

Commentary on the Epidemiology of Inflammatory Bowel Disease in Compounding Prevalence Nations: Toward Sustaining Healthcare Delivery

Inflammatory bowel disease (IBD), namely Crohn's disease and ulcerative colitis, affects millions of individuals worldwide.¹ IBD is characterized geographically by epidemiologic stages: Stage 1 (emergence) includes developing regions with low incidence and prevalence; stage 2 (acceleration in incidence) includes newly industrialized regions in Asia and Latin America with rapidly rising incidence but low prevalence; and stage 3 (compounding prevalence) includes early industrialized regions in North America, Europe, and Oceania with steadily climbing prevalence due to the cumulative effect of incidence greatly exceeding mortality over time.² Demographics are changing in regions entrenched in the third epidemiologic stage: Incidence is stabilizing in adult-onset IBD while continuing to rise in children with IBD.^{1,3} The IBD population is aging, making seniors the fastest

growing prevalent demographic with IBD.² Consequently, compounding prevalence regions face the unique challenge of providing equitable, high-quality care for an IBD population that is both rising in number and aging over time.⁴

The Canadian Gastro-Intestinal Epidemiology Consortium invited IBD epidemiologists from Catalonia (representing Southern Europe), Denmark (representing Scandinavia), Hungary (representing Eastern Europe), Israel, New Zealand (representing Oceania), Scotland (representing Western Europe), and the United States to an in person symposium (May 31, 2023) with lectures and round-table discussions. Epidemiologists were invited to the symposium based on availability, feasibility, and geographic representation of stage 3 regions. Further, these jurisdictions have advanced much of the known stage 3 epidemiology worldwide. This meeting's goal was to prepare healthcare systems in stage 3 regions to address the rising burden and changing population demographics of IBD. The objectives of this meeting were to describe the current epidemiology of IBD in stage 3 regions; to explore methodological heterogeneity in studying the epidemiology of IBD; to discuss how to provide accessible, equitable, and quality IBD health care in a sustainable manner; and to strategize future steps in the prediction and prevention of

disease. Addressing these objectives helps clinicians and researchers prioritize activities that counteract the rising burden of IBD (Box 1).

Epidemiology of IBD in Stage 3 Regions

Lectures during the meeting described the most current epidemiologic data on incidence and prevalence in the 21st century in stage 3 regions (Table 1). Overall, the annual incidence and prevalence of IBD presented at the symposium ranged from 20.9 to 44.4 per 100,000 and 519 to 893 per 100,000, respectively (Table 1).⁵⁻¹³ Scandinavia has the highest incidence and prevalence of IBD in the world; in 2017, the incidence and prevalence of IBD in Denmark was 44.4 and 890 per 100,000, respectively.⁸ The lowest reported incidence of IBD among the regions listed above was 21.0 per 100,000 person-years from 2007 to 2018 in Hungary.^{10,11} Israel reported the lowest prevalence of IBD at 519 per 100,000 in 2018.¹²

The hallmark of stage 3 is steadily rising prevalence.² For example, the prevalence of IBD increased by 4.3% per year from 2008 to 2018 in Scotland⁷ and by 2.4% per year from 2002 to 2014 in Canada.⁵ In Scotland, the forecasted prevalence in 2028 was 1023 per 100,000,⁷ whereas in Canada, the forecasted prevalence in 2030 was 981 per 100,000.⁵ Forecasting

Box 1. Lessons Learned From the Meeting

1. The prevalence of IBD is climbing in early industrialized nations in North America, Europe, and Oceania and is forecasted to be 1% of the population over the next decade.
2. Heterogeneity in epidemiologic data between regions is influenced by methodological differences of studies. These differences may be overcome by consortia that standardize data collection and research methodologies used across regions, while ensuring transparency of research methods to allow for accurate interpretation of results.
3. High-quality, accessible, and equitable care to those with IBD are attainable. However, achieving these goals requires a concerted effort to innovate healthcare delivery such as virtual clinics.
4. Increased funding, training, and integration of multidisciplinary clinics are needed to address the changing demographics of IBD populations where adult gastroenterologists manage older individuals with IBD and other age-related comorbidities and pediatric gastroenterologists handle the rising incidence of young children with IBD.
5. Prioritizing research toward preventing IBD through modifying environmental and behavioral determinates may slow the rising prevalence in compounding prevalence nations.

