Crohn's and Colitis Foundation of Canada

Fondation canadienne des maladies inflammatoires de l'intestin

Final Report and Recommendations

The Burden of Inflammatory Bowel Disease (IBD) in Canada

Approved by the Board of Directors of the Crohn's and Colitis Foundation of Canada

September 13, 2008

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Crohn's and Colitis Foundation of Canada

Fondation canadienne des maladies inflammatoires de l'intestin

Mission

Find the cure.

Vision

The Crohn's and Colitis Foundation of Canada (CCFC) believes that a cure will be found for Crohn's disease and ulcerative colitis. To realize this, the CCFC is committed, first and foremost, to raise increasing funds for medical research.

The CCFC also believes it is important to make all individuals with inflammatory bowel disease (IBD) aware of the Foundation, and educate these individuals, their families, health professionals and the general public about these diseases.

Approved by the Crohn's and Colitis Foundation of Canada Board on September 13, 2008

This Report was commissioned by the CCFC and developed under the guidance and input of an expert Steering Committee. The Report was then endorsed by the CCFC Board of Directors.

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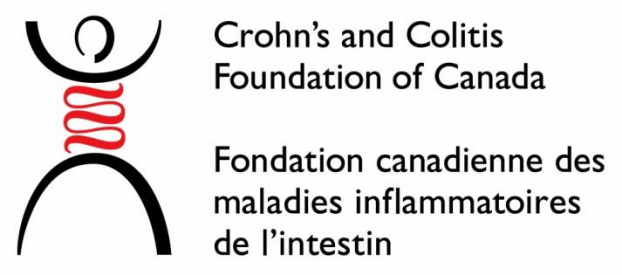

Background of the Crohn's and Colitis Foundation of Canada

The Crohn's and Colitis Foundation of Canada (CCFC) is a voluntary, not-for-profit, medical research foundation dedicated to finding the cure for Crohn's disease and ulcerative colitis, commonly referred to as inflammatory bowel disease (IBD). To achieve our mission, the Foundation is committed to raising funds for medical research. Medical research is the best hope for finding a cure for Crohn's disease and ulcerative colitis.

The CCFC invests over 80% of its net fundraising proceeds in research and education and is Canada's top funder of cure-directed IBD research. To date, CCFC has invested nearly $56 million in IBD research and is one of the world's leading sources of non-governmental funding of such research.

The CCFC's long history of funding Canada's most talented IBD researchers, universities, and research institutes has helped junior scientists attract follow-on funding from other sources; attracted foreign scientists to work with Canadian teams; and helped senior research leaders attract talented researchers to join their teams.

The CCFC has more than 65,000 supporters, including members in approximately 80 local volunteer groups across Canada.

The key to the CCFC's success is the interest and work of thousands of volunteers across the country. This network of highly organized volunteers participate in numerous fundraising initiatives throughout the year including national programs such as M&M Meat Shops Charity BBQ Day and the Heel 'n' Wheel-a-Thon. CCFC also gratefully acknowledges the support of many individual donors and corporate partners.

Due to the significant research investment made by CCFC, significant progress has been made in understanding the fundamental biology of the intestine and the genetic and environmental factors in inflammatory bowel disease. Much work, however, remains in order to find the cure.

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Acknowledgements and Disclosures

The CCFC would like to acknowledge the contributions of the following organizations:

- Australian Crohn's and Colitis Association: their report on the cost of IBD in Australia was helpful to guide the design of the Canadian report, and several of their analyses were cited in this report.

- Crohn's and Colitis Foundation of America: their website information was cited to prepare the Disease Background section.

- Axia Research: this research organization was contracted by the CCFC to assist in compiling data, conducting analyses and writing for this report.

- UCB Canada Inc. provided partial dedicated funding for this report as an unrestricted educational grant.

- The Crohn's and Colitis Foundation of Canada wishes to acknowledge and thank all of our donors and supporters for making this report possible.

Executive Summary

Inflammatory Bowel Disease (IBD) is a group of disorders that cause the sections of the gastrointestinal tract to become inflamed and ulcerated. An abnormal response of the body's immune system plays a role in each of the two main forms of IBD; namely Crohn's disease (CD) and ulcerative colitis (UC). In the absence of a cure, therapy is directed at achieving and maintaining freedom from symptoms. Most people require ongoing medication; when this fails, surgery is often required. Most often, these are lifelong diseases, usually starting in early adulthood in otherwise healthy, active individuals. IBD imposes a significant impact on quality of life through ongoing symptoms, reduced ability to work, social stigma, management of toilet access issues, difficulty with physical intimacy and restriction in career choices.

People with IBD in Canada

There are almost 201,000 Canadians living with IBD: 112,000 with CD and 88,500 with UC. Over 9,200 new cases are diagnosed every year – 5,100 with CD and 4,100 with UC. Canada has among the highest reported prevalence (number of people with CD or UC) and incidence (number of new cases per year) of IBD in the world. IBD can be diagnosed at any age, but has a typical age of onset in the twenties. People with IBD have an elevated risk of developing colorectal cancer. People with CD face a significantly elevated risk of premature death (47% higher) than the general public. IBD is about three times more common than multiple sclerosis or HIV; about as common as Type I diabetes or epilepsy; and somewhat less common than other chronic diseases such as schizophrenia or rheumatoid arthritis. Compared to the general population, quality of life in IBD is low across all dimensions of health.

Economic Costs of IBD

Economic costs for IBD are conservatively estimated at $1.8 billion per year in Canada in 2008 (over $9,000 per person with IBD every year). Direct medical costs totalled over $700 million per year. They are dominated by hospitalizations ($345 million), followed by medications ($162 million) and physician visits ($134 million). Costs are higher for CD than for UC, due to more frequent hospitalizations and greater use of newer, expensive drugs. Indirect costs (to society and to the patient, including loss of productivity) are greater than direct medical costs: over $1 billion per year. Indirect costs are dominated by lower labor participation rates (long-term work loss: $746 million per year), followed by patient out of pocket expenses ($239 million) and then short-term work absences ($138 million). These costs are similar between CD and UC.

Areas of Greatest Challenge

There are many challenges for people with IBD in the current environment, ranging from lack of awareness of IBD as a chronic disease, to social stigma, to lack of equity in access to expensive medications.

Recommendations for a National Vision

The CCFC recommends a long-term national vision for the future, to include government, media and the general public. The goals are to change community perceptions and attitudes to IBD, reduce stigma and recognize IBD as a chronic disease within provincial/territorial chronic disease strategies/frameworks.

Section 1: Introduction

1.1 Background

Inflammatory bowel disease (IBD) is the name of a group of disorders that cause the intestines to become inflamed (red and swollen). The main forms of IBD are Crohn's Disease (CD) and ulcerative colitis (UC). IBD has a tremendous impact on quality of life due to a host of symptoms, as well as a substantial personal burden. There is often a lack of support, both in the broader community and among the families and coworkers of people with IBD, stemming from a lack of understanding of the disease and the intimate nature of symptoms. IBD usually starts in early adulthood (but may occur at any age) and is a lifetime disease. Although most people with IBD can lead full, productive lives with the use of medications and surgery, there is no cure for IBD.

In Canada, there is a lack of public awareness of the impact of Crohn's disease and ulcerative colitis. Raising awareness is important to reduce the social stigma that is common with these diseases, and to help individuals maximize their overall quality of life. A better public understanding of IBD can also help to raise and direct funds for research, to improve the treatment of these diseases, and ultimately, to find a cure.

The Crohn's and Colitis Foundation of Canada (CCFC) was established with a two-fold purpose. First, the CCFC believes a cure will be found for IBD, and is committed to raising funds for research. Second, the CCFC believes it is important to make all individuals with IBD aware of the Foundation, and to educate the individuals, their families and the general public about these diseases.

To fulfill this vision, it is essential to gather and share high quality, current and relevant information on IBD. In Canada, we are fortunate to have many top-level researchers, who have conducted some of the landmark research on IBD in the world – much of which has been funded by the CCFC and its partners. The work that they have completed and published in the scientific literature should be gathered and shared amongst the general community. This will lead to improved awareness, better research opportunities, and better lives for people with IBD.

1.2 Objective

This burden of illness review of IBD is intended to collect and communicate information on IBD which is relevant to Canada and which can be appreciated by the lay public. This work aims to raise awareness and understanding of IBD in Canada, resulting in improved research opportunities and improved quality of life for people with IBD.

The different areas of information to be addressed in this burden of illness report include:

- Background information on IBD
- Occurrence of IBD (how many Canadians have IBD)
- Costs of IBD to the health care system, as well as to individuals and society

- Non-financial costs of IBD (quality of life impact)
- Directions for future strategies

1.3 Methods

1.3.1 General Overview

The concept for this work was to build on the existing high-quality scientific research on IBD in Canada – much of which has been funded by the CCFC - to generate a single, publicly-accessible document exploring the comprehensive financial impact of IBD on the nation of Canada.

To undertake this review, a steering committee was formed, composed of academic experts in gastroenterology and health economics. Then, topics were selected and defined by the Steering Committee, which also provided research guidance. The report was researched and written by a third party organization. Drafts of each section were circulated for revision and approval by the entire steering committee. Finally, the report was reviewed and approved by the Board of Directors of the CCFC.

1.3.2 Steering Committee

A Steering Committee was formed, composed of the following members:

- Health economist (and Chair of the Steering Committee):
    - Teresa Longobardi, Ph.D., University of Manitoba
- Gastroenterologists:
    - Charles Bernstein, M.D., University of Manitoba
    - Alain Bitton, M.D., McGill University
    - Brian Feagan, M.D., University of Western Ontario
    - Remo Panaccione, M.D., University of Calgary
- CCFC Staff:
    - Kevin Glasgow, M.D., Chief Executive Officer
    - George Tolomiczenko, Ph.D., Executive Director of Research

The Steering Committee guided the activities of the project consultant (Angela Rocchi, M.Sc., Axia Research), and was responsible for determining the methodology and content of the report, as well as providing input, review and approval of the report. The Steering Committee was also responsible for assisting in the identification of appropriate research and data sources.

1.3.3 Topic Definition

The Steering Committee decided on six different topics; a brief overview of each section is provided here.

<u>Disease background</u>

General information about both CD and UC were presented to provide a background for the average reader about these diseases. Symptoms were described, followed by currently recommended treatments options (including medications and surgeries).

Epidemiology

Epidemiology is the science that examines the patterns and occurrence of disease. The primary goal of this section was to estimate the current number of individuals in Canada with CD and UC. Other aspects of epidemiology which were reported included: factors that are associated with getting a disease, the rate at which individuals are newly diagnosed with disease, the age of people with IBD, premature mortality associated with IBD, and a comparison of results for Canada versus other geographic areas.

Direct costs

Direct costs are those costs incurred by the public health care system in Canada, and included: medications, hospitalizations, surgeries, physician visits, other health care professionals, laboratory tests and procedures, etc. For each of these types of health care resources, the total Canadian cost was calculated by multiplying the amount that was used per person, with the total number of individuals who have disease.

Indirect costs

Indirect costs are those incurred by individuals and society, outside of the health care system. Individuals can incur costs for such things as non-prescription medications, travel to medical appointments, and household support. Society incurs costs for worker absences and loss of productivity associated with disability, reduced participation in the work force, and death. Worker absences can be due to the individual with disease or the caregiver of the individual with disease (such as a parent). Again, the total Canadian cost was determined by combining the costs per person with the total number of individuals who have disease.

Non-financial costs

IBD has substantial impact on quality of life, and causes considerable personal, emotional and social burden. It is not well accepted to place a 'price' or attach a cost to this impact of IBD. Instead, information on quality of life was discussed for individuals with IBD, without determining a cost for this aspect of the burden of disease.

Conclusions and recommendations

A final section was developed with two objectives. First, it was important to place in context the Canadian experience of IBD with that of other diseases in Canada, as well as to compare costs for IBD from other countries. Second, the results were used to develop a set of strategies for the future of IBD in Canada.

1.3.4 Literature Review

For each section, an extensive literature review was conducted to obtain the most recent and relevant research for the report. Wherever possible, Canadian-based data and research were used. Scientific publications were the most important source for data for the review. The scientific literature was searched using key words such as CD or UC plus costing, quality of life, epidemiology, etc. There was a focus on retrieving work that was set in Canada. Published literature was supplemented where appropriate by the unpublished research of the steering committee members.

Additional data sources were also used where appropriate. For example, information on the costs of prescriptions was obtained from electronic databases of prescription drug claims from insurance plans. Websites were also used, such as the Statistics Canada website to track the census population of Canada.

Strong and robust research has been conducted in Canada with respect to epidemiology, utilization of health care resources, productivity, patient costs and quality of life. It was only very occasionally necessary to use non-Canadian research to supplement locally-derived data.

1.3.5 Analysis

Information from the various data sources was combined and converted into a burden of illness summary. First, it was necessary to determine best estimates for important factors, such as: the current number of individuals with IBD in Canada, the average per-person cost for medications and hospitalizations, and the average per-person costs in lost productivity. Where there was one particularly strong information source, it was used to generate the best estimate. For example, a landmark study has been published reporting on the number of people with IBD in Canada; this study was used as the primary data source for this factor. Where there were a number of different information sources, with sometimes differing results, the data were combined using statistical techniques to determine a best estimate. For example, there were ten different studies reporting international experiences of premature mortality with CD; these data were combined statistically to calculate a single best estimate of mortality risk.

Second, it was necessary to attach prices or costs to the amount of resources that are used for IBD. For example, studies would estimate the average number of hospitalizations or the average amount of lost productivity per person. This was multiplied by the total number of people with CD or UC to determine the total amount of resource utilization. Then, prices were determined for each element such as the cost of a hospitalization or physician visit, or the average wage rate. These prices were determined from public sources. Costs for health care resources were determined primarily from the Ontario health care system. Productivity losses were priced using the Canadian average wage rate as reported by Statistics Canada.

Costs were summed for a national total, but were also broken down by disease (CD versus UC) and by province.

Section 2: Background

2.1 Inflammatory Bowel Disease

Inflammatory bowel disease (IBD) is the name of a group of disorders that cause the intestines to become inflamed and ulcerated (red and swollen). The main forms of IBD are Crohn's disease (CD) and ulcerative colitis (UC). Because the symptoms of CD and UC are similar, it is sometimes difficult to establish the diagnosis definitively. In fact, approximately 10% of colitis cases are unable to be defined as either UC or CD and are called indeterminate colitis.

Both CD and UC are marked by an abnormal response by the body's immune system. Normally, the immune system protects the body from infection. In people with IBD, however, it reacts inappropriately. For unknown reasons, the immune system can mistake microbes, such as bacteria that are normally found in the intestines, as foreign or invading substances, and launch an attack. In the process, the body sends white blood cells into the lining of the intestines, where they produce chronic inflammation. These cells then generate harmful products that ultimately lead to ulcerations and bowel injury. When this happens, the patient experiences the symptoms of IBD.

Research looking into the environmental (internal and external) factors contributing to CD includes a focus on specific bacteria. The possibility of more than one infectious cause that leads to a similar set of symptoms confounds the research agenda to find both a cause and a cure for CD. CCFC has funded a number of research projects attempting to shed light on host-bacteria interactions including the Genetics, Environmental and Microbial (GEM) Project which is a collaboration looking at the factors contributing to CD currently underway across Canada. For more information, please visit www.ccfc.ca and www.gemproject.ca.

Although CD most commonly affects the lower end of the small intestine (the ileum) and the beginning of the large intestine (the colon), it may involve any part of the Gastrointestinal (GI) tract. In UC, on the other hand, the GI involvement is limited to the colon. In CD, all layers of the intestine may be involved; this can result in deep ulcers that go through the wall of the bowel completely. These can cause complications such as abscesses in the abdomen or can lead to the development of connections between the bowel and other organs (fistulas). For example there can be connections between the small bowel and bladder (leading to recurrent urinary tract infections). CD is often discontinuous, with normal healthy bowel in between patches of diseased bowel. In contrast, UC affects only the superficial layers (the mucosa) of the colon in a more even and continuous distribution, which starts at the level of the anus. Both CD and UC can present with extra intestinal manifestations (such as liver problems, arthritis, skin manifestations and eye problems) in different proportions. Differences are summarized in Table 2-1.[1]

Currently there is no cure for CD; current therapy is directed at achieving and maintaining remission (freedom from symptoms), and to achieve a normal quality of life. The approach is similar with UC, although UC technically can be 'cured' by surgical removal of the large intestine (although this option is reserved until medical therapy fails).

