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A 30-year Trend Analysis in the Epidemiology of Inflammatory Bowel Disease in the Songpa-Kangdong District of Seoul, Korea in 1986–2015

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Abstract

Background and Aims: Although the incidence of inflammatory bowel disease [IBD] is increasing in Asia, data on long-term epidemiological trends are limited. We performed a 30-year longitudinal study to investigate temporal trends in the epidemiology of Crohn's disease [CD] and ulcerative colitis [UC] in Seoul, Korea.

Methods: This population-based study included 1431 IBD patients [418 CD, 1013 UC] diagnosed between 1986 and 2015 in the Songpa-Kangdong district of Seoul, Korea. Temporal trends in incidence, prevalence, and disease phenotype at diagnosis were analysed.

Results: The adjusted mean annual incidence rates of CD and UC per 100 000 inhabitants increased from 0.06 (95% confidence interval [CI], 0.05–0.07) and 0.29 [95% CI, 0.27–0.31], respectively, in 1986–1990 to 2.44 [95% CI, 2.38–2.50] and 5.82 [95% CI, 5.73–5.92], respectively, in 2011–2015. Average annual percentage change in IBD incidence was 12.3% in 1986–1995, 12.3% in 1996–2005, and 3.3% in 2006–2015. The male-to-female ratio of the adjusted incidence rate was 3.3:1 for CD and

1.2:1 for UC. Perianal fistula/abscess was present in 43.3% of patients before or at CD diagnosis. At diagnosis, 54.3% of UC patients presented only with proctitis. The adjusted prevalence rate in 2015 was 31.59/100 000 [95% CI, 31.10–32.07] for CD and 76.66/100 000 [95% CI, 75.91–77.42] for UC. **Conclusions:** The incidence and prevalence of IBD in Korea have continued to increase over the past three decades. Korean patients have distinct demographic and phenotypic characteristics, including a male predominance and high frequency of perianal fistula/abscess in CD and high proportion of proctitis in UC.

Key Words: SK-IBD Study; Crohn's disease; ulcerative colitis; incidence; prevalence

1. Introduction

Crohn's disease [CD] and ulcerative colitis [UC] are two subtypes of inflammatory bowel disease [IBD], which has been known as a chronic relapsing condition causing significant morbidity and disability.[1] Because the aetiology of IBD is unknown, it is important to understand the epidemiology and natural history of IBD to elucidate the genetic and environmental aetiological factors involved in this incurable disease.[2] In the 20th century, the incidence of IBD increased mainly in Western regions, including North America, Europe, Australia, and New Zealand;[3] this trend was followed in newly industrialised regions including Asia, Central America, and South America in the 21st century.[4,5]

We previously published two population-based studies using a well-defined population-based cohort in the Songpa-Kangdong district of Seoul, Korea which demonstrated that the incidence of IBD in Korea rapidly increased from 1986 to 2005.[6,7] During this 20-year period, the age- and sex-adjusted annual incidence of CD and UC increased progressively from 0/100 000 and 0.22/100 000 inhabitants, respectively, in 1986, to 1.68/100 000 and 3.62/100 000, respectively, in 2005.[3,6,7] Recently, however, several longitudinal analyses of population-based cohorts in Western countries suggest that incidence of IBD has reached a plateau or even decreased in the late 20th–early 21st century, although the data are controversial.[8–10] In addition, recent Korean reports from a nationwide health insurance database suggest that the incidence of IBD has plateaued in Korea since 2006.[11,12] However, further studies are needed, because there is little convincing evidence the incidence of IBD has stabilised—especially in previously low-incidence regions such as Asia, where the incidence of IBD is rapidly increasing. In addition, we could not adequately analyse the temporal trends of disease phenotype of IBD in our previous reports due to the relatively short study period.

Therefore, we performed a 30-year longitudinal population-based study in the Songpa-Kangdong district of Seoul, Korea, to investigate the incidence trends of IBD and to evaluate the temporal trends of disease phenotype. Having a better understanding of IBD epidemiology in newly developed regions in Asia and how trends compare with those of Western countries may provide insight into aetiological factors in IBD.