Table 1. Summary of IBD Epidemiologic Studies Presented at the Symposium Meeting on May 31, 2023

	Canada ⁵	United States ⁶	Scotland ⁷	Denmark ⁸	Catalonia ⁹	Hungary ^{10,11}	Israel ¹²	New Zealand ¹³
Year	2014	2011	2018	2017	2016	2015	2018	2014
Cohort size	267,983	815	7035	51,604	40,614	1952	46,074	205
Population size	37,250,385	144,535	897,210	5,752,126	7,448,332	353,068	8,607,919	515,040
Region	Nationwide	Olmsted County	Lothian	Nationwide	Catalonia	Veszprem	Nationwide	Canterbury
IBD prevalence (per 100,000)	651	533	784	893	545.3	554.6	519	Not available
IBD incidence (per 100,000)	29.0	22.9	40.8	44.4	43.6	20.9	25.4	39.5
Data source	Health administration databases	Medical records	Health administration databases	Health administration databases	Health administration database	Medical records	Health administration databases	Medical records
IBD case definition	ICD-9 555/556	Manual case verification using medical records	ICD-10 K50/51/52	ICD-8 563.00-563.09/563.19/569.04	ICD-9-CM 555/556	Manual case verification using medical records	ICD-9 555/556	Manual case verification using medical records
	ICD-10 K50/K51 Algorithm		Prescriptions	ICD-10 K50/51	Algorithm		Algorithm	
			Pathology	Algorithm				
			Manual case verification using medical records					

ICD, International Classification of Diseases.

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epidemiologic data allows regions to proactively implement the necessary changes to accommodate the increasing number of people living with IBD in compounding prevalence regions.

Methodological Heterogeneity in IBD Epidemiology

Differences in methodologies may explain heterogeneity in incidence and prevalence estimates between compounding prevalence regions.¹⁴ Collecting data through administrative databases, particularly in regions with public healthcare systems, produces estimates with high external validity for the regional population of interest. Although health administrative data capture almost the entire population being studied, IBD case definition depends on use of a diagnostic coding system such as the International Classification of Diseases and thus is subject to misclassification bias.¹⁴ Validation of coding algorithms is used for case definition accuracy. Coding algorithms with high sensitivities reduce the false negatives that miss IBD cases and result in an underestimation of prevalence, whereas those with high positive predictive values reduce false-positive cases of IBD and result in an overestimation of prevalence. Backward washout periods (ie, years of lead data) are necessary to identify an inception cohort. Without adequate removal of early years, prevalent cases are mixed with incident cases, which may skew temporal trend analyses by overinflating the incidence in the earliest cohort.¹⁴

Collecting data through medical records allows studies to access more detailed individual information and to confirm the IBD diagnosis, resulting in a lower risk of misclassification bias. However, this method is costly, time consuming, and logistically impractical in many regions.¹⁴ Consequently, population-based registry studies are typically limited to local regions, which may lack the geographic representation of the entire nation, leading to limited generalizability.

Heterogeneity of epidemiologic estimates within a nation may also occur

when comparing regional population-based studies with nationwide data. For example, IBD incidence is highest in urban centers, which may have over-represented incidence when studied in subregions with more densely populated urban centers than national estimates that also account for rural areas. Another limitation of regional population-based studies is under-representation of indigenous populations and racial and ethnic diversity. For example, the indigenous Māori population is low in the Canterbury region of New Zealand, from which much of the epidemiologic data reported in the region are drawn.¹³ The prevalence of IBD among First Nations peoples in Saskatchewan, Canada increased from 64 per 100,000 in 1999 to 142 per 100,000 in 2016; however, this trend is unknown among other provinces.¹⁵

Methodological heterogeneity can be addressed in future epidemiologic studies. First, transparency of research reporting and aiding in recognizing methodological differences between studies is facilitated by the use of reporting guidelines, such as the RECORD (REporting of studies Conducted using Observational Routinely collected Data) guidelines.¹⁶ Second, comparative epidemiologic analyses across regions are warranted, for example, by using a distributed network analysis (an approach that uses similar study methodology on individual-level data to obtain regional estimates) followed by meta-analysis to obtain pooled estimates and measure heterogeneity between regions.¹⁷

Workshop on Sustaining IBD Health Care

Symposium attendees were divided into 4 focus groups to prioritize issues and solutions in 3 categories: access, quality, and equity of IBD healthcare delivery; changing demographics of IBD populations; and IBD prediction and prevention. An open forum discussion followed, and each attendee received 5 dot stickers to vote on priority issues using the cumulative voting approach, also known as dot voting.¹⁸ A postmeeting survey was completed by attendees to finalize the

topics and identify areas not raised during the symposium (Table 2).