Both CD and UC have significant impacts on the person's quality of life through symptoms such as abdominal pain, bleeding, fatigue, vomiting, diarrhea, itchiness or irritation around the anus, flatulence and bloating. Weight loss and anemia also pose significant problems. IBD is a lifelong disease, usually starting in early adulthood in otherwise healthy, active individuals. IBD has a substantial personal burden: it can impact career choices, lead to reduced work hours, impact family planning decisions, and lead to disparity and depression. IBD poses unique issues with intimate relationships, contributing to a divorce rate several times higher than the Canadian average. There are also the concerns which surround ongoing drug treatment, recurrent hospitalizations and surgeries. It can complicate travel, life and working arrangements due to the need for toilet access. People with IBD can lead generally normal lives most of the time, but with ongoing medication needs and occasional flares that may require hospitalization with surgery. The unpredictability of symptoms and the prospect of eventual surgery burden daily life. Finally, there can be a lack of support from family, friends and work due to the intimate nature of symptoms.

TABLE 2-1: COMPARISONS OF CHARACTERISTICS OF CD AND UC

	CD	UC
Occurrence	More females than males All ages, usual onset 15-35 years	Similar for males and females All ages, usual onset 15-45 years
Symptoms	Diarrhea, fever, sores in the mouth and around the anus, abdominal pains and cramps, anemia, fatigue, loss of appetite, weight loss, pain and swelling in the joints	Bloody diarrhea, mild fever, abdominal pains and cramps, fatigue, loss of appetite, weight loss, pain and swelling in joints
Terminal ileum involvement	Common	Rarely
Colon involvement	Often	Always
Rectum involvement	Often	Always
Peri-anal disease	Common	Never
Distribution of Disease	Patchy areas of inflammation	Continuous area of inflammation
Endoscopic Findings	Deep and snake-like ulcers	Diffuse ulceration
Depth of inflammation	May be transmural, deep into tissues	Shallow, mucosal
Fistulas between organs	Common	Never
Stenosis	Common	Rarely
Granulomas on biopsy	Common	Never
Surgical 'cure'	Often returns following removal of affected parts, women also have a decreased likelihood of pregnancy	Usually 'cured' by removal of colon, decreased likelihood of pregnancy
Treatment	Drug treatment (sulfasalazine, corticosteroids, immune modifiers, antibiotics, biologic therapies) Diet and nutrition Surgery (repair fistulas, remove obstruction, resection and anastomosis)	Drug treatment (sulfasalazine, corticosteroids, immune modifiers, biologic therapies) Surgery (rectum/colon removal)
Cure	Incurable Maintenance therapy is used to reduce the chance of relapse	Through colectomy only Maintenance therapy is used to reduce the chance of relapse
Complications	Blockage of intestine due to swelling or formation of scar tissue, abscesses, sores or ulcers (fistulas), malnutrition	Bleeding from ulcerations, perforation (rupture) of the bowel
Smoking	Higher risk for smokers	Lower risk for smokers
Mortality risk	Increased risk of colorectal cancer and overall mortality	Increased risk of colorectal cancer. No Change in mortality risk

2.2 Crohn's Disease

As noted above, CD is a chronic (ongoing) disorder that causes inflammation of any area of the GI tract from the mouth to the anus, although it most commonly affects the small intestine and/or colon. The symptoms and complications of CD differ, depending on what part of the intestinal tract is inflamed. CD is classified based on the age at diagnosis, the location of the disease, and the disease behaviour (penetrating and/or stricturing [scarring] or neither).[2]

2.2.1 Symptoms

Persistent diarrhea (loose, watery, or frequent bowel movements), crampy abdominal pain, fever, and, at times, rectal bleeding are the hallmark symptoms of CD, but they vary from person to person and may change over time. Loss of appetite and subsequent weight loss may also occur. However, the disease is not always limited to the GI tract; individuals may experience symptoms outside of the intestine, which may affect the joints, eyes, skin and liver. Fatigue is another common complaint. Children who have CD may suffer delayed growth and sexual development.

Some patients may develop tears (fissures) in the lining of the anus, which may cause pain and bleeding, especially during bowel movements. Inflammation may also cause a fistula to develop. A fistula is a tunnel that leads from one loop of intestine to another, or that connects the intestine to the bladder, vagina or skin. Fistulas occur most commonly around the anal area. If this complication arises, the patient may notice drainage of mucus, pus, or stool from this opening.

Symptoms may range from mild to severe. Because Crohn's is a chronic but fluctuating disease, patients will go through periods in which the disease flares up, is active, and causes symptoms. These episodes are followed by times of remission – periods in which symptoms disappear or decrease and good health returns. In general, people with CD lead mostly full, active and productive lives. Children with CD may fail to develop or grow properly.

2.2.2 Treatment Options

As there is no cure for CD, the short-term goal of medical treatment is to bring symptoms under control, by suppressing the inflammatory response to induce a remission. Remission leads to normalization of quality of life, and is hopefully associated with healing of the damaged bowel. The long-term goal is to maintain this remission, that is, to use medical therapy to decrease the frequency of disease flares and to prevent complications.

Several groups of drugs are used to treat CD today. They are:

- Corticosteroids: Prednisone and budesonide, among other steroids, are available orally and rectally. Corticosteroids can also be given intravenously (methylprednisolone). They non-specifically suppress the immune system and are used to treat moderate to severely active CD. They are very effective agents but may be associated with significant short- and long-term side effects. They should not be used as a maintenance medication.

- Immune modifiers: Azathioprine, 6-Mercaptopurine (6-MP), methotrexate and cyclosporine, sometimes called immunomodulators, are used to help decrease corticosteroid dependency. In addition, immune modifiers may help maintain disease remission.

- Antibiotics: metronidazole, ciprofloxacin and others help heal anal fistulas.

- 5-Aminosalicylates (5-ASA): This class of anti-inflammatory drugs includes sulfasalazine and oral formulations of mesalamine and 5-ASA drugs; also may be administered rectally. These medications typically are used to treat mild symptoms.

- Biological therapies: Infliximab and adalimumab are currently approved in Canada for moderately to severely active Crohn's in patients who have not responded adequately to conventional therapy. Given by infusion or injection, these drugs are produced by live cells (hence the name 'biologicals'). They work by blocking the immune system's production of tumour necrosis factor-alpha (TNF-alpha), a cytokine (chemical) that intensifies inflammation. Several other biologic agents for both CD and UC have been shown, in some cases, to be effective in clinical trials. They have been approved for use in other countries and may be approved by Canadian regulatory authorities over the next few years.

Currently, people with CD in Canada are treated in step-wise approaches – the traditional "step-up" or the newer "step-down" approaches. The "step-up" approach treats patients with corticosteroids during periods of disease flare, to reduce symptoms and induce remission. These drugs are not generally taken on a long-term basis. For long-term control, people may start with 5-ASA if symptoms are mild, or may start with one of the immune modifiers if symptoms are moderate. In the next step-up, people often have to try more than one immune modifier to get good results. If people have tried one or two different immune modifiers and still have problems, then biological therapies are tried.[3] In the "step-up" sequence, biologicals are reserved for later use because they are the most expensive of the drugs available. However, patients with fistulizing disease may start a biological therapy early, because other drugs are not effective. Best practices for the use of biologicals are still being defined, and there may be a variety of current practice patterns. For example, some researchers and clinicians now think that it may be worthwhile to try these drugs early in a "step-down" approach since they can be very effective and they could change the course of the disease, by making surgery a less likely outcome for severe cases.

2.2.3 Surgery

Historically, two thirds to three quarters of patients with CD have required surgery at some point during their lives.[4] Surgery becomes necessary in two situations: first, when medications are not working (medically refractory disease) and second, if complications arise such as fistulae, absesses or scarring and narrowing of the bowel. In most cases, the diseased segment of bowel and any associated abscess is removed (resection). The two ends of healthy bowel are then joined together in a procedure called an anastomosis. While resection and anastomosis may allow many symptom-free years, this surgery is not considered a cure for CD, because the disease frequently recurs at or near the site where the bowel is joined together.

An ostomy may be required when surgery is performed for CD when there is no healthy bowel to connect. This may happen in patients with disease of both the rectum and the colon. After the surgeon removes the colon, the small bowel is brought to the skin, so that waste products may be emptied into a pouch attached to the abdomen. The result is an ileostomy or a colostomy.

The overall goal of surgery in CD is to conserve bowel where possible and return the individual to the best possible quality of life.

2.2.4 Complications

The most common complication of CD is blockage of the intestine due to swelling and the formation of scar tissue. This usually results from repeated bouts of inflammation and ulceration. The result is thickening of the bowel wall and a significantly narrowed intestinal passage. Symptoms of intestinal obstruction include crampy pain around the mid-abdomen, frequently associated with vomiting. The abdomen may also become bloated and distended. Medications may relieve the obstruction by reducing the local area of inflammation, but surgery may be required if the obstruction is severe and does not respond to medical treatment. Surgery may also be indicated if the blockage recurs frequently.

Another complication is sores or ulcers within the intestinal tract that sometimes turn into fistulas. These affect about 30% of people with CD and often become infected. If the fistula is small, medical treatment may be sufficient to heal it. Large or multiple fistulas, on the other hand, may signal the need for surgery, particularly if they are accompanied by fairly persistent symptoms, such as fever or abdominal pain or severe diarrhea. Occasionally a fistula forms an abscess, or collection of pus, near the intestine. This is a pocket of infection that requires drainage either through a catheter inserted by a radiologist or a special drain that is surgically inserted. The areas around the anus and rectum are often involved. In addition to fistulas, cracks or fissures may also develop in the lining of the mucus membrane of the anus.

Another type of complication commonly encountered in people with CD is related to malnutrition or the presence of nutritional deficiencies. These are deficiencies of proteins, calories, and vitamins. They generally do not develop unless the disease is extensive and of long duration, conditions that may contribute to inadequate dietary intake and poor absorption of nutrients. Medical treatment and/or nutritional supplements are usually effective in the replacement of nutrients.

Risk of cancer of the colon and small bowel is also a potential complication of longstanding CD.

2.3 Ulcerative Colitis

UC is a chronic (ongoing) disease of the colon. The disease is marked by inflammation and ulceration of the colon mucosa, or innermost lining. Tiny open sores, or ulcers, form on the surface of the lining, where they bleed and produce pus and mucus. Because the inflammation makes the colon empty frequently, symptoms typically include diarrhea (most often bloody) and often crampy abdominal pain. There is also a sense of incomplete emptying after bowel motions

along with urgency. Some patients will have false urges and pass only tiny amounts of blood and mucous.

The symptoms of UC, as well as possible complications, will vary depending on the extent of inflammation in the rectum and the colon. The rectum is always involved, but can extend a variable distance up to and including the entire colon.

2.3.1 Symptoms

The first symptom of UC is a progressive loosening of the stool. The stool is generally bloody and may be associated with crampy abdominal pain and severe urgency to have a bowel movement. The diarrhea may begin slowly or quite suddenly. Loss of appetite and subsequent weight loss are common, as is fatigue. In cases of severe bleeding, anemia may also occur. In addition, there may be skin lesions, joint pain, eye inflammation, and liver disorders. Children with UC may fail to develop or grow properly.

Approximately half of all patients with UC have relatively mild symptoms: multiple stools a day, usually without blood, some pain and cramping, a constant feeling of the need to empty the bowel, and no fever or a low-grade fever. Severely ill people experience more than six bloody stools a day, with fever and/or anemia. In general, the severity of symptoms correlate with the extent of colon involved with the disease. The symptoms of UC tend to come and go, with fairly long periods in between flare-ups in which patients may experience no distress at all. These periods of remission can span months or even years, although symptoms do eventually return. The unpredictable course of UC may make it difficult for physicians to evaluate whether a particular course of treatment has been effective or not.

2.3.2 Treatment Options

Currently, there is no medical cure for UC. However, effective medical treatment can suppress the inflammatory process. As such, the treatment of UC involves medications that decrease the abnormal inflammation in the colon lining and thereby control the symptoms, with the goal of maintaining this induced remission. Medical options are centered around 5-ASAs and topical (rectal) therapy for people with mild to moderate symptoms. Corticosteroids are used for moderately to severely active disease. However, due to long-term side effects they should not be used for maintenance therapy. Immune modifiers can be used to replace corticosteroids once symptoms of a flare come under control. Biological modifiers are indicated in patients who have failed conventional therapy or who are hospitalized with severe colitis not improving with corticosteroids. Cyclosporine, a potent immunosuppressant used to prevent rejection in transplant medicine may be used for severe cases of UC.

2.3.3 Surgery

In one-quarter to one-third of patients with UC, medical therapy is not completely successful or complications arise. Under these circumstances, surgery may be considered. This operation involves the removal of the colon (colectomy). Unlike CD, which can recur after surgery, UC is "cured" once the colon is removed.

Depending on a number of factors, including the extent of the disease and the patient's age and overall health, one of two surgical approaches may be recommended. The first involves the removal of the entire colon and rectum, with the creation of an ileostomy or external stoma (an opening on the abdomen through which wastes are emptied into a pouch, which is attached to the skin with adhesive). A more recently developed procedure also calls for removal of the colon, but it avoids an ileostomy. By creating an internal pouch from the small bowel and attaching it to the anal sphincter muscle, the surgeon can preserve bowel integrity and eliminate the need for the patient to wear an external ostomy appliance.

2.3.4 Complications

Local complications of UC include profuse bleeding from deep ulcerations, perforation (rupture) of the bowel, or simply failure to respond appropriately to the usual medical treatments.

Another complication is severe abdominal distension. A mild degree of distention is common in individuals without any intestinal disease and is somewhat more common in people with UC. However, if the distention is severe or of sudden onset, and if it is associated with active colitis, fever, and constipation, a physician may suspect a serious complication of colitis, called toxic megacolon. Fortunately, this is a rare development. It is produced by severe inflammation of the entire thickness of the colon, with weakening and ballooning of its wall. The dilated colon is then at risk of rupturing. Treatment is aimed at controlling the inflammatory reaction and restoring losses of fluid, salts, and blood. If there is no rapid improvement, surgery may become necessary to avoid rupture of the bowel.

As with CD, risk of colorectal cancer is a potential complication of longstanding UC.

Section 3: Epidemiology

Summary:

- *IBD is more common in developed countries, and is influenced by genetics, environment, ethnicity and gender.*
- *Canada has among the highest frequency of people with CD and UC in the world.*
- *The best estimate is that there are 112,000 people living with CD and 88,500 people living with UC in Canada in 2008, for a total of nearly 201,000 individuals with IBD (0.60% of the population).*
- *Over 9,200 people every year are newly diagnosed with IBD: 5,100 people with CD and 4,100 with UC.*
- *The age of onset is typically in the twenties for CD, and throughout adulthood for UC. The number of people with disease peaks around age 30 for both diseases, and does not decline until age 80.*
- *Compared to people without disease, there is a 47% increased risk of premature death with CD, which includes an increased risk of colorectal cancer. There does not seem to be an increased risk of premature death with UC.*

3.0 Introduction

Epidemiology is the science that examines the occurrence and distribution of a disease.

Epidemiology answers questions like these:

- Who gets a disease?
- Why are some people more likely to get a disease?
- How many people have a disease?
- How many new cases of a disease get diagnosed per year?
- How many people die from this disease?

This section of the report will cover four aspects of epidemiology:

- Risk factors (also known as etiology): the causes of IBD and/or the factors that are linked to occurrence of IBD
- Prevalence: the number of people who have IBD at a given point in time
- Incidence: the number of new cases of IBD that can be expected each year
- Mortality: the occurrence of death in people with IBD

3.1 Etiology

The causes of CD and UC have not been determined. It is expected that there is a combination of genetic and environmental factors that inappropriately activate the gastrointestinal immune system. While the specific causes of IBD are not known, there are some patterns of disease occurrence that have been observed. The strongest of these is the geographical pattern.