2. Materials and Methods

2.1 Study area and population

The Songpa-Kangdong IBD [SK-IBD] study was performed in the Songpa-Kangdong district, a well-defined administrative region in Seoul, South Korea, from the 1986 [year of first IBD diagnosis] to 2015. During this 30-year period, the population in this region was ethnically homogeneous [predominantly Korean] and increased gradually in number, from 936 097 in habitants in 1986 to 1 118 960 in 2015. Information was obtained on this population grouped by age and sex from the National Statistical Office, which provided mid-year estimates of the resident population for each year.[13] All inhabitants were covered medically by a unified public insurance system, with easy accessibility to medical care at any time. As we previously reported, the health care system of Korea differs from that of North America in that every hospital has an outpatient clinic, and patients can visit the outpatient clinics of tertiary referral centres without referral by their primary physicians. This study was approved by the Institutional Review Board [IRB] at Asan Medical Center. The IRBs of all involved hospitals also approved this study.

2.2 Case identification and ascertainment

A prospective registry for all IBD patients was set up on January 1, 1997 in the Songpa-Kangdong district. Cases detected before 1997 were collected retrospectively and cases diagnosed since January 1, 1997, were enrolled prospectively, as described in our previous studies.[6,7] To recruit all patients with IBD in the study area, we used the sources described before.[7] First, the major source of study patients was the Asan Medical Center, which is located in the study area and is a major referral centre in Korea. Second, all other hospitals and clinics in the study area which had facilities for diagnosing or managing IBD patients participated in this study. These included two referral centres, four local hospitals, and two private clinics. Third, to catch any possible IBD patients who were referred to hospitals that were located outside the study area, four referral centres and two colorectal-anal specialty hospitals situated around the study area were invited to participate in the study. In addition, to exclude the possibility that there were any IBD patients who were not managed by our study group, a questionnaire was sent to all general and private practitioners in the study area, asking them to identify patients with IBD in their daily practice. If collected data were insufficient, they were contacted by telephone to clarify their response to this survey. Based on this process, we confirmed that there was no established IBD patient in their care, and that any patient with a clinical suspicion of IBD was referred to the investigators of this study group for definite diagnosis and management. During the study period, investigators have met regularly every year to review data and discuss patient recruitment. In addition, a central coordinator regularly visited hospitals involved in this study to check the quality of data.

All cases recruited from each source were carefully reviewed by two authors [SKY and BDY]. If the records were incomplete, the patient was interviewed by phone. After this process of patient identification, only definite cases of IBD were included in the study. The diagnostic criteria of CD and UC in this study were based on the conventional clinical, radiological, endoscopic, and histopathological criteria, as described previously.[7,14,15]

2.3 Clinical information

Using the unified case report forms, we collected data including age at diagnosis, sex, disease location and behaviour at diagnosis, interval from onset of symptoms to diagnosis, smoking history at diagnosis, and family history of IBD. Disease phenotype at diagnosis was categorised by age, disease location, and disease behaviour [for CD], according to the Montreal classification.[16] The disease location of CD was classified as ileum [L1], colon [L2], and ileocolon [L3]. We also collected data regarding the upper gastrointestinal disease modifier [L4]. The disease behaviour of CD was classified as inflammatory [B1], stricturing [B2], and penetrating [B3]. The presence of perianal disease modifier at diagnosis was also noted. The disease extent of UC was classified as ulcerative proctitis [E1], left-sided UC [E2], and extensive UC [E3].

2.4 Statistical analysis

The annual incidence of IBD, defined as the number of newly diagnosed cases per 100 000 inhabitants per year, was calculated for each year using the exact population of this area for that year. We used the year of diagnosis for the incidence of IBD, rather than the year of symptom onset. To measure the trend transition over 30 years, the average annual percentage changes were estimated as a weighted average of the annual percentage changes from the joinpoint model.[17–19] Prevalence was defined as the total number of patients with IBD living in the study area per 100 000 inhabitants as of December 31, 2015. The incidence and prevalence were directly standardised to the 2015 Korean population using 5-year age groups, and 95% confidence intervals [CIs] were estimated by assuming a Poisson distribution of cases. To evaluate the temporal trends in the incidence, age at diagnosis, interval from symptom to diagnosis, and proportion of disease location/extent, the study period was divided into six 5-year periods. The Poisson regression analysis with the robust variance estimator, the Mann-Whitney U test, the Kruskal-Wallis test, the chi square test, or Fisher's exact test were used as appropriate for the comparison of the above parameters. All statistical analyses were performed using SAS software [version 9.4, SAS Institute, Inc., Cary, NC, USA].