Access, Quality, and Equity of IBD Healthcare Delivery

The problem facing healthcare systems of stage 3 regions is providing the resources needed for continuously growing IBD populations while maintaining quality of care. Participants voiced concerns that the ratio of gastroenterologists to patients is unsatisfactory, which may lead to delays in diagnosis and treatment, resulting in potentially avoidable emergency department visits and hospitalizations that exacerbate costs to healthcare systems and individuals. Some practical solutions noted were using telemedicine, increasing the number of IBD nurses, and creating clinical care pathways that appropriately triage individuals toward the care they need in a time- and cost-effective manner (Table 2). Consequently, national IBD charitable organizations should advocate raising awareness to policymakers.

Knowledge mobilization requires practical solutions that consider feasibility, acceptance, and patient preference. For instance, remote monitoring, noninvasive testing (eg, fecal calprotectin), and telemedicine benefit those facing barriers to accessing health care such as those living in rural areas. Remote monitoring (eg, digital applications for mobile devices) could be integrated through in-person training in the clinic that transitions to subsequent home use for the individual. Populations facing barriers to accessing health care (eg, rural residents, seniors, indigenous peoples) may be averse to using virtual clinics. For these communities, telemedicine may be best implemented by telephone, which is universally accessible.

Individuals with mild IBD could be managed by nurse-driven clinics, freeing up specialists in multidisciplinary clinics for moderate-to-severe cases. Primary care physicians can serve as a bridge to alleviate the patient load faced by gastroenterologists such as by supporting health maintenance of those in remission. A

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Table 2. Discussion Points Generated During the Workshop Regarding What Could Be Important to Consider for IBD Management Over the Next Decade

Access, Quality, and Equity of IBD Healthcare Delivery	Changing Demographics of the IBD Population	Prediction and Prevention of IBD
^a Use of telemedicine and virtual clinics to support those with IBD facing barriers to access of health care including those living in rural areas, seniors with IBD, and indigenous populations.	^a Develop guidelines to manage age-related comorbidities such as cardiovascular disease, cancer, and dementia that will influence IBD care among the rapidly growing number of seniors with IBD.	^a Intervene on modifiable environmental and behavioral risk factors that reduce the incidence of IBD.
^a Advocate policymakers for personnel, resources, and infrastructure to improve sustainability of care for the rising prevalence of IBD.	^a Incorporate multidisciplinary care teams and partner with primary care physicians to support care of seniors with IBD.	^a Identify clinical biomarkers of early detection of IBD to expedite treatment.
^a Diversify specialist teams to include multidisciplinary clinics with allied health professionals including dietitians and psychologists.	^b Support the clinical needs of changing of racial demographics and immigration patterns of those with IBD.	^a Target communication to individuals most at risk of developing IBD (eg, first-degree relatives).
^b Establish remote monitoring such as mobile applications for self-reported symptoms, education, and management of disease.	^b Understand the lived experience of subpopulations such as indigenous peoples.	^b Collaborate with policymakers on advocacy initiatives.
^b Integration of IBD nurse clinicians and practitioners into multidisciplinary clinics and nurse-driven clinics.	^c Expand the diversification of gastroenterologists and allied healthcare providers to match the changing racial and ethnic diversity of those with IBD.	^b Use technology such as artificial intelligence to predict the development of IBD.
^b Develop clinical care pathways to standardize delivery of care across different expertise in managing IBD.	^c Establish transition clinics and care pathways from pediatric to adult care.	^c Intervene on societal-level risk factor modification such as encouraging a healthy, balanced lifestyle that may reduce the incidence of IBD.
^b Identify IBD profiles for safe drug de-escalation.	^c Train more pediatric gastroenterologists and allied healthcare providers to support the increase in early-onset IBD.	
^c Recognize and mitigate barriers to health care for vulnerable populations with IBD including minority groups, indigenous peoples, substance abuse, low socioeconomic status, and those without a fixed address.	^d Train gastroenterologists with expertise in geriatrics to support the needs of seniors such as polypharmacy.	
^c Partner with primary care physicians to serve as a bridge in seeing a specialist and to support health maintenance.	^d Provide culturally safe and trauma-informed care for indigenous peoples living with IBD.	
^d Support healthcare innovation and improved access to integrated models of care for IBD and IBD nurses for individuals living in rural and remote communities.		
^d Adopt noninvasive disease monitoring such as intestinal ultrasound and fecal calprotectin.		
^d Reduce out-of-pocket costs borne by individuals with IBD and their caregivers.		
^d Reallocate cost savings from implementation of biosimilars and government-led negotiation to reduce drug costs.		