For reasons that are not clearly understood, IBD is largely a disease of the developed world. Historically, this has been areas in northerly latitudes (northern Europe and North America). IBD seems low in developing countries, but as these societies become more industrialized, UC emerges. Subsequently, CD rates begin to climb, ultimately matching and often surpassing the occurrence of UC. When people migrate, they take on the frequency of disease of the new country.[5]

IBD clusters in families, although on most occasions there are no affected relatives. Siblings are most likely to be affected; the risk of IBD in a sibling is 10 to 20 times higher than the general population.[6,7] The strongest evidence is from twin studies. Up to 50% of identical twins will both have CD, while 10% will both have UC.[8,9] However, the reverse is also true: for at least 50% of identical twins where one has CD, the other will <u>not</u> have CD.

Researchers are working to find a link to specific genes that are related to the transmission of the disease. The most important abnormal mutation identified thus far is in a gene known as NOD2/CARD 15; it occurs up to three times as frequently in people with CD as in the general population.[10,11] This single mutation cannot predict who will get the disease, since it also occurs in people without CD (in other words, many people who will never get CD also have this mutation). Mutations like this one may eventually serve as a marker for type and/or severity of disease.[12,13] The growing number of identified mutations associated with CD and also UC may help to understand the pathways that lead to disease.[14]

Some factors in the environment have been linked to IBD. People who have had an appendectomy also have a lower occurrence of UC.[15] There may be a weak association between the use of the birth control pill and the development of IBD.[16] There are conflicting reports on childhood infections and whether they are a risk factor for IBD.[17] The underlying idea is that a decrease in childhood exposure to bacteria and viruses in modern environments with high levels of hygiene can lead to inappropriate reactions of the immune system (the 'hygiene hypothesis'). Curiously, smokers have a lower occurrence of UC than non-smokers.[18] In contrast, smokers have a higher risk of CD.[25] Finally, although diet would seem to be an obvious link to IBD, there has been no conclusive evidence associating any dietary habits with IBD.[5] It is important to note that an association with IBD does not necessarily imply causality. In other words, just because something occurs more or less frequently in people with IBD, it does not mean that this causes (or prevents) IBD.

IBD is more common in some ethnic groups, such as Ashkenazi Jews of European descent,[19] while others appear to have a lower occurrence, such as aboriginal Canadians and New Zealand's Maori.[20,21,22] In the United States, Caucasians more often have IBD, but rates have been increasing

in African Americans.[23] Rates remain comparatively low in Americans of Hispanic or Asian origin.[23,24]

In Canada, there is a higher frequency of CD in women (1.3 females are affected for every 1 male).[25] There is no gender difference in UC. Slightly more cases of UC are found in urban settings than rural settings; there is no such association for CD.[25]

Key Findings:

- IBD is largely a disease of the developed world, with increasing occurrence of UC and then CD as a country becomes industrialized.

- Genetics is involved, shown by clustering within families and the identification of several genes which are more common in people with CD.

- Environmental factors are presumably involved, but it is not well understood how they influence the development of IBD.

- There is a higher frequency of CD in females in Canada.

3.2 Prevalence

Prevalence is the number of people with CD or UC in a population at a given point in time or over a period of time (usually per year). The percentage of people in a population who have a disease is also usually determined; this is called the prevalence proportion.

There are different methods to measure the prevalence of a disease in a population. One method is to conduct a survey in a representative sample of the entire population. This will capture everyone with a diagnosed disease, including people who are not currently engaged in the health care system (for example, people in remission). This is particularly important for CD and UC, which have fluctuating courses of disease. In a population-based survey, a random sample of a population is asked if they have a given disease. The assumption is that people can accurately report if they have been diagnosed with a disease. This assumption has limitations because people can be confused with imprecise wording or may use different words to describe their disease.

Another method is to examine a database of health records. Every time a person visits a physician or is admitted to a hospital in Canada, the visit and the reason are recorded in an electronic database. In a database study, records are searched for people who match a set of criteria (such as, a physician visit due to IBD). This will capture people who have a disease as diagnosed by a physician and who seek health care. As long as several years of medical history are examined, it should also capture people with fluctuating disease (who may go several years without any health care contacts for their disease). In Canada, with universal access to health care, electronic health database studies include the entire population.

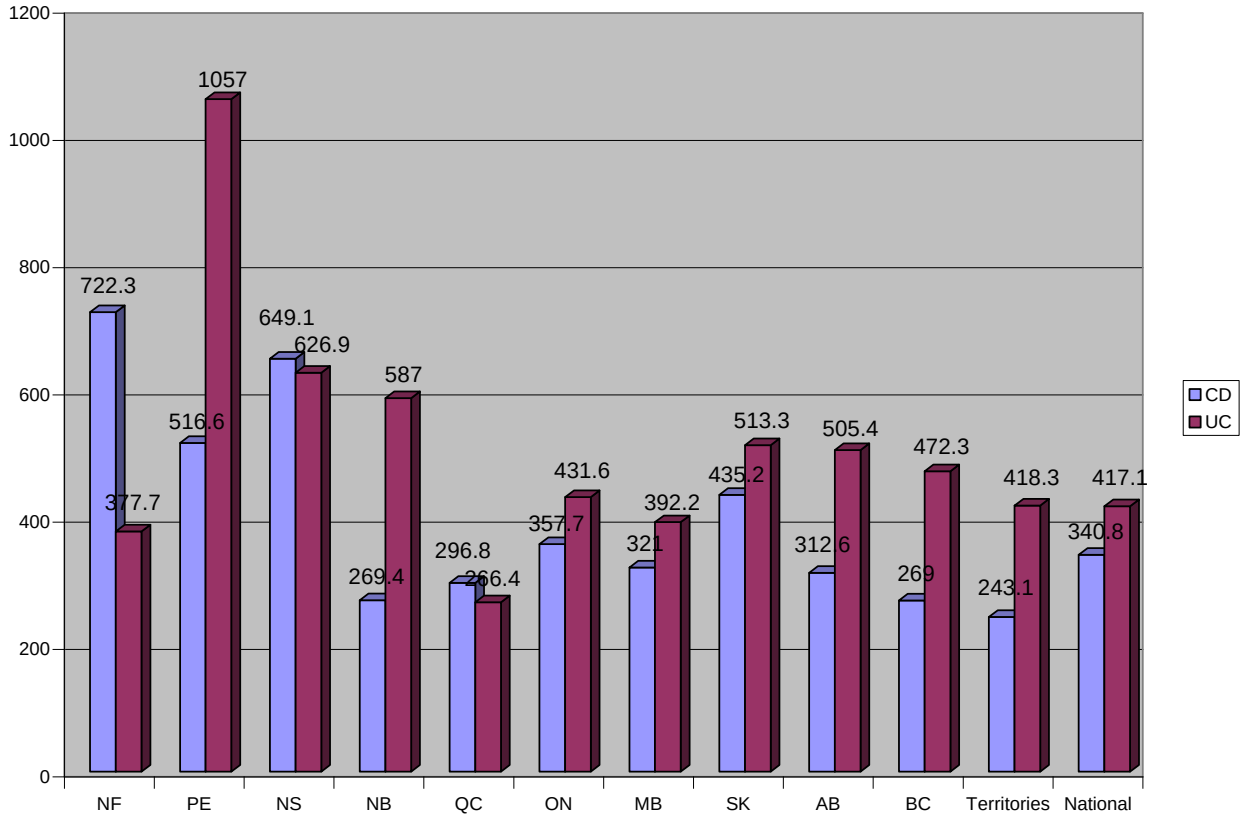
Canada is fortunate to have both survey and database studies of the prevalence of UC and CD. This report will focus on the Canadian-specific research, especially since we know that prevalence

varies considerably by country. There will also be an international comparison to place the Canadian findings in context.

3.2.1 CCHS Survey

The Canadian Community Health Survey (CCHS) was conducted by Statistics Canada to provide cross-sectional estimates of health issues across Canada. Approximately 130,000 Canadians were surveyed in 2005 and asked a variety of health-related questions, including: "Do you suffer from a bowel disorder such as Crohn's Disease, ulcerative colitis, irritable bowel syndrome or bowel incontinence diagnosed by a health professional?" Based on the responses, the number of people and percentage of people in the population was estimated for each province. The results are in Figure 1 for CD and UC.

Figure 1: CCHS Survey – Prevalence per 100,000, CD and UC[26]



Key Findings:

- In 2005, nearly 206,000 Canadians reported having CD or UC out of the 27 million sampled for the survey; that is, 758 cases per 100,000, or 0.76% of the population. Based on this self-reported data, UC was more common than CD. However, self-report data are typically an overestimate.

- For Canada's 33 million population in 2008, there would be 252,000 cases of IBD.

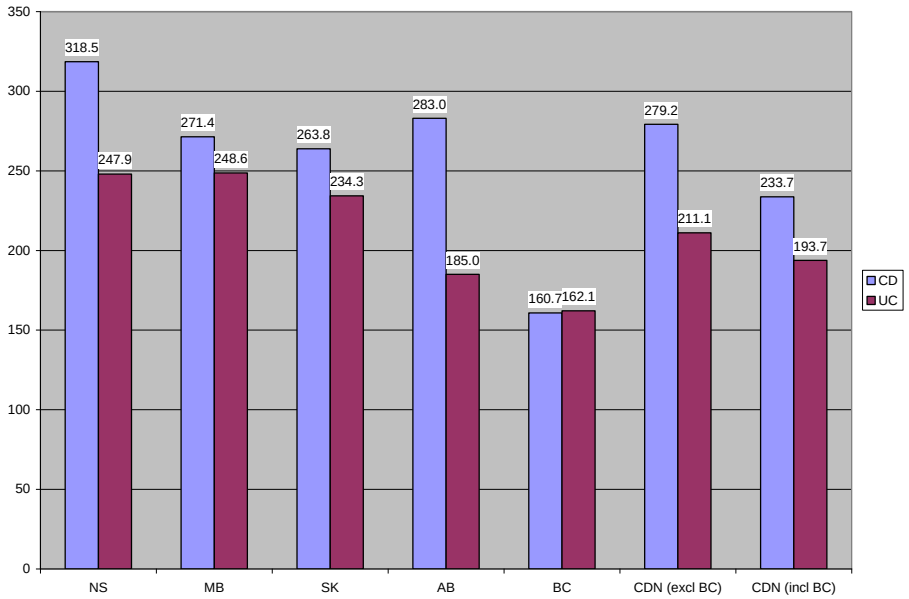
- UC was more common than CD, both nationally and in most regions (except QC, NS and NF). There were estimated to be 113,000 cases of UC and 92,000 cases of CD.

- There were large differences between provinces, particularly in less populous provinces where a random sample could be less representative of the population.

3.2.2 Database Study

A landmark study was conducted by Canadian researchers to estimate the prevalence and incidence of CD and UC in Canada.[25] Funded by the Crohn's and Colitis Foundation of Canada, this study was led by researchers in Manitoba, who had first developed and tested a case definition which was capable of selecting almost all of the people with the disease of interest (sensitivity) but almost none of the people without the disease (specificity).[27] The definition of a case was someone who had at least five health system contacts (outpatient visit or hospitalization) recorded for IBD. For people who were registered in the health system for less than two years, this was reduced to three contacts. There were five provinces that participated; all provinces had at least thirteen years of records available in each province. Results are estimated as of July 1, 2000 and are presented in Figure 2.

Figure 2: Prevalence of CD and UC per 100,000 by Province[25]



Key Findings:

- In 2000, Canadian prevalence was estimated at 468.1 per 100,000 for UC and CD combined, or 0.47% of the population.

- Prevalence was found to be lower in the database study than in the survey; typically, population surveys are overestimates, as they rely on patient recall.

- Results were much more consistent across provinces than the survey data. The only exception in this study was BC, which had substantially lower prevalence. Therefore, a Canadian average was calculated by excluding BC.

- CD was more common than UC in all provinces except BC, where they were similar.

- Females were substantially more likely than males to have CD (1.31 females for every 1 male). There was no gender difference for UC.

- Overall there was no difference in prevalence for urban versus rural settings for CD; for UC, there were 1.13 urban dwellers for every 1 rural dweller.

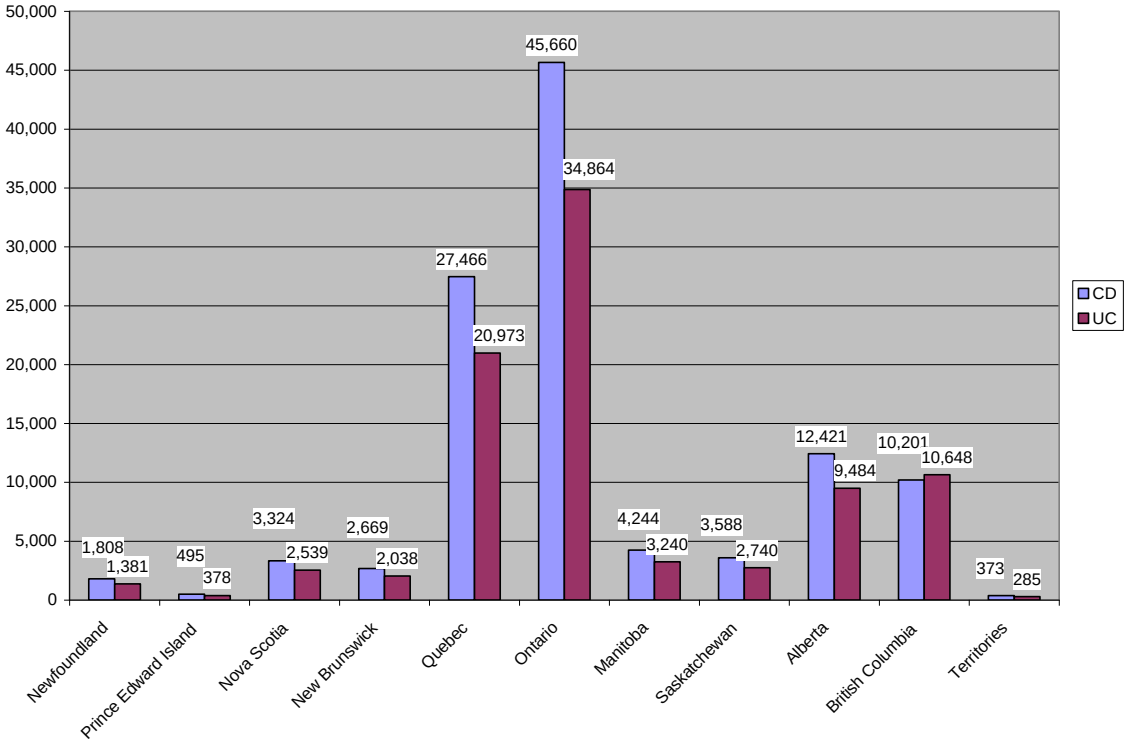
3.2.3 Estimated Current Prevalence

The current prevalence of IBD in Canada can be estimated using either or both sets of prevalence results. The survey was more likely to over-estimate the total number of people with IBD because of imprecise understanding of medical questions in the general public, but it included all regions of Canada. The database study was more likely to be accurate for the provinces that contributed data, but it was missing some provinces.

To estimate the current number of Canadians with IBD, the database study was extended to all remaining provinces and territories using the Canadian average (excluding BC). Over time, there was an increase in the population of Canada, which would increase the number of people with IBD. More importantly, every year there are new cases diagnosed (see Section 3.3). The new cases have to be added to the existing group of people with IBD to calculate a current estimate. On the other hand, there are also losses due to migration and death, and these cases need to be subtracted.

In 2008, there are estimated to be 112,000 Canadians with CD and 88,500 Canadians with UC, for a total of 200,500 people (0.60% of the population). The results are depicted for each province in Figure 3.