3. Results

3.1 General data

During the 1986–2015 period, a total of 1431 IBD patients were diagnosed: 418 with CD [318 men and 100 women] and 1013 with UC [543 men and 470 women]. The major source of patient recruitment was Asan Medical center [69.4% of CD patients and 51.2% of UC patients]. In addition, 19.9% of CD patients and 38.6% of UC patients were identified at hospitals and clinics within the study area. The remainder of the patients with IBD [10.8% of CD and 10.2% of UC] were identified at referral centres and hospitals around the study area. The median age at diagnosis was 22 years [range, 5–66 years] for CD and 36 years [range, 9–83 years] for UC [p <0.001]. The median interval from symptom onset to diagnosis was 10 months [range, 0–241 months] for CD and 2 months [range, 0–321 months] for UC [p <0.001]; it tended to decrease over time in patients with UC [p = 0.09], but not in patients with CD [Tables 1 and 2]. The rate of current smokers at diagnosis was 18.9% [271/1431] among the incident cases of IBD. In patients with CD, 114 men [35.8%] and 4 women [4.0%] were current smokers at diagnosis [p <0.001]. In UC patients, 133 men [24.5%] and 20 women [4.3%] were current smokers at diagnosis [p <0.001].

For CD, the procedures used for the evaluation of disease location at diagnosis included ileocolonoscopy for 409 patients [97.8%], small bowel follow-through for 271 patients [64.8%], computed tomography [CT] or magnetic resonance [MR] enterography for 244 patients [58.4%], bowel surgery for 36 patients [8.6%], capsule endoscopy for 46 patients [11.0%], and double-balloon enteroscopy for eight patients [1.9%]. The overall rates of ileocolonoscopy and small bowel evaluation did not change during the study period. However, the main diagnostic modality for small bowel evaluation changed from small bowel follow-through [79.8% of patients] in 1986–2005 to CT or MR enterography [70.9% of patients] in 2006–2015. For UC, the procedures used to determine the extent of disease at diagnosis were colonoscopy for 961 patients [94.8%], flexible sigmoidoscopy with double-contrast barium enema for 20 patients [2.0%], and flexible sigmoidoscopy alone for 32 patients [3.2%]. The rate of colonoscopy increased in recent years [87.0% for the years 1986–2005 vs 99.4% for 2006–2015, p <0.001].

3.2 Incidence

The age- and sex-adjusted mean annual incidence rate for the entire study period was 1.06/100 000 inhabitants [95% CI, 1.05–1.08] for CD and 2.89/100 000 inhabitants [95% CI, 2.86–2.92] for UC. The age-adjusted incidence rate was significantly higher in men than in women for both CD (1.63/100 000 inhabitants [95% CI, 1.60–1.66] vs 0.50/100 000 inhabitants [95% CI, 0.48–0.51], p <0.001) and UC (3.21/100 000 inhabitants [95% CI, 3.17–3.25] vs 2.57/100 000 inhabitants, [95% CI, 2.54–2.61], p <0.001) [Figure 1, Supplementary Table 1, available as Supplementary data at *ECCO-JCC* online]. The age-specific incidence rate of CD peaked in their teens and 20s, with the highest incidence rate for men in the 20–29-year-old age group and that for women in the 10–19-year-old age group, and then decreased markedly [Figure 1, Supplementary Table 1]. In contrast, the age-specific incidence rate of UC was relatively stable in patients in their 20s to 60s, with the highest incidence rate for men in the 60–69-year-old age group [Figure 1, Supplementary Table 1].

The age- and sex-adjusted annual incidence has increased progressively throughout the 30-year study period: from 0.00/100 000 inhabitants in 1986 to 2.42/100 000 inhabitants [95% CI, 2.29–2.56] in 2015 for CD and from 0.33/100 000 inhabitants [95% CI, 0.28–0.38] in 1986 to 6.58/100 000 inhabitants [95% CI, 6.36–6.81] in 2015 for UC [Figure 2, Supplementary Table 2, available as Supplementary data at *ECCO-JCC* online]. When analysed by 5-year intervals, the mean annual incidence rate increased significantly from 0.06/100 000 inhabitants [95% CI, 0.05–0.07] in 1986–1990 to 2.44/100 000 inhabitants [95% CI, 2.38–2.50] in 2011–2015 for CD, and from 0.29/100 000 inhabitants [95% CI, 0.27–0.31] in 1986–1990 to 5.82/100 000 inhabitants [95% CI, 5.73–5.92] in 2011–2015 for UC [p <0.001; Table 3]. Average annual percentage change of IBD incidence was 12.3% [95% CI, 8.7–16.0] in 1986–1995 and 12.3% [95% CI, 8.7–16.0] in 1996–2005, whereas it was only 3.3% [95% CI, 2.2–4.5] in 2006–2015 [p <0.05].