^a6 or more votes.^b3–5 votes.^c2 or less votes.^didentified in the postmeeting survey.

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multidisciplinary team approach is necessary to optimize the quality of care for disproportionately affected populations with IBD, such as indigenous peoples, those of low socioeconomic status, immigrants and refugees, and those struggling with substance abuse (Table 2). Integration within multidisciplinary teams—including nurse clinicians, psychologists, social workers, and dieticians—may offset the time demand on gastroenterologists by team members taking on different roles in the care pathway.

Participants in the workshop universally agreed that healthcare systems need to strive toward equal access to high-quality care and to efficacious advanced therapies regardless of age, gender, race and ethnicity, socioeconomic status, or place of residence. Cost savings from implementing biosimilars and government-led negotiation to reduce drug costs could be reallocated toward improving access, equity, and quality of healthcare delivery to people with IBD.

Changing IBD Population Demographics

Seniors (those aged ≥ 65 years) are the fastest growing prevalent group with IBD due to both long-standing disease and new diagnoses.² For example, in Canada, the prevalence of IBD in seniors was 841 per 100,000 in 2014 and was forecasted to exceed 1500 per 100,000 (1.5%) over the next decade.⁵ As the IBD population continues to age, the proportion of seniors with IBD in gastroenterology clinics will increase, leading to more complex ambulatory visits such as managing polypharmacy. Age-related comorbidities such as diabetes, cancer, cardiovascular disease, and dementia may be more prevalent in individuals with IBD with long-standing disease and can complicate treatment decisions for gastroenterologists.¹⁹ Training experts in geriatric gastroenterology may reconcile the demand for care in the growing number of seniors with IBD. Ultimately, primary care physicians will be vital partners with gastroenterologists to support the management of age-related comorbidities (Table 2).

Incidence rates are climbing in children worldwide, particularly in younger children.^{3,20} The reasons for this increase is unknown and contrasts with the stable incidence rates in adults and seniors. Nonetheless, healthcare systems will need to expand the expertise of pediatric IBD care, including helping children transition to adult care.

Participants also discussed the implications of a rising prevalence of IBD among immigrants and minority demographics, including indigenous peoples in regions such as Canada and New Zealand.¹⁵ With cultural humility and recognizing the diverse cultures of indigenous peoples, healthcare providers and researchers can work with indigenous community members reciprocally by connecting with indigenous communities, including indigenous people living with IBD, community leaders, and elders; listening to the concerns, needs, and ideas of indigenous community members; learning and applying the appropriate engagement protocols of each community; agreeing on the level of engagement with community members; and prioritizing the role of community partners and ceremonies during the research process.^{21,22}

IBD Prediction and Prevention

Interventions that reduce the incidence of IBD will have the strongest impact on slowing the rising prevalence of IBD over time. Achieving this goal requires predicting those at highest risk of IBD (eg, prediagnostic biomarkers), identifying modifiable environmental and behavioral determinates of IBD development, and implementing risk factor modifications to individuals or across populations. Targeting those who are at high risk for developing IBD (eg, first-degree relatives of individuals with IBD) and educating them on risk factors that are associated with IBD may help prevent new cases. The topic of family member risk is often approached by individuals to their gastroenterologists and is therefore the most appropriate scenario to converse about individual-level preventative measures. Gastroenterologists can

address anxiety around their family members developing IBD by reassuring the overall risk is low and that preventative measures encourage adopting a healthy lifestyle. Guidelines in modifying environmental risk factors (eg, International Organization for Study of Inflammatory Bowel Diseases) have been developed for dissemination by gastroenterologists.²³

Another group that could be considered at high risk for developing IBD are persons with other chronic immune-mediated diseases such as spondyloarthritis, psoriasis, or iritis. When these individuals have gastrointestinal symptoms, they need to be assessed for IBD. They should be similarly advised on lifestyle issues to potentially prevent IBD. Further, societal-level interventions (eg, smoking reduction policies, judicious use of antibiotics) may lead to cohort effects whereby differential exposures across time may prevent IBD development in the future.