Figure 3: Estimated 2008 Prevalence, CD and UC



New data emerging from ongoing research support the extrapolation of Bernstein's Canadian average to the remaining provinces. Specifically, the prevalence of CD in Quebec has recently been estimate at 243 in 2000 (compared to 234, the 2000 Canadian average [excluding BC]).[28]

Key Findings:

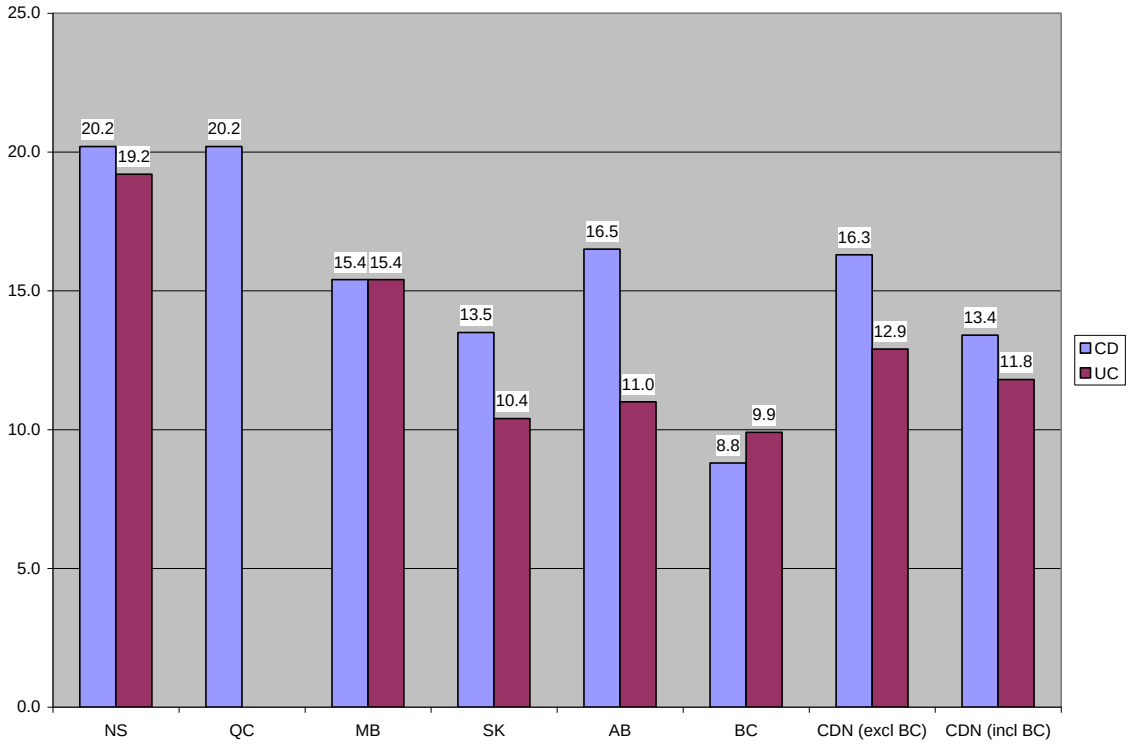
- In 2008, the best estimate of the prevalence of IBD is nearly 201,000 Canadians with IBD: 112,000 with CD and 88,500 with UC (0.60% of the Canadian population).

- Using the self-report CCHS data, upper bound for the prevalence of IBD can be set: 252,000 individuals (0.76% of the Canadian population).

3.3 Incidence

The number of new cases per year (incidence) was calculated in the database study and in a recent Quebec study, as the average annual rate for 1998 – 2000. The findings are presented in Figure 4.

Figure 4: Incidence per 100,000 by Province[25,28]



Key Findings:

- The pattern of incidence mirrored the pattern of prevalence: lowest in BC, and highest in NS and QC.

- The average Canadian incidence is 16.3 new cases of CD and 12.9 new cases of UC for every 100,000 people. This means that the number of people newly diagnosed with CD is greater than the number of people newly diagnosed with UC.

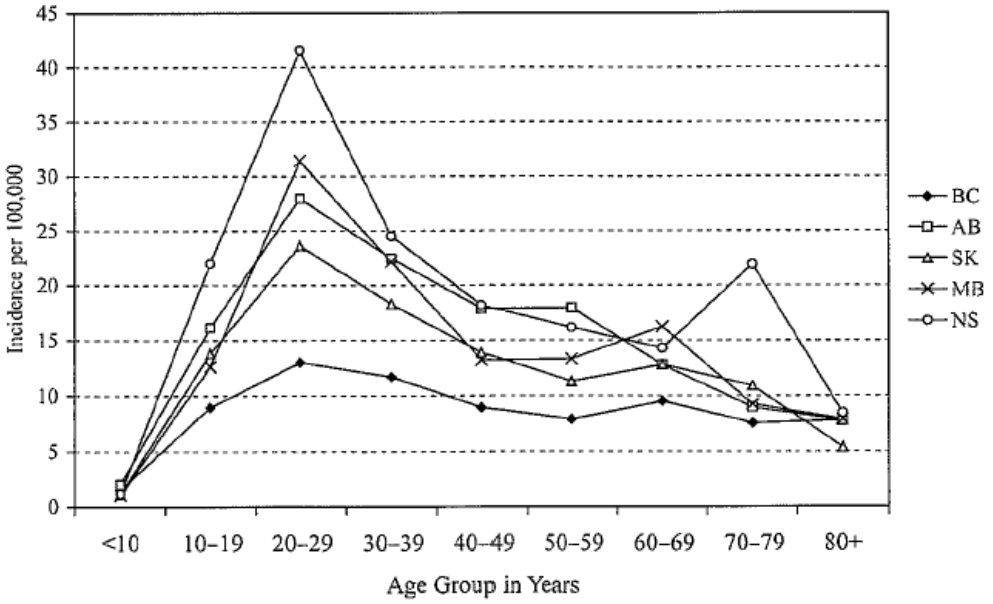
- Every year, there are 9,200 new cases of IBD: 5,100 people with CD and 4,100 people with UC.

3.3.1 Age Distribution

The database study investigated the ages of people with CD and UC.

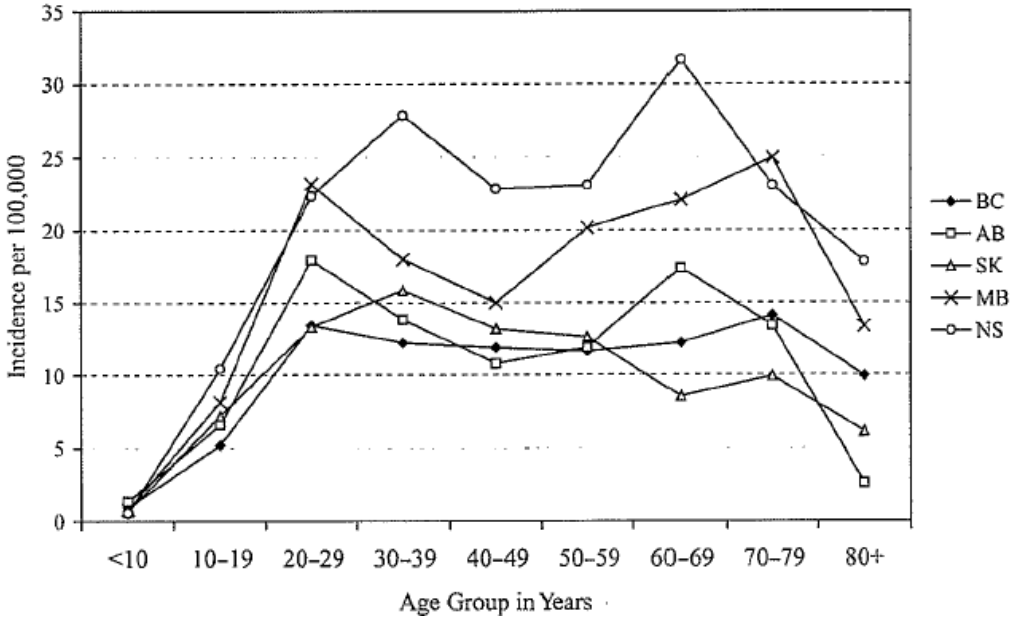
The age-specific incidence is shown in Figures 5 and 6. This reflects the age of onset for the disease, that is, the age at which the disease was diagnosed.

Figure 5: Incidence by Age, CD[25]



Bernstein et al 2006

Figure 6: Incidence by Age, UC[25]



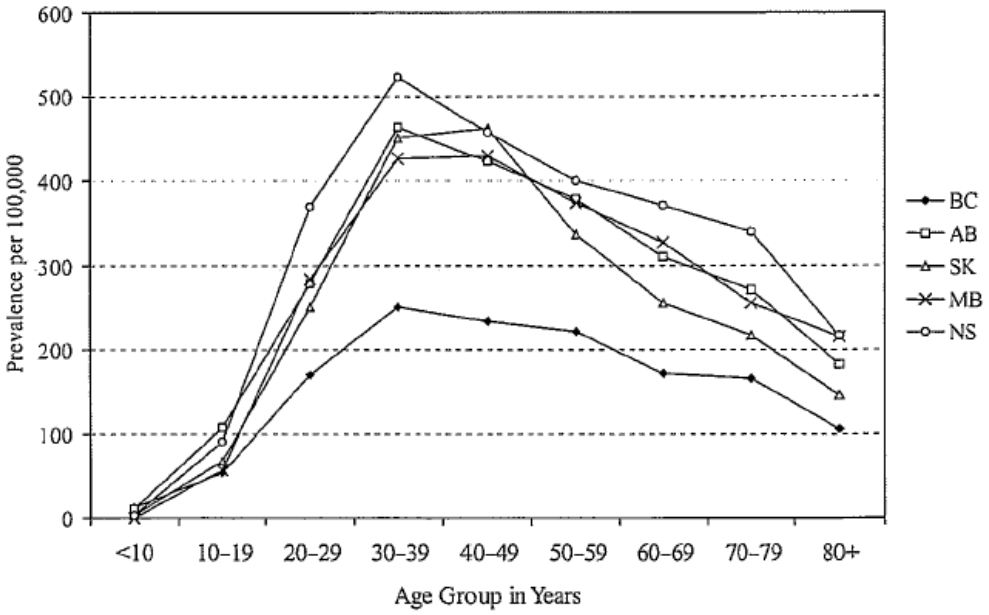
Bernstein et al 2006

Key Findings:

- The age of onset is most commonly in the twenties for CD, across all provinces.
- There was no single peak age of onset for UC; there was an initial peak in the twenties, followed by a plateau, and possibly a second peak in later years.

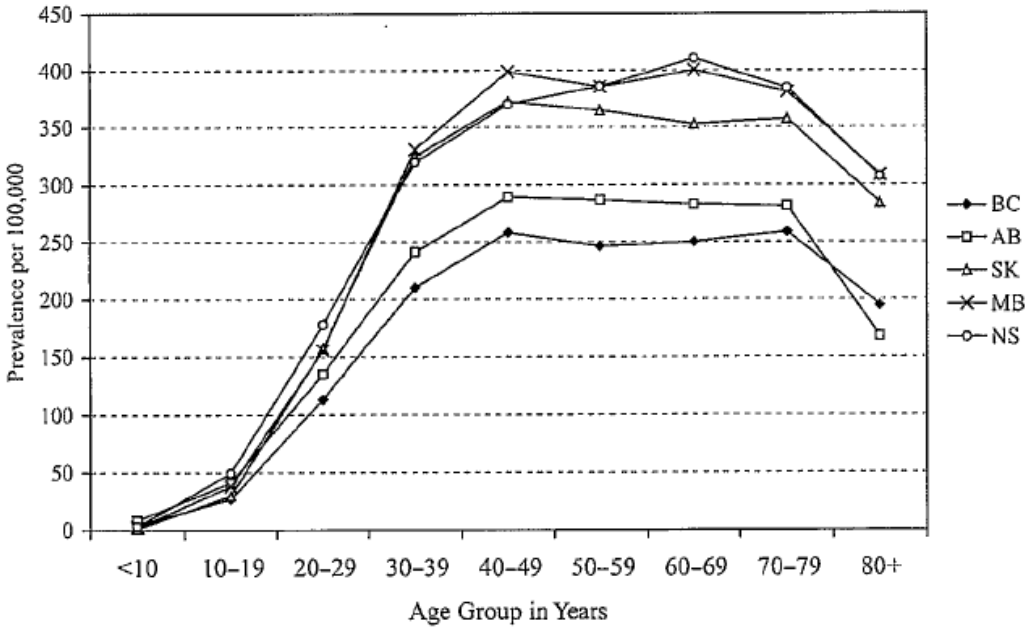
CD and UC can be diagnosed at a young age, but new cases continue to appear in older ages. As a result, as people age, there are more and more cases in the population. In other words, the overall prevalence stays high while prevalence within older age groups declines for CD – see Figures 7 and 8.

Figure 7: Prevalence by Age Group, CD[25]



Bernstein et al 2006

Figure 8: Prevalence by Age Group, UC[25]



Bernstein et al 2006

Key Findings:

- The overall prevalence of CD and UC increases with increasing age.

- Prevalence within specific age groups peaks between 30 and 39, and remains at this level, only decreasing after age 80 for UC while declining across age groups for CD.

3.3.2 Pediatric Epidemiology

CD and UC also occur in children. There are less data available in this age group. Children over 12 were in the CCHS survey, but results are not available for children as a separate group. Children were included in the database study and were analyzed separately. Incidence and prevalence for those under 20 are presented in Figures 9 and 10.

Figure 9: Canadian Pediatric Incidence per 100,000[25]

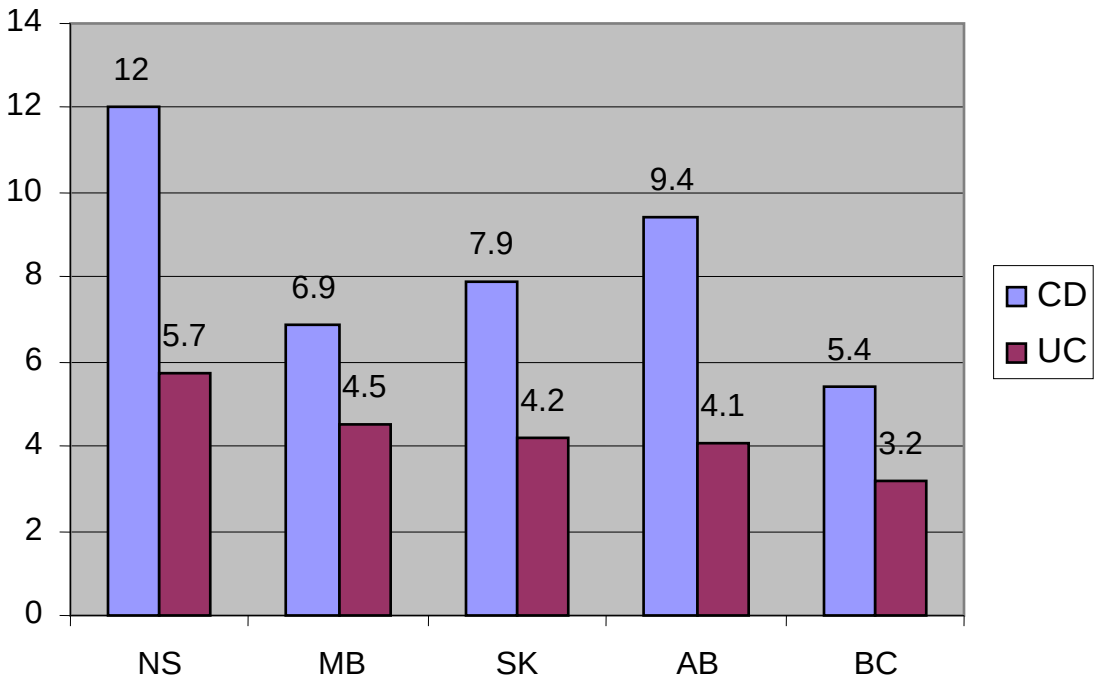
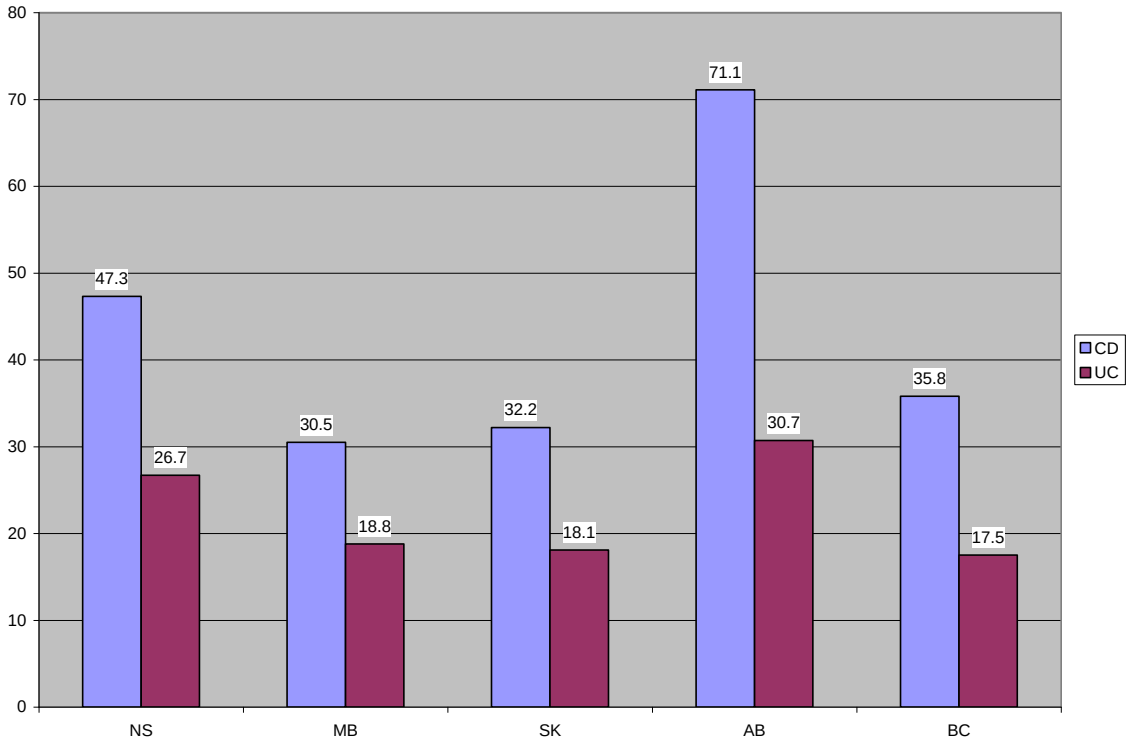