3.3 Disease phenotype

In CD patients, disease location at diagnosis was ileal in 104 patients [24.9%], colonic in 39 [9.3%], and ileocolonic in 275 [65.8%]. The incidence increased progressively in all three disease locations [ileal, p <0.001; colonic, p =0.02; ileocolonic, p <0.001] [Figure 3A, Supplementary Table 3, available as Supplementary data at *ECCO-JCC* online]. The upper gastrointestinal disease modifier was present in 22.5% [94/418]. Disease behaviour at CD diagnosis was inflammatory in 339 patients [81.1%], stricturing in 34 [8.1%], and

Table 1. Demographic and clinical characteristics at diagnosis in 418 patients with Crohn's disease in the Songpa-Kangdong district, Seoul, 1986–2015

	Overall	Year of diagnosis					
		1986–1990 [*n* = 4]	1991–1995 [*n* = 19]	1996–2000 [*n* = 35]	2001–2005 [*n* = 85]	2006–2010 [*n* = 127]	2011–2015 [*n* = 148]
Age at diagnosis [years], median [IQR]	22 [18–29]	23 [17.5–34]	17 [17–21]	19 [18–27]	24 [19–31]	23 [18–29]	22 [18–31]
Age at diagnosis, *n* [%]							
≤16 years [A1]	56 [13.4]	1 [25.0]	4 [21.1]	5 [14.3]	12 [14.1]	15 [11.8]	19 [12.8]
17–40 years [A2]	324 [77.5]	2 [50.0]	15 [78.9]	29 [82.9]	65 [76.5]	98 [77.2]	115 [77.7]
>40 years [A3]	38 [9.1]	1 [25.0]	0 [0.0]	1 [2.9]	8 [9.4]	14 [11.0]	14 [9.5]
Male, *n* [%]	318 [76.1]	2 [50.0]	11 [57.9]	27 [77.1]	69 [81.2]	97 [76.4]	112 [75.7]
Current smoking at diagnosis, *n* [%]	118 [28.2]	1 [25.0]	5 [26.3]	9 [25.7]	29 [34.1]	31 [24.4]	43 [29.1]
Interval from onset to diagnosis [months], median [IQR]	10 [3–35]	16 [4.5–23.5]	36 [5–49]	17 [8–35]	11 [5–37]	9.5 [3–28.5]	7.5 [2–30]
Disease location at diagnosis, *n* [%]							
Ileum [L1]	104 [24.9]	2 [50.0]	3 [15.8]	4 [11.4]	24 [28.2]	33 [26.0]	38 [25.7]
Colon [L2]	39 [9.3]	0 [0.0]	6 [31.6]	3 [8.6]	4 [4.7]	17 [13.4]	9 [6.1]
Ileocolon [L3]	275 [65.8]	2 [50.0]	10 [52.6]	28 [80.0]	57 [67.1]	77 [60.6]	101 [68.2]
Upper gastrointestinal disease modifier [L4]	94 [22.5]	0 [0.0]	4 [21.1]	3 [8.6]	14 [16.5]	21 [16.5]	52 [35.1]
Disease behaviour at diagnosis, *n* [%]							
Inflammatory [B1]	339 [81.1]	2 [50.0]	15 [78.9]	29 [82.9]	74 [87.1]	108 [85.0]	111 [75.0]
Stricturing [B2]	34 [8.1]	2 [50.0]	2 [10.5]	2 [5.7]	6 [7.1]	7 [5.5]	15 [10.1]
Penetrating [B3]	45 [10.8]	0 [0.0]	2 [10.5]	4 [11.4]	5 [5.9]	12 [9.4]	22 [14.9]
Perianal fistula/abscess before or at diagnosis	181 [43.3]	2 [50.0]	8 [42.1]	14 [40.0]	41 [48.2]	62 [48.8]	54 [36.5]

IQR, interquartile range.

Table 2. Demographic and clinical characteristics at diagnosis in 1013 patients with ulcerative colitis in the Songpa-Kangdong district, Seoul, 1986–2015.