Early diagnosis enables effective therapies to have their maximum impact by mitigating the long-term complications of IBD. Advocacy to government agencies for changes in policy that could mitigate harmful exposures for disease development on a societal level (eg, a balanced, healthy lifestyle) may reduce the incidence of IBD.²⁴

Gap Areas and Limitations of the Workshop

Topics generated from the workshop are generalized and require practical solutions for implementation within a local health system that depends on a region's population demographics, infrastructure, and resources. Implementing solutions requires patient engagement, education, and integration as well as assessing feasibility within a clinic. For example, incorporating a multidisciplinary team approach can vary in conceptualization and execution based on the specific needs of the target population for IBD health care. Some gastroenterology clinics (eg, IBD centers) may be able integrate allied healthcare professionals into their clinic directly, whereas other clinic models

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591 may require external partnerships. Prac-
592 ticality of interventions will need to be
593 addressed and fine-tuned by healthcare
594 systems on their decision to move for-
595 ward with implementation.

596 Because of logistical and financial
597 constraints, we could not include rep-
598 resentation from every stage 3 country.
599 The symposium and workshop did not
600 address emerging and newly industri-
601 alized regions in Africa, Asia, and Latin
602 America, which are currently experi-
603 encing unique epidemiologic trends of
604 IBD and challenges to their healthcare
605 systems. Future, similar exercises
606 geared specifically toward these re-
607 gions are planned. The symposium
608 focused predominantly on IBD without
609 discriminating in areas that differ for
610 Crohn's disease and ulcerative colitis,
611 and future efforts to prepare and sus-
612 tain IBD care should also consider each
613 condition separately. Our symposium
614 comprised the perspective of clinicians
615 and epidemiologists as a first step;
616 future iterations focused on generating
617 practical interventions aligned with our
618 general recommendations will invite
619 patient and caregiver representation as
620 well as healthcare administrators and
621 policymakers.

622 Conclusion

623 The burden of IBD is an immense
624 issue for compounding prevalence re-
625 gions in North America, Europe, and
626 Oceania. Currently, healthcare systems
627 are ill equipped to respond to the
628 growing IBD population while main-
629 taining equitable and quality healthcare
630 delivery. This meeting served an
631 important role in the international
632 collaboration among gastroenterolo-
633 gists and researchers to generate plau-
634 sible and actionable solutions to
635 achieve successful management of IBD
636 in the future. Next steps include initi-
637 ating the process of changes in health-
638 care policy for improved delivery of IBD
639 care and continued research in pre-
640 dicting and preventing IBD.

643 Q4 MICHELLE HERAUF
644 STEPHANIE COWARD

645 Division of Gastroenterology and
646 Hepatology
647 Department of Medicine
648 University of Calgary
649 Calgary, Alberta, Canada

JUAN-NICOLÁS PEÑA-SÁNCHEZ

Department of Community Health and
Epidemiology
College of Medicine
University of Saskatchewan
Saskatoon, Saskatchewan, Canada

CHARLES N. BERNSTEIN

Department of Medicine
University of Manitoba IBD Clinical and
Research Centre
Max Rady College of Medicine
Rady Faculty of Health Sciences
University of Manitoba
Winnipeg, Manitoba, Canada

ERIC I. BENCHIMOL

SickKids Inflammatory Bowel Disease
Centre
Division of Gastroenterology, Hepatology
and Nutrition
The Hospital for Sick Children (SickKids)
Toronto, Ontario, Canada and
Department of Paediatrics
Institute of Health Policy, Management
and Evaluation
University of Toronto
Toronto, Ontario, Canada and
Child Health Evaluative Sciences
SickKids Research Institute
Toronto, Ontario, Canada and
ICES
Toronto, Ontario, Canada

GILAAD G. KAPLAN

Division of Gastroenterology and
Hepatology
Department of Medicine
University of Calgary
Calgary, Alberta, Canada

CANADIAN GASTRO-INTESTINAL EPIDE-
MIOLOGY CONSORTIUM

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Conflicts of interest

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COMMENTARY

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 829 McKesson Canada and the Dairy Farmers of
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 831 to treat inflammatory bowel disease and has also
 832 acted as a consultant for the Canadian Agency
 833 for Drugs and Technology in Health (CADTH) and
 834 holds the Northbridge Financial Corporation Chair
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