Figure 10: Canadian Pediatric Prevalence per 100,000[25]



Key Findings:

- Results in children mirror those of adults from the database study. CD was more common than UC in all provinces. Prevalence and incidence were lowest in BC and highest in NS, but similar amongst the three prairie Provinces.

- There are about 3,300 children under 20 with CD and 1,600 children under 20 with UC in Canada, for a total of 4,900 people.

3.4 International Comparison

Overall, Canada has among the highest reported prevalence and incidence of IBD in the world.

Historically, countries in more northerly latitudes have a higher occurrence of both CD and UC.[5] There is more disease in the developed countries of northern Europe and North America than in southern Europe, Asia, Africa and Latin America. This may explain why BC has a substantially lower rate of CD than the rest of Canada, given more residents of recent Asian immigration. Interestingly, children of Asian immigrants may have a high occurrence of IBD, as the effect of the environment serves to "catch up" this population to the much-higher Canadian average.[29]

In the past, international studies of IBD had used a mixture of methods, different definitions of IBD, definition of the study population, etc. The quality of research was not always high and the

underlying variation resulted in a broad range of results. This made it difficult to do precise international comparisons. The Bernstein papers have set a new standard in the measurement and reporting of IBD epidemiology. It is encouraging to see that recent studies have adopted this rigourous methodology. Recent studies have been conducted in the US and New Zealand; these studies have found disease occurrence that approach Canadian levels. Results of international studies are summarized in Table 1 for CD and Table 2 for UC.

Table 1: International Comparison, Crohn's Disease

Location	Incidence per 100,000	Prevalence per 100,000
Older studies		
Europe[25]	1.6 – 11.6	27 – 48
North Europe[30]	7.0	up to 214
South Europe[30]	3.9	Not reported
Southern Areas[5,25]	<1.0 – 4.2	Not reported
Recent studies		
Minnesota[31]	7.9	174
United States[32]	Not reported	201
Canterbury, NZ[21]	16.5	155
Canada[25]	16.3	338

Table 2: International Comparison, Ulcerative Colitis

Location	Incidence per 100,000	Prevalence per 100,000
Older studies		
Europe[25]	6.3 – 15.1	58 – 157
North Europe[30]	11.8	up to 243
South Europe[30]	8.7	Not reported
Southern Areas[5,25]	<1.0 – 6.0	Not reported
Recent studies		
Minnesota[31]	8.8	214
United States[32]	Not reported	238
Canterbury, NZ[21]	7.6	145
Canada[25]	12.9	267

Several studies have found that incidence is rising internationally, particularly for CD.[33,34,35,36] This means that UC and especially CD are being diagnosed more frequently, and that the number of people with these diseases will increase over time. Furthermore, it also appears that populations with historically low incidence (Asia, south Europe) may be experiencing accelerated growth in these diseases.[5,37]

International studies are very similar to Canadian findings with respect to other aspects of epidemiology, specifically age of onset and prevalence by age. Findings from the recent broad

American database study found reasonably similar results for incidence and prevalence in the pediatric population.[32] Interestingly, it was observed that the gender bias was reversed in children: although CD was more common in adult females (as in Canada), CD was more common in pediatric males.[32] That is, males were more likely to get CD as children, while females were more likely to get CD as adults.

3.5 Mortality

There have been many international studies of mortality in IBD, although none has been conducted specifically with a Canadian population. It is reasonable to assume that the risk of death is similar in European and North American countries, given a uniformly high standard of medical care and life expectancy. Therefore, the international studies were reviewed to determine expected Canadian mortality from IBD.

It is difficult to study mortality in IBD, for two reasons. First, the majority of people with IBD are relatively young. There are very low rates of death in younger people, even for those with severe disease. This means that it is necessary to study a very large group of people, and/or study them for a very long period of time, in order to identify any trends of increased death. Second, it can be difficult to decide if a death was due to the underlying presence of IBD, even for people who die from a gastrointestinal disease.

3.5.1 Crohn's Disease

There have been at least ten population-based studies of mortality in CD patients. Seven of these studies have found an increased risk of death, while three studies have reported a slightly lower risk of death. When faced with conflicting results from multiple studies, researchers can conduct a meta-analysis. This is a statistical technique which combines data from multiple independent studies to generate a more precise estimate. Studies which are similar in methods and in quality can be combined, with more weight given to studies which include more patients (and less weight given to smaller studies).

A meta-analysis was conducted for the Australian Crohn's and Colitis Association (ACCA) in 2006. It combined ten studies and found that CD was associated with a statistically significant 47% increase in the premature mortality risk (range, 30 – 67%).[38]

The results of this meta-analysis were very close to the result of a recently published meta-analysis of thirteen studies, which found a 52% increase in the risk of premature mortality (range, 32% to 74%).[39] Since the conduct of these meta-analyses, two other important studies have been published, from California and from Denmark; they reported similar results (a 40% increase in premature mortality risk in California and 31% in Denmark).[40,41]

There were increased death rates from cancer, cardiovascular disease, respiratory disease, GI diseases, infections, and complications following medical and surgical interventions.[38] Meta-analyses of colorectal and small bowel cancer studies have found that people with CD had an elevated risk of colorectal cancer, estimated at 2.9% over the ten years following diagnosis of CD.[42,43]

3.5.2 Ulcerative Colitis

Similarly, there have been several studies of ulcerative colitis mortality, with conflicting results. The ACCA conducted another meta-analysis, using these studies: three studies reporting an increased risk, and five studies reporting a decreased risk. However, with UC, there was no significant difference in mortality risk. That is, people with UC experienced the same mortality risk as the general population. These results were duplicated in two studies published since the meta-analysis: the large California study[40], as well as a large European study (limited to the first ten years since diagnosis of UC).[44]

It appeared that people with UC had increased deaths from some diseases (gastrointestinal diseases, infections, colon cancer) but these were offset by low rates of other diseases (cardiovascular disease, lung cancer).[38] This could be due to the fact that people with UC are more likely to be non-smokers, and thus are less likely to suffer from cardiovascular disease and lung cancer. More research is needed to remove the smoking factor to determine whether there is an underlying increased risk of premature mortality among UC patients.

Key Findings:

- There is an excess risk of premature mortality for people with CD. There is a 47% increased risk of death, and an increased risk of colorectal cancer.

- There is no excess risk of premature mortality for people with UC, although there is an increased risk of colorectal cancer.

Section 4: Direct Costs

Summary:

- *Direct medical costs for IBD are estimated at $753 million in Canada in 2008. Costs are over twice as high for individuals with CD ($522 million) than with UC ($231 million). These costs are in addition to any non-IBD medical needs.*
- *Hospitalization and surgery are the largest component of cost at $345 million in Canada in 2008 ($229 million for CD, $116 million for UC).*
- *Prescription drug therapy, including biologicals, will cost $162 million in Canada in 2008. Drug therapy has changed dramatically in the past ten years. Current drugs are more expensive but can produce savings by preventing hospitalization.*
- *Physician visits are estimated at $134 million in Canada in 2008 ($80 million for CD, $54 million for UC).*
- *Many other aspects of direct medical costs have not been directly estimated in Canada, such as: laboratory tests, other health professionals (nutritionist, occupational therapist, etc), and social services (home making, meal delivery, etc). A conservative estimate based on international measurements is $93 million in Canada in 2008 ($62 million for CD, $31 million for UC).*
- *Costs depend on many factors such as age, severity, and decade of diagnosis. However, an average cost per patient was estimated to be at least $3,750 per year.*

4.0 Introduction

Direct costs are costs for resources that are offered by the public health care system. Typically, this includes: hospitalizations, surgeries, emergency department visits, physician services, medications, laboratory tests and procedures, other health care professionals (physiotherapist, occupational therapist, dietitian, chiropractor, massage therapist, etc.) social services (home health care, meal delivery, transit for handicapped, etc.) and long-term care (nursing homes, institutional care).

As described in Section 2: Disease Overview, there is no cure for either CD or UC. People with IBD live with symptoms, usually at a milder level while in remission and at a more severe level during disease flares. Between 75 – 90% of patients are in remission at any given point in time.[45] A Canadian survey of people with IBD reported severe disease activity among 9% of people with UC and 11% of people with CD.[46] Disease severity is important, because medical costs vary

dramatically by severity; studies have shown that the minority of severe patients incur the majority of costs.[47,48,49,50]

To manage their disease, people with IBD need ongoing medical care. They use physician visits, medications, and laboratory tests on a regular basis. Other health care professionals, especially dietitians, are also helpful. With increasing disease activity and flares, medications are increased and hospitalizations for surgery become common. People who have severe disease may require high levels of care, including home health care and (very rarely) institutional care.

There has been quite a bit of research into the costs of disease, especially for CD. One limitation with this research is that prices and patterns of use for health care services reflect local health care systems and practices. While there can be considerable similarity across countries, the most reliable way to measure direct medical costs in Canada is to use research conducted in Canada.

4.1 Prescription Drugs

Many people with IBD require regular medications to control their disease. These medications must be taken all the time (even while in remission) to prevent their disease from flaring, and to keep their symptoms at a manageable level. During times of increasing symptoms and higher disease activity, most patients will require increased doses or additional medications to reduce symptoms, prevent complications and return to remission.

For disease flares, corticosteroids are powerful drugs to control the immune system and induce remission. However, these drugs have long-term safety concerns, so it is not desirable to stay on these drugs for prolonged periods of time. For long-term control, people are treated with medications such as immune modifiers and 5-aminosalicylates to control their disease on an ongoing basis. More recently, new drugs called 'biologicals' became available for IBD. These drugs are made by live cells (hence the name 'biologicals') and are classified as anti-TNF drugs because they are directed against a molecule which promotes inflammation – tumour necrosis factor (TNF). They are used by people with moderately active to severe disease. They are much more expensive than conventional, older drugs, given the complicated way that they are produced, but they are also quite effective, especially for people who have not done well on other drugs. They have reduced the need for surgeries and hospitalizations; patients can achieve remission using drugs instead of surgery, for both CD and UC.[51,52,53,54] This has changed the type of costs that are incurred for CD and UC over previous years. This creates a problem when measuring medical costs. Unless research is very recent, it could reflect patterns of care that are becoming outmoded.

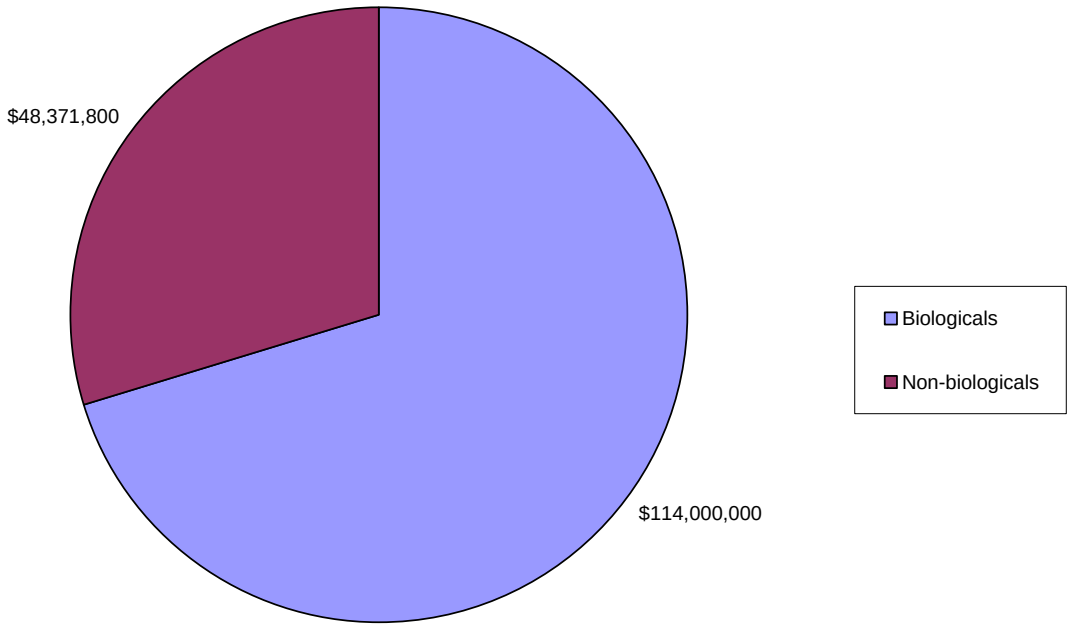
A study conducted in Manitoba in 1997 reported that 87.5% of IBD subjects had prescriptions that year (compared to 66% in the general population).[55] At that time, only 8% of people with IBD used immune modifiers, and only 4% used biologicals (which were only available on an experimental basis at the time). The average cost per patient was $774 (1997 CDN$). These figures are now outdated. What are probably still true are the patterns of use that were observed. Older people had more prescriptions than younger people. People with CD were more likely to use immune modifiers, while people with UC used 5-aminosalicylates. There was no difference in drug use between males and females. The decade of diagnosis affected prescribing

patterns; this means that newly diagnosed people were treated differently than those who had been diagnosed ten or twenty years previously.

To get a current estimate of prescription drug use, two recent data analyses were used. For an up-to-date estimate of the cost of biologicals, prescriptions in Canada in 2007 were examined for those who had drug claims paid for by public or private plans. Given the current number of claims and the estimated rate of growth, the cost of biological prescriptions for CD was forecast at $114 million in Canada in 2008.[56] This excludes prescriptions for people who do not have drug plans, but given the high cost of these drugs (over $10,000 per person per year), it is reasonable to assume that very few people pay for them out of pocket.