	Overall	Year of diagnosis					
		1986–1990 [*n* = 16]	1991–1995 [*n* = 53]	1996–2000 [*n* = 106]	2001–2005 [*n* = 194]	2006–2010 [*n* = 296]	2011–2015 [*n* = 348]
Age at diagnosis [years], median [IQR]	36 [27–48]	31 [25.5–43]	36 [24–41]	36.5 [27–43]	35.5 [27–45]	36 [27–50]	37 [27–53]
Age at diagnosis, *n* [%]							
≤16 years [A1]	37 [3.7]	1 [6.3]	3 [5.7]	10 [9.4]	3 [1.5]	10 [3.4]	10 [2.9]
17–40 years [A2]	573 [56.6]	10 [62.5]	35 [66.0]	56 [52.8]	118 [60.8]	168 [56.8]	186 [53.4]
>40 years [A3]	403 [39.8]	5 [31.3]	15 [28.3]	40 [37.7]	73 [37.6]	118 [39.9]	152 [43.7]
Male, *n* [%]	543 [53.6]	4 [25.0]	29 [54.7]	54 [50.9]	101 [52.1]	168 [56.8]	187 [53.7]
Current smoking at diagnosis, *n* [%]	153 [15.1]	0 [0.0]	4 [7.6]	14 [13.2]	29 [15.0]	56 [18.9]	50 [14.4]
Interval from onset to diagnosis [months], median [IQR]	2 [1–9]	4.5 [1.5–11.5]	4 [1.0–11.0]	4 [1.0–12.0]	2 [1.0–10.0]	2 [0–7.0]	2 [0–7.0]
Disease extent at diagnosis, *n* [%]							
Proctitis [E1]	550 [54.3]	5 [31.3]	16 [30.2]	44 [41.5]	108 [55.7]	161 [54.4]	216 [62.1]
Left-sided colitis [E2]	228 [22.5]	6 [37.5]	23 [43.4]	30 [28.3]	46 [23.7]	64 [21.6]	59 [17.0]
Extensive colitis [E3]	235 [23.2]	5 [31.3]	14 [26.4]	32 [30.2]	40 [20.6]	71 [24.0]	73 [21.0]

IQR, interquartile range.

penetrating in 45 [10.8%]. Perianal fistula/abscess was present in 43.3% [181/418] before or at CD diagnosis. In UC patients, disease extent at diagnosis was proctitis in 550 patients [54.3%], left-sided colitis in 228 [22.5%], and extensive colitis in 235 [23.2%]. During the study period, the proportion of proctitis progressively increased [p <0.001], although the incidence increased in all three extents of disease [p <0.001] [Figure 3B, Supplementary Table 3].

3.4 Prevalence

On December 31, 2015, there were 1241 IBD patients [385 CD, 856 UC] in the study area, giving an overall age- and sex-adjusted prevalence rate of 108.35/100 000 inhabitant [95% CI, 107.45–109.25]: 31.59/100 000 inhabitants [95% CI, 31.10–32.07] for CD and 76.66/100 000 inhabitants [95% CI, 75.91–77.42] for UC. The age-adjusted prevalence rate of IBD was 131.63/100 000 inhabitants [95% CI, 130.23–133.04] for men and 85.05/100 000 [95% CI, 83.93–86.18] for women. The age-adjusted prevalence rate of CD was 45.08/100 000 inhabitants [95% CI, 44.27–45.91] for men and 18.25/100 000 [95% CI, 17.73–18.78] for women, whereas that of UC was 86.52/100 000 inhabitants [95% CI, 85.38–87.66] for men and 66.80/100 000 [95% CI, 65.81–67.81] for women.

4. Discussion

In the present study of the descriptive epidemiology of IBD in a population-based cohort of Songpa-Kangdong district, Seoul, Korea, between 1986 and 2015, the incidence of both CD and UC has increased during the entire study period, although the increase seems to have slowed down in recent years. To our knowledge, the incidence of IBD in the present study was the highest estimate among the Asian countries.[4] Nevertheless, the incidence rates of CD and UC in this study are only 13–26% and 31–54%, respectively, of the recent Western data from Denmark,[20] South Limburg of The Netherlands,[21] Olmsted County of the USA,[22] and Ontario of Canada,[23] where the highest incidence and prevalence rates were reported. Likewise, the prevalence of IBD in this study is only 13–21% of the recent Western data.[21–24] However, extrapolating the prevalence rate of this study to the 2015 Korean population, there may be approximately 55 800 IBD patients [16 300 with CD, 39 500 with UC] in Korea in 2015. This number is comparable to, or even higher than that of Western countries with a high prevalence of IBD but with smaller populations such as Sweden,[25] Denmark,[26] Norway,[27] and Switzerland.[28]

