact that newer therapies that are effective for the treatment of CIC, such as lubiprostone and linaclotide (58–60), also appear to be of benefit in constipation-predominant IBS (61,62).

The findings of this study have implications for both future research and clinical practice. The prevalence of constipation in certain geographical regions, such as Africa, should be studied to enable the global prevalence of CIC to be calculated with greater precision. Population-based studies using the Rome III criteria to define CIC remain scarce. Extracting and analyzing study data on the prevalence of CIC has emphasized the magnitude of this disorder within the community, and thus the implications for health services worldwide. Health-seeking behavior in those affected results in 2.5 million health visits per year in North

REVIEW

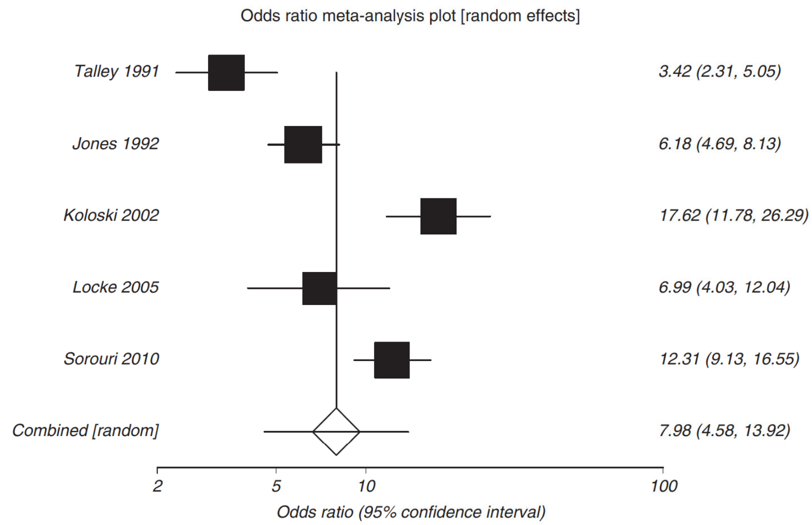

Figure 4. Pooled odds ratio for chronic idiopathic constipation in individuals with irritable bowel syndrome compared with those without.

America alone, with a third of these in primary care, leading to significant costs to the health service (63).

Although an association between IBS and CIC has been suggested, the reasons for this are not fully understood. Continued research in this area should focus on longer follow-up and reassessment of participants to support the data from Wong *et al.* (10) that sufferers of the two disorders may undergo 'switching' of symptoms some months after initial diagnosis. The higher rates of constipation in those with IBS compared with those without, and variations in prevalence depending on definitions used, highlight the need for consistent, and perhaps more accurate, diagnostic criteria. The Rome criteria for functional bowel disorders have been reached through a consensual process, with the third iteration published in 2006 (2). Despite their laudable aims, and the fact that they are accepted as the current gold standard for the diagnosis of the various FGIDs, these criteria have never been subjected to rigorous validation studies, and this issue needs to be addressed in order to assess their true accuracy. In addition, physicians should recognize the potential for overlap between IBS and CIC, and consider the implications of this in their management, particularly where therapies fail.

In conclusion, this systematic review and meta-analysis has demonstrated a global prevalence of CIC of 14%. Rates were higher according to self-report or questionnaire compared with more objective measures, such as the Rome II or III criteria. The condition was commoner in women, older individuals, and those of lower socioeconomic status. Finally, there was a significantly higher prevalence of CIC individuals with IBS, once again calling into question potentially artificial divisions between the FGIDs.

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CONFLICT OF INTEREST

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