A recent analysis of all IBD drug claims in Manitoba showed that biologicals may comprise up to 70% of the total cost of prescription drugs.[57] Combining these two data sources, it can be estimated that in 2008 drug costs were $162 million in Canada – the majority is due to biologicals ($114 million,) with $48 million due to all the other drugs combined (see Figure 1). This cost can be expected to grow in the future, as more biologicals are developed and continuing research expands their role in therapy. Currently, the majority of this cost is attributable to CD since the biologics have been more widely used for more years in CD compared to UC. A precise breakdown of costs is not available, but a preliminary estimate is that CD costs $141 million versus $21 million for UC.

Figure 1: Prescription Drug Costs in Canada, 2008



Key Findings:

- Prescription drug costs have changed dramatically in the past ten years, due to increasing use of high-cost biologicals.

- Currently, prescription drugs for IBD cost about $162 million in Canada in 2008 (approximately $809 per person per year).

- These costs are expected to continue to grow substantially over the coming years.

4.2 Inpatient Costs: Hospitalizations and Surgeries

Canadian studies on inpatient costs include database studies in Manitoba and a national survey of members of the Crohn's and Colitis Foundation of Canada.

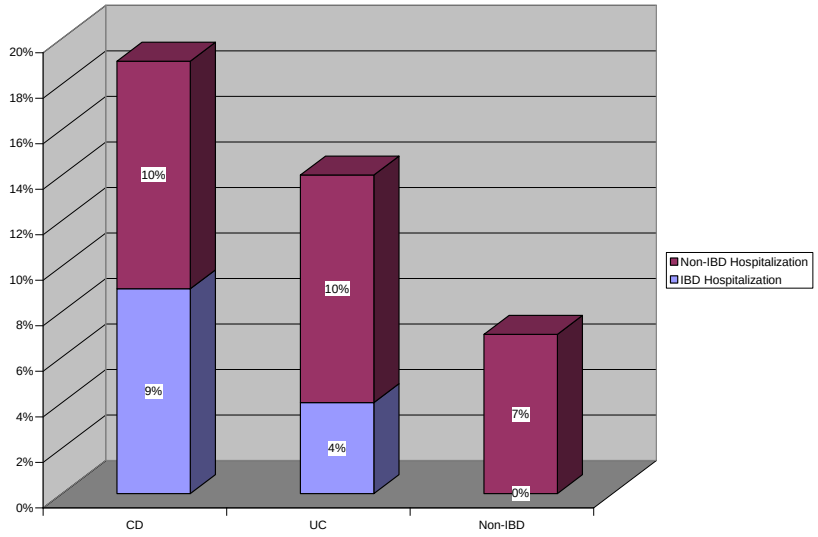
Researchers in Manitoba checked health records for people who had been identified as having IBD.[58] Individuals with IBD were twice as likely to have a hospitalization (15% per year), compared to people without IBD (7% per year). People with CD were more likely to have a hospitalization than people with UC.

Hospitalizations that were strictly due to IBD occurred in 9% of people with CD and 4% of people with UC (6% combined). This is shown in Figure 2.

People with IBD also have more hospitalizations for non-IBD reasons – at 10% per year, compared to 7% for people without IBD (Figure 2).

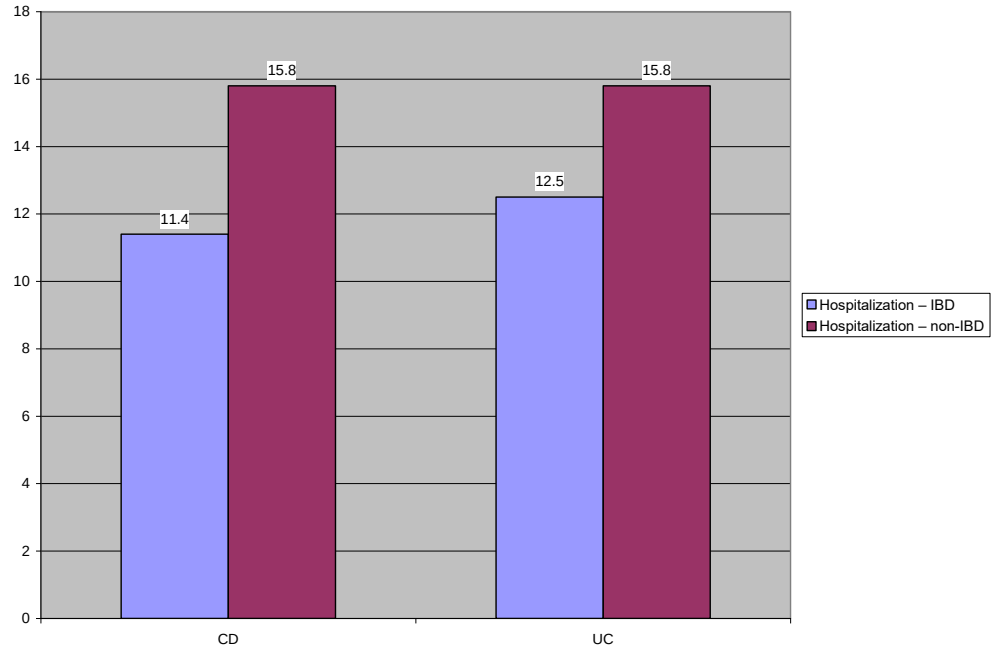
Altogether, each year, there is an excess annual rate of hospitalization of 12% for individuals with CD and 7% for individuals with UC - these extra hospitalizations are as a result of their disease.

Figure 2: Inpatient Resource Utilization[58]



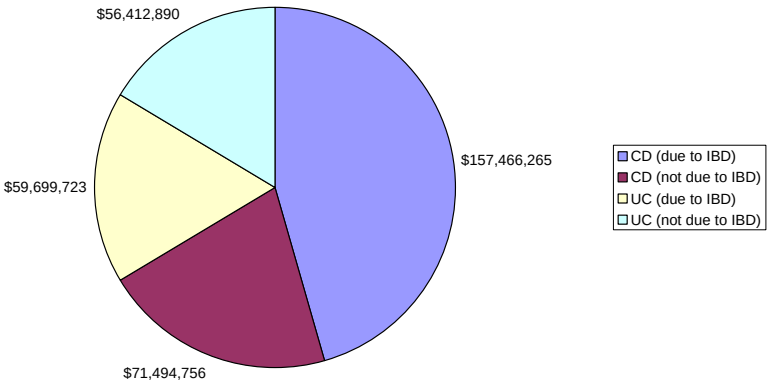
The mean length of stay was 11.4 days for CD, 12.5 days for UC, and 15.8 days for non-IBD hospitalizations (Figure 3).

Figure 3: Length of Stay



Costs for excess hospitalizations were assigned using Ontario prices for hospitalizations and physician services.[59,60] The total cost of each hospitalization was $15,587 for CD, $16,851 for UC, and $21,231 for non-IBD hospitalizations. Each year, excess hospitalizations cost an additional $229 million for Canada's 112,000 people with CD, and $116 million for Canada's 88,500 people with UC, for a total of $345 million – an average cost of $2,040 per person with CD, and $1,311 per person with UC (Figure 4). The use of biologicals can reduce this cost in the future.

Figure 4: Excess Costs of Hospitalization for IBD



A considerable amount of hospitalization occurs within the first years of diagnosis of disease.[61] For those people who will have an IBD hospitalization, 58% of these hospitalizations occur within the first two years of diagnosis, and 36% of surgeries also occur within the first two years. Similar patterns are found in the United States.[62] This makes sense, because diagnosis is usually made during a period of intense disease activity. There can be aggressive treatment to try to control the disease and achieve remission; subsequently, there is a steadier use of health care resources over the long-term. A Canadian survey was conducted in people with IBD who had a mean duration of disease of 18 years for CD and 15 years for UC. Amongst those with CD, 84% had been hospitalized and 65% had received surgery. For people with UC, 51% had been hospitalized, and 16% had ever received surgery.[46]

Key Findings:

- People with IBD have twice as many hospitalizations as people without IBD.
- Excess hospitalizations cost $229 million per year for people with CD, and $116 million per year for people with UC for a total of $345 million.
- The annual per-person cost is $2,040 for CD and $1,311 for UC.
- Most hospitalizations involve a surgical procedure.
- Most patients experience their first hospitalization within two years of diagnosis.

4.3 Outpatient Costs: Physician Visits and Procedures

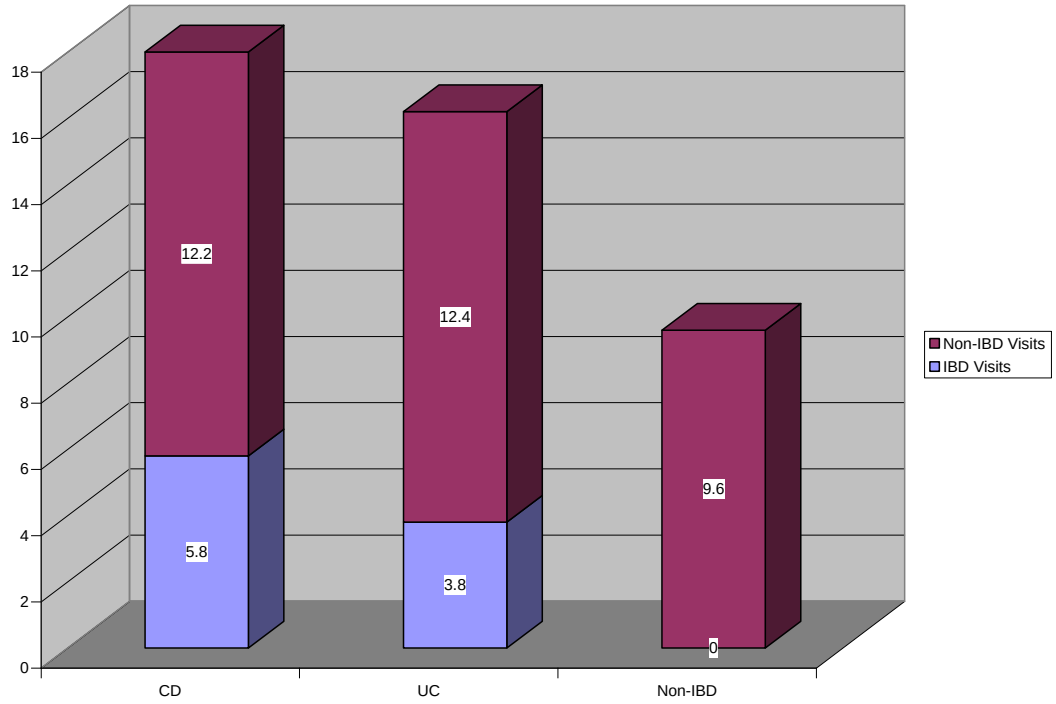
Canadian studies of outpatient costs include a database study in Manitoba and a national survey of members of the Crohn's and Colitis Foundation of Canada.

Researchers in Manitoba checked health records for people who had been identified as having IBD.[58] Compared to people without IBD, people with IBD had twice as many outpatient physician visits (13.2 versus 7.4 respectively).

For IBD-related medical visits, people with CD had more outpatient physician visits than people with UC. In 2001, the number of physician visits strictly for IBD was 5.8 per year for people with CD and 3.8 per year for people with UC (Figure 5).

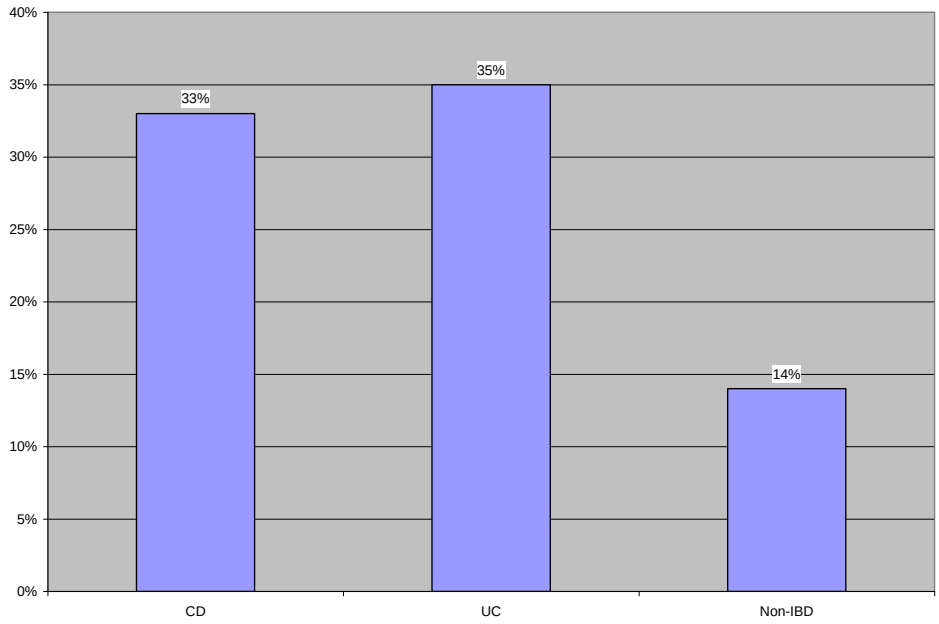
Moreover, people with IBD saw physicians more often for non-IBD specific reasons – an average of 12.2 visits per year, compared to 9.6 visits per year for people without IBD. This works out to an average of 2.6 extra visits per year for non-IBD reasons; there was no difference here between people with CD versus UC (Figure 5).

Figure 5: Outpatient Physician Utilization[58]



There was also an excess use of outpatient surgery for non-IBD reasons: 33% use among people with IBD, versus 17% for people without IBD (see Figure 6).

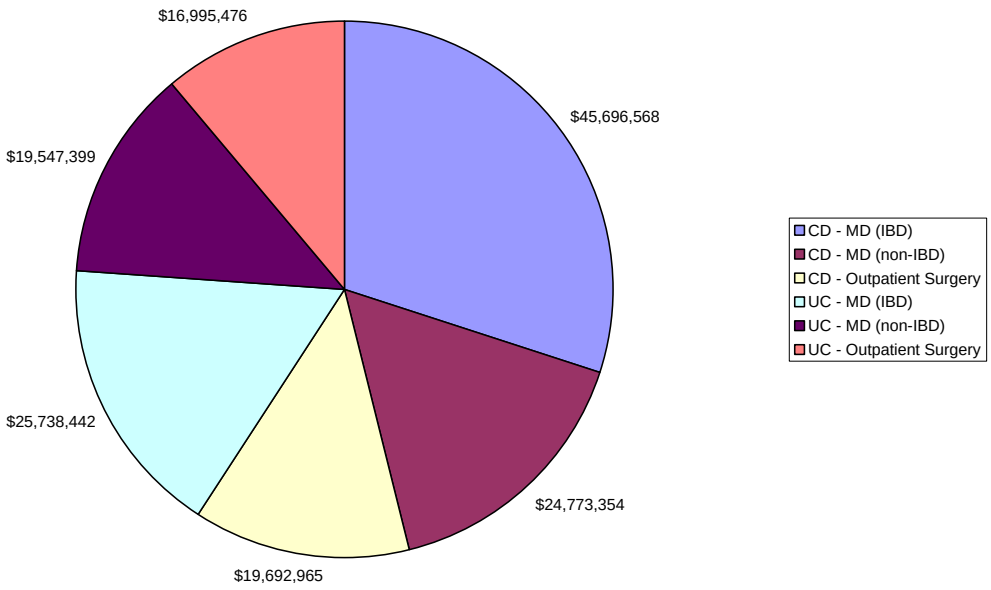
Figure 6: Rates of Outpatient Surgery[58]



Costs associated with excess physician visits were calculated.[46,58,60,63] People with CD required additional physicians visits costing $80 million per year, while people with UC required $54 million,

for a total of $134 million in excess physician visits in 2008. This worked out to a cost of $710 per person with CD, and $610 per person with UC.

Figure 7: Excess Outpatient Costs



Key Findings:

- People with IBD have twice as many physician visits as people without IBD.
- Excess physician visits and outpatient surgeries cost $80 million per year for people with CD, and $54 million per year for people with UC, for a total of $134 million.
- The per-patient annual cost is $710 for CD and $610 for UC.