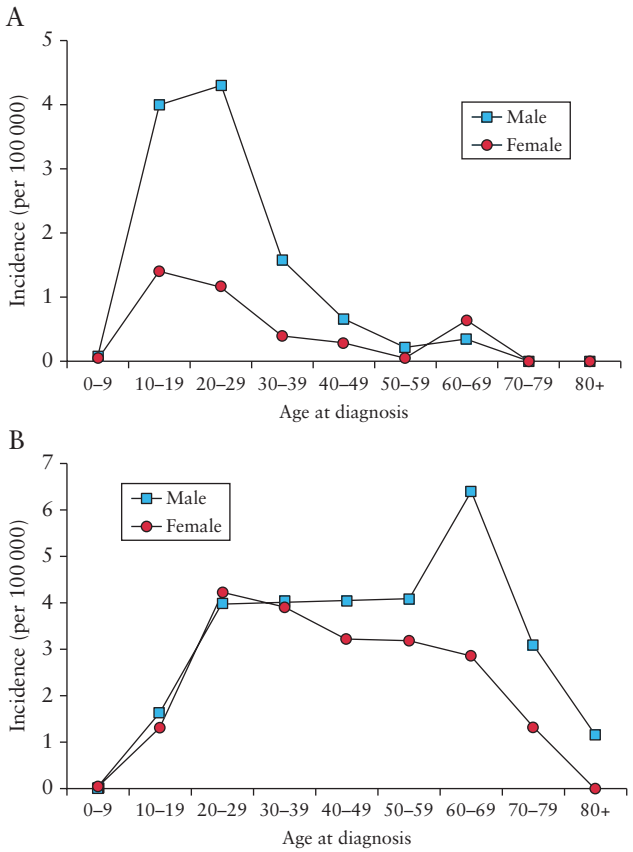

Figure 1. Age-specific incidence of Crohn's disease [A] and ulcerative colitis [B] in the Songpa-Kangdong district, Seoul, 1986–2015.

Although the incidence of IBD has continued to increase over the past three decades, as shown by our study, the increase seems to have slowed down in the past decade. We do not have a proper explanation for this trend. According to a study from South Limburg in The Netherlands, the incidence of IBD in this region did not increase in the 1990s, but significantly increased again in the 2000s.[21] Therefore, we likely need to observe a cohort for a longer period of time before we can conclude that the slowing trend we observed in our study has continued.

In the present study, the prevalence-to-incidence ratios were just 13.1 in CD and 11.7 in UC, which were much lower than the 21–23 reported in Western data.[21–23] The reason for this may be the relatively short history of IBD along with the rapid increase of incidence rates of IBD in Korea. However, using a 2015 incidence rate for IBD of 9.00 per 100 000 population, and assuming no further increase in incidence, a median age of onset of 31 years, and a life expectancy of 75 years, the prevalence of IBD should ultimately increase to 396 cases/100 000 persons.

Recent reports from Korea using a nationwide health insurance database insisted that the incidence of IBD in Korea reached a plateau or even decreased between 2006 and 2014.[11,12] However, they used relatively short washout periods [1 or 2 years] between enrolment in the administrative database and IBD diagnosis, which can cause misclassification bias if prevalent cases are misclassified as incident cases.[29] This factor might confound the true incidence of IBD in studies using the administrative database, because prevalent and incident cases will be mixed, resulting in an artificial inflation of the incidence in the early years.[29]

After we reported the male predominance of CD in our previous study,[7] several epidemiological studies from Asian countries showed a similar pattern of a male predominance of CD.[30–34] Also, the recent

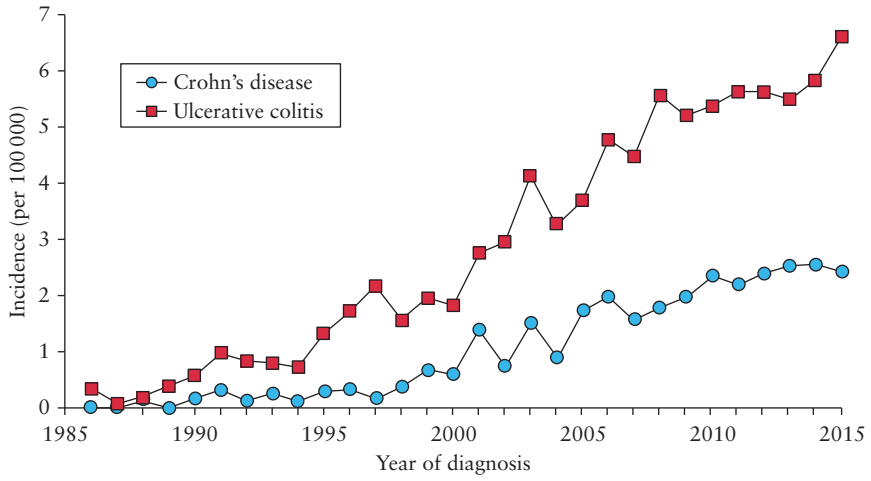

Figure 2. Age- and sex-adjusted annual incidence of Crohn's disease and ulcerative colitis in the Songpa-Kangdong district, Seoul, 1986–2015.

Table 3. Age- and sex-adjusted incidence rate for Crohn's disease and ulcerative colitis and their ratio by 5-year intervals in the Songpa-Kangdong district, Seoul, 1986–2015.

		Year of diagnosis					
	Overall	1986–1990	1991–1995	1996–2000	2001–2005	2006–2010	2011–2015
Incidence [/10^5] [95% CI]							
Inflammatory bowel disease	3.95 [3.92–3.98]	0.35 [0.32–0.37]	1.17 [1.12–1.21]	2.28 [2.22–2.34]	4.64 [4.56–4.73]	7.02 [6.92–7.12]	8.26 [8.15–8.37]
Crohn's disease [CD]	1.06 [1.05–1.08]	0.06 [0.05–0.07]	0.22 [0.20–0.24]	0.44 [0.41–0.46]	1.27 [1.23–1.32]	1.95 [1.90–2.01]	2.44 [2.38–2.50]
Ulcerative colitis [UC]	2.89 [2.86–2.92]	0.29 [0.27–0.31]	0.95 [0.91–0.99]	1.84 [1.79–1.90]	3.37 [3.30–3.44]	5.07 [4.98–5.15]	5.82 [5.73–5.92]
UC/CD ratio	2.72	5.03	4.34	4.22	2.64	2.57	2.39

CI, confidence interval.

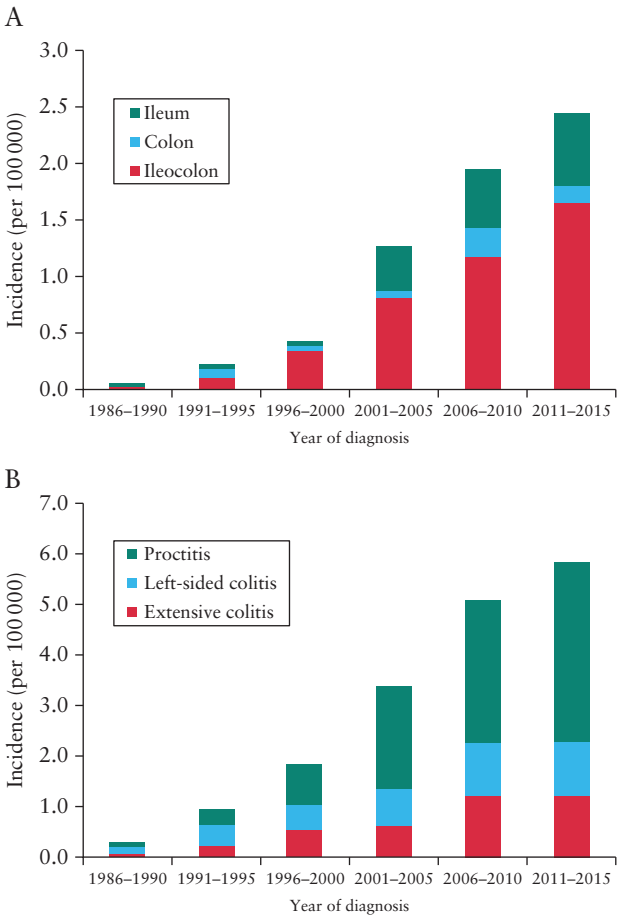

Figure 3. Age- and sex-adjusted incidence of Crohn's disease [A] and ulcerative colitis [B] according to disease location and extent in the Songpa-Kangdong district, Seoul, 1986–2015.