4.4 Other Costs

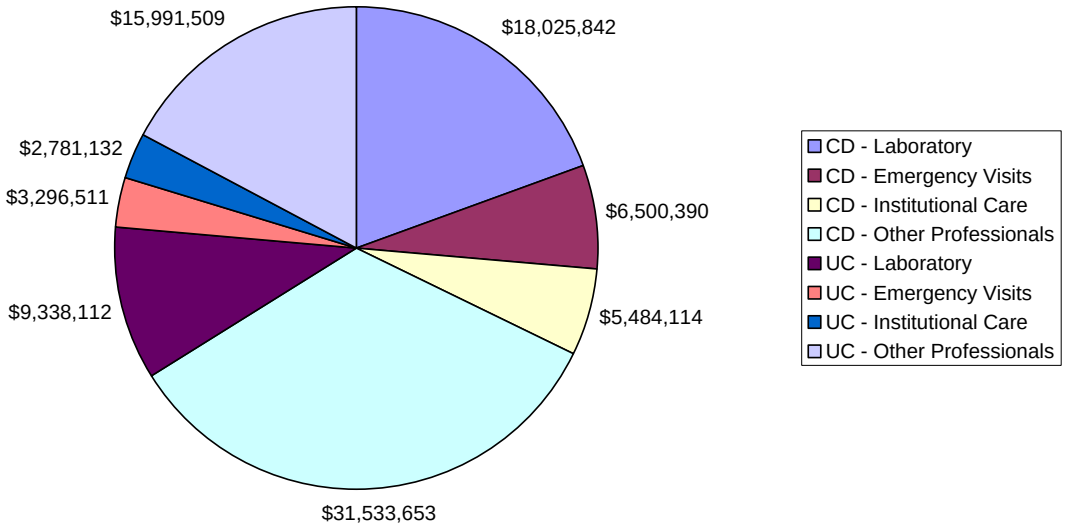
The most important direct costs are hospitalizations and physician services, for which we have accurate measurements in Canada. However, other health care system costs have not been studied in Canada. They have been not been well studied, if at all, in other countries. Often, they are reported without enough detail in order to accurately convert data to a current Canadian cost. As mentioned earlier, patterns of care in other countries are not necessarily the same as in Canada. However, international studies are needed to get an estimate of these other costs, because there are no Canadian sources. In this situation, it is important to be as conservative as possible – that is, to underestimate the costs wherever there is uncertainty in the results. We can

piece together estimates from other countries where they do not overlap with any other resources. This procedure may end up missing some costs, but it is conservative.

Diagnostic and investigative laboratory tests and procedures have been measured in an IBD clinic in the UK from 2000.[50] They reported the frequency of use for such resources as X-rays, blood work and ultrasounds separately for people with CD and UC. This type of test needed to be added to the direct costs for IBD. Canadian prices[60] were applied to the UK estimates of resource use (e.g. number of blood tests, number of X-rays).

An Australian study of IBD patients reported on the use of institutional care and other health care professionals.[64] Emergency room visits were measured in an American study of people with CD, using records from a health maintenance organization.[48] In each case, the cost in Canada was estimated from the cost in the US or in Australia, to reflect the size of the Canadian IBD population. Other costs are presented in Figure 8 – a total of $93 million in additional health care system costs ($62 million for CD and $31 million for UC). This corresponds to $548 annually per person with CD and $355 per person with UC.

Figure 8: Other Health Care System Costs



Key Findings:

- Other costs are higher for people with CD than people with UC.
- Use of other health care professionals and laboratory tests are common.

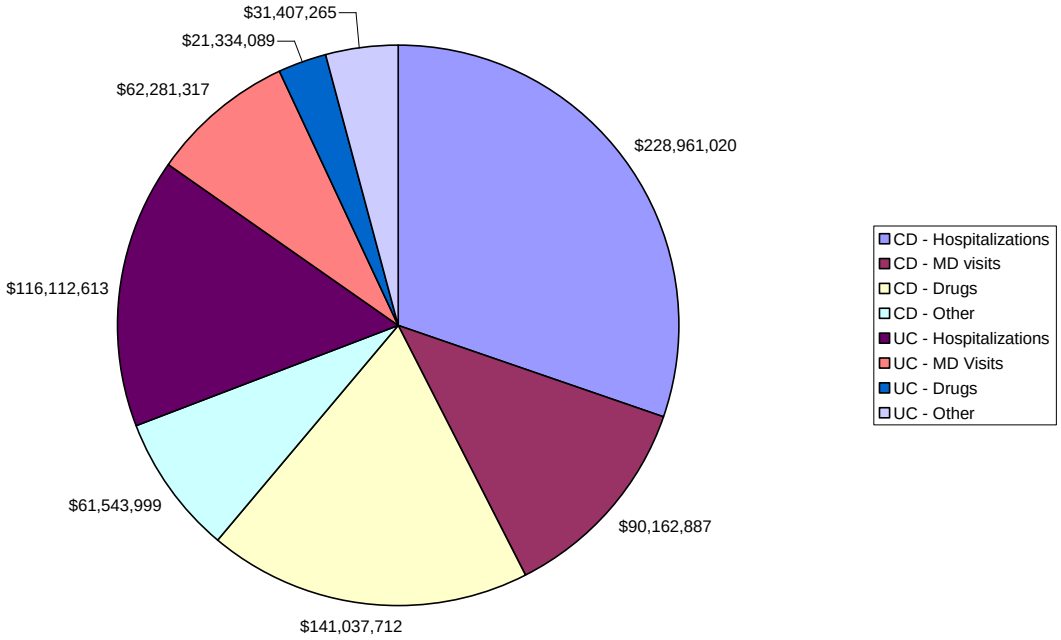
- Other costs are conservatively estimated to cost $62 million per year for people with CD, and $31 million per year for people with UC, for a total of $93 million.

- The annual per person cost is $548 for CD and $355 for UC.

4.5 Summary

Total direct medical costs exceeded $700 million per year in Canada in 2008. These costs are summarized in Figure 9: hospitalization costs were the highest, followed by physician visits and then medications. Costs are twice as high for CD as for UC, based on higher hospitalization costs and greater utilization of biological drugs.

Figure 9: Summary of Direct Costs



Section 5: Indirect Costs

Summary:

- *Indirect costs are higher than direct medical costs and are estimated at $1.064 billion in Canada in 2008 ($595 million for CD, and $469 million for UC).*
- *Short-term work absence strictly due to IBD averages 7.2 days per employed person with IBD, or $138 million in Canada in 2008.*
- *People with IBD are more likely to have lower labour participation rates than the general population, ranging from 3% to 13% less employment. The most likely minimum estimate is that this loss of productivity costs $746 million per year since at least 18,100 individuals would not be able to be in paid employment.*
- *Productivity losses from premature deaths are estimated at $7 million per year.*
- *Caregiver work absences are estimated to be $5 million per year for parents of pediatric IBD cases, plus $66 million per year for severely ill people with IBD.*
- *The individual's out of pocket expenses are estimated at $239 million (non-prescription medicines, household support, travel for medical care, etc.).*

5.0 Introduction

Indirect costs are costs that are borne by people and by society, rather than costs incurred from use of the health care system. Typically, the largest indirect cost is productivity losses, or work absences – both short-term (sick leave) and long-term (disability leave and/or early retirement). For some diseases, premature death is an important cause of productivity loss. In addition, some people may never enter the work force, or may work part time hours, for reasons related to health. Also, caregivers (including parents) may have to take time off from work. Economists classify productivity losses as costs that are borne by society in general. Other costs are borne by the individual personally – out of pocket expenses such as home aids and modifications, formal care (housekeeping, daycare), travel for medical appointments, nutritional products, and complementary and alternative medicines.

Most people living with IBD have had the disease for most of their adult lives. People with milder disease may experience some periods of poorer health and long periods of relatively normal health. This may allow them to be in regular employment, but with some absences for sick leave and/or medical appointments. People with more severe disease may have to reduce their hours, change their type of employment, or they may eventually withdraw from work altogether.

Living with IBD can influence the type of employment that is possible. The requirement to have easy access to a bathroom may restrict the types of jobs an individual can perform, such as production line work, outdoor work or jobs with frequent travel, with a trend to select sedentary occupations.[65,66]

People with IBD worry that their disease may affect their job and career. A German study found that 47% of people with CD thought their careers were affected by IBD, as did 39% of people with UC.[67] Similarly, a UK study found that 24% of people with CD felt that their disease had limited their employment prospects and had either prevented them from seeking promotion or had actually prevented promotion.[68] Finally, IBD can have a broad impact, with 11% of spouses reporting that IBD had compromised their professional careers.[69]

5.1 Education Impact

IBD is often diagnosed in childhood, adolescence or early adulthood. This can impact educational attainment as well as the selection of a career. Education can be affected by temporary absences from school and difficulty with studying or sitting for exams, as well as lack of understanding and discrimination from teachers.[68,70] Overall, however, while the individual may face difficulties and challenges, the levels of educational attainment do not differ statistically for those with IBD from the general population or a healthy comparison group. No costs or deficits were assessed for impact on education.

5.2 Short-Term Work Losses

Employed people with IBD may miss work due to medical appointments, illness, or hospitalization.

At a minimum, days spent in hospital must be days missed from work, for those who are employed. It is estimated that in 2008 there will be 8,900 hospitalizations for CD and 4,300 hospitalizations for UC, for a total of 125,000 days in hospital.[71] Given an employment rate of approximately 60% in IBD[66], and a mean daily wage rate of $158.79[73], this would correspond to $12 million per year, just for days spent in hospital. In reality, the true number of days missed from work is much higher. In order to find out how many days are missed due to IBD, the most realistic method is to survey people with IBD. For example, it is not feasible to survey workplaces to collect data on how many days of sick leave are taken per employee with IBD, and the reasons for sick leave.

There are few Canadian-specific data on short-term work losses due to IBD. It is widely thought that productivity losses are 'transferable across borders'; that is, people in different countries are just as likely to respond to illness by taking time off work. This implies that productivity data collected in one country can be transferred to another country, since the number of days off work per person is unlikely to vary much between countries with similar labour practices and sick leave policies. Among the countries with reported data (Canada, Australia, and Western Europe), labour practices are likely to be relatively similar.

There have been nine studies that report data on short-term work losses. The diversity in the collection and reporting of results required a meta-analysis to determine an average estimate of the expected sick leave per employed person with IBD.[72]

Few studies separated costs for CD versus UC. Overall, it was reasonable to assume that there were similar costs for time off work for both CD and UC.

On average, 43% of employed people with IBD took time off work per year, and each employed person with IBD took 7.2 days off per year due to IBD. These papers reported an average rate of employment of 60%; this is almost identical to the labour participation reported by people with IBD in Manitoba.[66]

To convert this to a Canadian cost, the total number of days lost per person can be multiplied by the number of people with disease, the percentage who are employed, and the mean daily wage rate ($158.79 per day, according to Statistics Canada).[73] The total cost of short-term work loss was $138 million for the 120,500 actively employed individuals with IBD.

Key Findings:

- 43% of employed persons with IBD required time off due to IBD.
- Short-term work losses were estimated at 7.2 days per employed person with IBD per year, strictly due to IBD.
- This costs $138 million per year in short-term work losses in Canada for the 120,500 actively-employed individuals with IBD in 2008.

5.3 Long-Term Work Losses

Long-term work losses can result from long-term absences from employment (disability), long-term reduction in hours of work, premature retirement, and premature mortality.

It can be difficult to isolate the specific factors why an individual has withdrawn from the workforce (or has never entered the workforce). Often there are multiple factors involved. This makes it difficult for people with IBD to single out a reason why they are employed or not. Instead, it is more reliable to compare overall rates of employment in people with IBD to rates in the general population. The assumption is that any difference in employment rates can be due to IBD.

5.3.1 Impact on Employment

There were two studies in Canada, two in Australia, two in Europe and one in the United States which looked at employment rates in people with IBD. A meta-analysis of these seven studies found that IBD was associated with a 13% reduction in the probability that a person will be employed. In other words, since the Canadian general population has a labour participation rate of 80%, then an IBD population would have a labour participation rate of (80% - 13% =) 67%. Each

year, this would correspond to $1,078 billion for 26,000 Canadians with IBD who would not able to work.

It is important to look at the two studies that were conducted in Canada. These two studies had inconsistent findings. The first was conducted in the province of Manitoba, using people who were definitely identified as having IBD based on repeated health care system contacts due to IBD.[66] Their employment status was compared to that of the general Manitoba population. They found that after diagnosis, people with IBD gradually withdrew from work and were more likely to be unemployed, disabled or retired. Compared to the general population, people with IBD had a statistically significant reduction of about 9.3% in employment rate.

In a different approach, researchers asked Canadians who participated in the National Population Health Survey whether they had IBD. The labour participation rates were compared between people who reported IBD and those who did not. This approach can be limited by recall and the wording of the question, that is, whether people accurately report whether they have IBD. In fact, 1.7% of the population reported having IBD in the survey. This is much higher than expected (0.60%); the sample of people "with IBD" was in fact composed mostly people without IBD. The results of this study were that non-participation due to IBD was found to be only 2.9%.[74] By contrast, an American general population health survey was done by the same researchers who did the Canadian survey. In this survey, the percentage of people who reported IBD was 0.4% of the population – pretty much what would be expected, given the prevalence of IBD. This suggests that the questions in the survey were worded in such a way as to obtain a more correct sample. In this survey, the excess rate of non-participation was 12.3% - very close to the meta-analysis finding.[75] The main difference between the surveys was that too many people in the Canadian survey described themselves as having IBD when they likely did not, and these individuals had a rate of labour participation similar to the national average.

Key Findings:

- People with IBD have a lower labour participation rate than the general population, in the range from 3% to 13% lower.

- The costs of reduced labour participation could range from $249 million (with 3% non-participation) to $1.078 billion (with 13% non-participation). The best estimate is a minimum of $746 million (9% non-participation – 18,100 individuals).

- There are likely additional costs from people who reduce their work hours, but this has not been measured in any survey.

5.3.2 Premature Retirement

Premature retirement was investigated in one Swedish study. This study looked at people with CD only. They reviewed national registers of social services and determined that each year approximately 1% of the CD population was granted early retirement pensions, with an average duration of 14 years of early retirement.[76] In Canada, with 112,000 people living with CD, there could be 1,120 persons taking premature retirement due to CD each year. However, it is difficult

to separate these cases from the preceding analysis on long-term employment impact. Long-term absence could be from people who did not enter the workforce, but also from premature retirement (people who entered the work force, but left early). To avoid the potential for double-counting, there was no separate calculation for premature retirement in the analysis.

- Costs from premature mortality were assumed to be included in the estimate of costs from long-term work absences.

5.3.3 Premature Mortality

From a purely economic standpoint, premature mortality from IBD can cause productivity losses to society. In Canada, there are an average of 73 deaths due to CD and 38 deaths due to UC each year.[77] Of these, there are an average of 27 deaths from CD and 8 deaths from UC in people under the age of 65 (the typical cut-off for the working population). Based on the mortality analysis, UC does not cause excess mortality. It can be conservatively assumed that none of the UC deaths contributed to productivity losses. That is, these deaths would have occurred even in the absence of UC. Therefore, the focus was on CD only.

Of the 27 deaths per year in CD, assuming that 60% of people with IBD are employed, then there would be 16 deaths per year in employed people with CD. The average age at death was 49 for those who died before age 65; this corresponds to 16 years of lost employment. There would be a productivity loss of $456,000 per person, or $7.3 million for the 16 premature deaths each year.

Key Findings:

- There are 16 deaths per year in employed people with CD, at an average age of 49 years. The productivity loss associated with these deaths is $7 million.

- No costs were assigned to premature deaths in people with UC.

5.4 Caregivers

Caregivers are people who provide informal (unpaid) care to others who need assistance for health reasons. Caregivers may take time off work to accompany people to medical appointments, stay with or visit hospitalized people, or care for them at home. Caregivers may also take time off work to do the unpaid work of the person with IBD such as housekeeping, grocery shopping, etc. when the individual is unable to do so. Caregivers are needed for the most severely affected people with IBD, and also for children with IBD (whose parents would need to be involved in their care). However, there are very few data available on the economic impact of IBD on caregivers.