systematic review found a male predominance of IBD in the Asia-Pacific region.[35] This male predominance continued in the present study. In contrast to this trend, recent pooled analysis of 17 Western population-based cohorts showed a significant female predominance of CD in adults.[36] The exact reason for this difference is unclear, but there may be sex-related differences in predisposing factors according to race and ethnicity. The difference in the smoking rate between men and women might be a contributing factor to the marked male predominance of CD in this study, because the smoking rate in men is much higher than that in women [37.7% in adult men vs 3.5% in adult women] among the general population in Korea.[37] However, among 259 never-smoking CD patients in the present study, the male-to-female ratio was 1.8:1. Moreover, considering the number of non-smokers is much higher in women than in men among the general population in Korea, the male predominance of CD is remarkable among non-smokers in Korea. Therefore, the difference in smoking rate between men and women does not seem to be enough to explain the male predominance of CD in this study. Of note, there was a slight male predominance of UC in this study. This result is different from that of our previous report where the ratio of men to women in the incidence of UC was 1:1.[7] In this analysis, the gender ratios in the incidence of UC were 1.03 in 1986–1995, 1.06 in 1996–2005, and 1.37 in 2006–2015. Further studies are needed to check whether it will continue to increase in the future.

Regarding the disease location, 54.3% of UC patients have proctitis at diagnosis in this study population, which seems slightly higher than the 29–51% reported in Western population-based studies.[38] Also, there was a progressive increase in the proportion of patients with proctitis over time. Improved diagnostic tools to detect mild disease may be a possible contributing factor of the increasing incidence of IBD in this study, like a recent Western report.[21] However, the UC incidence seemed to be truly rising considering that the incidence of left-sided colitis, and extensive colitis also increased significantly during the study period. The disease location of CD at diagnosis showed some difference from Western reports. In this study, about two-thirds of Korean CD patients have ileocolonic disease, whereas only about 9% have colonic disease at the time of diagnosis. This is comparable to data from East Asian countries, which showed that ileocolonic disease is the most common CD phenotype with a range of 51–71%.[39–41] In the Western CD population, however, ileal, colonic, and ileocolonic diseases are usually found in equal proportion.[38,42] In addition, a recent meta-analysis showed that perianal involvement by CD is more common in Asian patients than in Caucasian patients, and this finding is consistent with the high rate of perianal fistula/abscess at CD diagnosis in the present study.[43]

One interesting finding in the present study is the bimodal distribution of age at IBD diagnosis, especially with UC in 60–69-year-old patients. Several Western studies have reported a second small peak in incidence at around 60 years for CD and UC patients, probably because of the ageing cohort in these regions.[23,44,45] In contrast, recent Asian studies showed only one peak at younger ages, without a prominent second peak.[31,32,46] However, these studies either included too few patients in these age groups for analysis, or they showed only the number of patients rather than age-specific incidence rates.

The strength of this study is that all case identification and ascertainment were made meticulously by clinical diagnoses and medical record review by two experts, rather than by administrative data. Because the SK-IBD Study Group included not only hospitals but also local clinics in and around the study area, we were able to capture essentially all patients with a diagnosis of either CD or UC during the study period. Also, the population of this area is identical racially and ethnically [Korean]. However, there are a few limitations to the present study. There may be limited follow-up in some cases, especially in those cases when patients moved out of the study area. Also, the prevalence rate might be underestimated because we excluded all cases who were lost to follow-up from the calculation of prevalence rate, although some of the excluded cases have the possibility of living in this study area without therapy in 2015.

In conclusion, the incidence of IBD in the Songpa-Kangdong district is lower than that in Western countries, but has continued to rise over the past three decades. The prevalence of IBD in this area in 2015 was more than 108 cases per 100 000 inhabitants. If this trend continues, health care costs associated with IBD will become an important issue shortly in Korea.

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Conflict of Interest

SKY received a research grant from Janssen Korea. The remaining authors disclose no conflicts.

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Author Contributions

Study concept and design: SHP, BDY, SKY. Acquisition of data: SHP, KHR, YHK, SNH, KHK, SIS, JMC, SYP, SKJ, JHL, HP, JSK, JPI, HY, SHK, JJ, JHK, SOS, YKK, BDY, SKY. Statistical analysis and interpretation of data: SHP, YJK, BDY, SKY. Drafting of the manuscript: SHP, SKY. Critical revision of the manuscript for important intellectual content: BDY, SKY. Study supervision: SKY.

Supplementary Data

Supplementary data are available at *ECCO-JCC* online.

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