For pediatric cases of IBD, at least one parent would be involved in care of the affected child. If the typical employed person with IBD required 7.2 days per year of sick leave for their own disease management,[72] it could be reasonably assumed that the same amount might be required to manage a child's illness. Parent of children with IBD could be assumed to have a labour participation rate equal to the general public (81.5% according to the large national surveys in Canada and the US).[74,75] An average work wage should be assigned to employed parents,[73] while a

minimum wage is typically assigned to non-employed individuals (homemakers, etc.).[78] Minimum expected caregiver costs for parents of children with IBD total $5 million for parents the 4,900 children with IBD in Canada in 2008.

For severely affected people with IBD, there are survey data from an Australian study on caregivers. This survey found that there were 2,600 primary caregivers for people whose main condition was disease of the digestive system.[79] However, there was a very small sample size for this estimate, and the results should be treated with caution. Applying prevalence estimates, approximately 23% of these caregivers would be for people with IBD. This translates into one caregiver per 100 persons with IBD (presumably, those with the most severe disease, who would be unable to function normally). Overall, primary caregivers averaged 30 hours a week caring for people with disabilities. Assuming that 1% of people with IBD required 30 hours a week for care giving, with a Canadian prevalence of 201,000 people with IBD (2,008 severely ill people), care giving would cost approximately $66 million.

Key Findings:

- There are very limited data with which to estimate caregiver costs.

- At a minimum, parental care giving for pediatric cases of IBD could cost $5 million a year. Potentially, care giving for severely ill people could cost $66 million per year.

5.5 Out of Pocket Expenses

Only a few studies have examined out of pocket expenses for people with IBD. These expenses could include home aids and modifications, formal care (housekeeping, daycare, etc.), travel for medical appointments, nutritional products, and complementary and alternative medicines.

A survey of members of the Crohn's and Colitis Foundation of Canada found that use of complementary and alternative medicines was quite common.[80] Half of respondents had used or were currently using complementary or alternative medicines, with 24% as current users and 24% as past users. Herbal or plant-based therapies were the most commonly reported. Special diets were also used by 28% of respondents. The average person with IBD who uses these medicines spends $523 (CDN$2008) per year; given that 24% of people with IBD are current users, this converts to $126 per person with IBD, or $25 million per year.

A German population study surveyed people with IBD over a broad range of costs, including out of pocket expenses: travel, household support, and patient activities. The mean cost per 4 weeks was 50 Euros per person with CD and 46 Euros per person with UC (2004 Euros).[81] This converts to $1,061 (2008$CDN per year) – and a total cost of $214 million per year for the 201,000 people with IBD in Canada.

Key Findings:

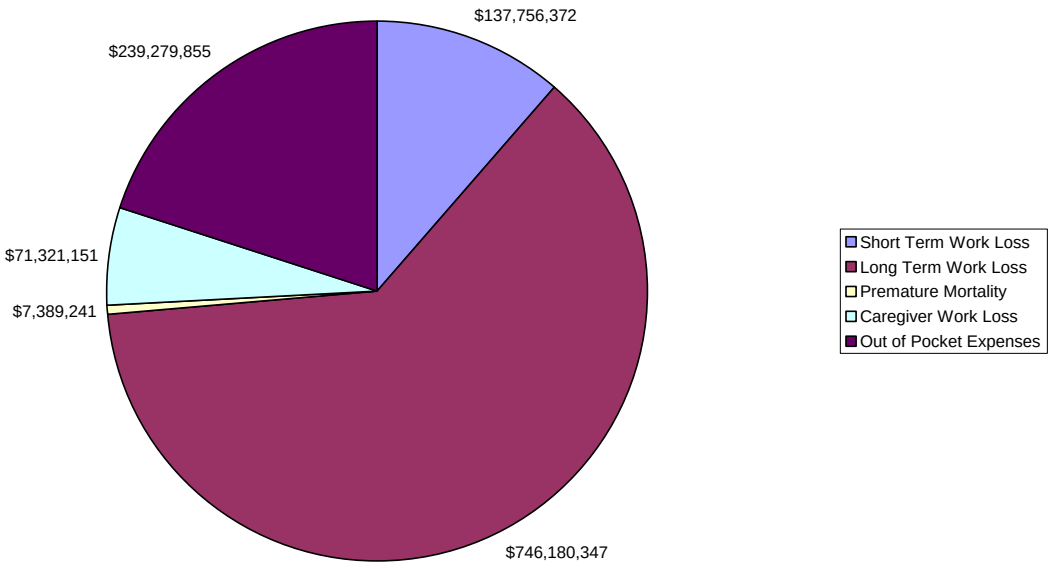
- Use of complementary and alternative medicines costs approximately $25 million per year.

- Other out of pocket expenses (travel, household support, patient activities) cost $214 million per year.

5.6 Summary

Total indirect costs are presented in Figure 1, and top $1 billion. These costs are split between CD and UC based on their prevalence: $595 million for CD (56%), and $469 million for UC (44%).

Figure 1: Indirect Costs by Type of Cost



Section 6: Non-Financial Costs

Summary:

- *IBD causes non-financial costs to individuals who bear the burden of disease and their families, including reduced quality of life, loss of leisure time, and limited choices of career, travel and other personal options.*
- *Quality of life is most affected by disease activity: individuals with moderate to severe symptoms have the most reduced quality of life. However, even people without symptoms suffer from distress, anxiety and fear, leading to a loss of quality of life.*
- *CD and UC have a comparable effect in the reduction of quality of life.*
- *Individuals with IBD have a lower quality of life, compared to the general population, across almost all different dimensions of health. People with active moderate to severely active disease have very significantly impaired quality of life, but even those in remission have a quality of life below the population average.*
- *Adolescents with IBD may be particularly troubled by psychological and behavioural issues related to their IBD and its impact on their quality of life.*
- *Quality of life can be significantly improved with effective treatment, including both surgery and drug therapy. Treatment-improved quality of life often leads to restored productivity.*
- *It is difficult to quantify the cost of loss of quality of life but, based on Australian research, the cost of IBD in Canada for loss of quality of life may be more than $4 billion (CAD).*

6.0 Introduction

This report has explored the financial costs associated with IBD, from the viewpoint of the individual with IBD, the health care system, and society. However, beyond out of pocket expenses, the person with IBD also experiences tremendous additional personal cost, that is, the burden of having a disease. There are many difficulties associated with IBD; there are ongoing medical issues to contend with, from the experience of symptoms (pain, diarrhea, fatigue) to the worry about how the course of the disease will affect your life. The fluctuating nature of IBD can make it very difficult to plan for the future. In particular, there is reduced quality of life from living with the disease, as well as reduced choices with respect to career, travel and other personal options. Another aspect that is not traditionally "costed" is the value of non-work time which is spent being ill or dealing with illness. This includes leisure time for working age people, but also all of the time for non-working people (such as students, retirees, and homemakers).

It is possible to calculate a dollar cost for the individual's burden of suffering from a disease, and it has been done before when estimating the burden of an illness (both for IBD and for other diseases).[82,83] However, in order to convert a decrease in quality of life into a dollar cost, it is necessary to place a price on the value of life, health and suffering. This is a controversial topic, and it can be difficult to come up with an acceptable solution. Also, when costs are assigned for a decrease in quality of life, these costs are generally very high, and in fact can dwarf the actual financial costs of a disease. For example, researchers in Australia estimated the financial cost of IBD to be almost $500 million, but the additional cost of the quality of life decrease was $2.7 billion (Australian dollars).[82] Given that Australia is a medium prevalence IBD country with 20 million people compared to high prevalence Canada with a population of 33 million, a conservative estimate for the quality of life cost in Canada (based on the ACCA report) is $4 billion (CAD). Rather than debate the price of health, this section of the IBD burden of illness will describe the impact of IBD to the individual's health, but will not attempt to further quantify the burden with a dollar cost.

6.1 Quality of Life

Quality of life can be measured using questionnaires, which people complete with respect to their current state of health. Sometimes the questions might be symptom-related, such as: Do you often have diarrhea? How often are you tired? Many questions focus on how health impacts a person's life. Quality of life questions that relate to health might be: How do you feel about your state of health? Does your health prevent you from physical activities? …From social activities? More general questions about quality of life might be: How often do you feel sad? Are you often worried about the future? There are three types of quality of life questionnaires that will be discussed: disease-specific, generic, and utility questionnaires. Table 1 briefly states these three types of questionnaires, with more detail in each subsequent section.

Table 1: Quality of Life Questionnaires

Type	Audience	Primary Advantage
Disease-specific	Can only be given to people with the specific disease	Very informative within the disease
Generic	Can be given to anyone	Allows for comparison between diseases
Utility	Can be given to anyone	Allows for numerical comparison between diseases

6.1.1 IBD-Specific Quality of Life

Quality of life instruments that focus on a specific disease helps us to understand what aspects of a disease are most troubling, and what factors impact quality of life for people with the disease of interest. The Inflammatory Bowel Disease Questionnaire (IBDQ) has been the most commonly used quality of life instrument. It can be given to people with either CD or UC. It has been used in many different countries. Researchers around the world have found that quality of life is decreased in people with IBD. Using the IBDQ, it has become clear that quality of life is most strongly impacted by severity of disease.[84,85,86] That is, people with more severe disease have the

greatest reduction in quality of life, and people with milder disease have less reduction in quality of life. They have also found that women are more likely to have lower quality of life than men with IBD.[85,86] Both CD and UC have a similarly negative impact on quality of life, and there are no significant differences in quality of life between people with CD and UC.

It is important to note that all people with IBD can have reduced quality of life, even those who do not have symptoms (due to a fluctuating disease, or because their medications have caused a remission). Canadian researchers, using the Manitoba database of individuals with IBD, have done some interesting work comparing people with consistently active versus fluctuating disease. They found that quality of life was worse in people with active disease (that is, people who are always symptomatic). However, even those without symptoms have psychological distress (stress, anxiety, fear about pain, and worry about the consequences of their disease).[87,88] People also are troubled by a lack of emotional support, and a feeling that they are not in control of their disease or their life. Other researchers have found similar results, that quality of life is driven most by disease activity, but is followed by psychological distress – common both to those with symptoms and those without). On the other hand, factors such as personality or sociodemographic characteristics (age, income, education, ethnicity, etc.) are not important to quality of life in IBD, although they are often relevant for other diseases.[89]

An example of the impact on quality of life is presented in the words of Lynn, a marathon runner afflicted with IBD:

> "During a long training run in the spring of 2005, I completely lost my bowel function. This was my epiphany moment: I knew that I could no longer deny what was happening within my body. A physician friend of mine encouraged me to get checked out and I knew I had to stop training. Frankly, I was tired and glad to let my mind and body off the hook, at least for a while.
>
> That April, a colonoscopy confirmed that I had Crohn's Disease. I will always remember that time in the process when I felt as though I had lost my identity. There was a significant moment when late one night I heard my dog bark. I was walking down the stairs when I tripped, and once again my bowels gave way - you can guess the details. As I lay on the floor in my own shame, I felt as though I had surpassed that forsaken wall and sunk to rock bottom. Something as simple as running, which defined me to some degree, was gone. My daughter found her mother in a puddle of her own sorrow at the foot of the stairs."

6.1.2 Pediatric Issues

Quality of life is affected for everyone who has IBD, including both adults and children. It is important to distinguish that children may experience a disease differently, and thus have different impacts of their disease. An IBD-specific measure to assess Quality of Life impact for children has also been developed.[90] Children with IBD have a reduced quality of life, as do children with other diseases; however, it is teenagers who are most strongly affected by their IBD.[91,92] Adolescents are significantly affected in multiple ways; they have reduced functioning and autonomy, at an age when separation and independence are extremely important. Their social functioning is compromised, when this is a critical factor in their lives. Attendance with school can be difficult, at a time when

important lifetime choices need to be made (such as post-secondary education). Adolescents easily fall prey to negative emotions and poor self-esteem, resulting in troubled behaviour or depressive issues. As Courtney, who's now 23, reflects on her experience, though, she shows how teens afflicted with IBD can show remarkable resilience:

> "Dealing with colitis has impacted every element of my life including affecting those closest to me. At only 16 years old I was hospitalized for five months straight and lost a whole semester of my grade 10 year of high school. This impacted my family greatly. My Mom stayed with me the whole time not leaving my side. I had two emergency surgeries where no one knew if I would survive and even went into cardiac arrest at one point. I even had to learn how to roll over in bed again and how to walk again! I had to learn how to survive teenage life with an ileostomy including dating, friends, and schooling. For many years I was blessed with being relatively healthy. Then unfortunately, years later I needed many more surgeries and had to stop my University education for a couple years. I had completed three years of my bachelor degree and could no longer continue in school. I had many operations and needed years of home nursing care before I could return to my normal life. I was lucky enough to start dating my long-term boyfriend just two weeks before one of those serious operations and we are still together! I just recently went back to complete my University degree and graduated on the Dean's honours list!"

6.1.3 Quality of Life and Treatment

Since quality of life is most affected by disease activity, it makes sense that effective treatment can improve quality of life, by reducing symptoms, inducing remission and helping people feel that they are in control of their disease.

Surgical treatments are associated with a normalization in quality of life, both for CD and for UC.[93,94] As well, conventional drugs such as steroids and azathioprine have been proven effective at improving quality of life.[95] More recently, the new biological agents have shown significant increases in quality of life for all types of disease: UC, CD and fistulizing CD.[96,97,98] The improvement in quality of life seen with treatment can effectively place a person suffering from active disease into a state of remission, without significant symptoms. It can also be important to the individual with IBD that effective treatment provides them with some feeling of control or predictability to their disease, reducing the fear and anxiety that are problematic even when people are not suffering from active disease.

At the age of 21, Amanda, of Newfoundland, was diagnosed with Crohn's disease following detection of a bowel blockage:

> Carew had bowel resection surgery shortly after her diagnosis [of Crohn's Disease]. "I was tube fed, and when I did get home, I had to be off work for about eight weeks because I had staples in my stomach and I wasn't allowed to lift anything over five pounds;' she said.
>
> While medication has kept her from having any major flare-ups, she still lives with the disease every day and says it can be as embarrassing as it is painful.

"I can be sitting down at my desk reading an e-mail and, all of a sudden, I'll have to rush to the bathroom," she said. "People in the office know about it, but it's still embarrassing. And it's the same if I'm at the mall - when I have to go to the bathroom, I know I just have to go."[99]

6.1.4 Quality of Life and Productivity

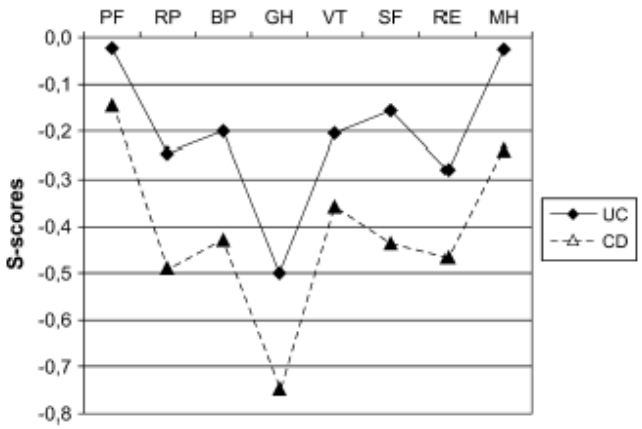
Quality of life has a direct relationship with productivity. Unemployment, disability and sick leave are related to low quality of life.[100] Conversely, quality of life is higher in people with IBD who are employed.[101] People who achieve remission with effective drug therapy often report not only an improvement in quality of life but also a return to employment – either returning to work (for those who were not employed) or returning to full time work (for those who were employed part-time). A study in CD found that people who responded to treatment had twice the employment rate than for people who did not respond to treatment after a year of therapy.[102] A study in UC found similar dramatic results, with responders 2.5 times more likely to be employed and three times more likely to not receive disability compensation.[103]

6.2 Comparison between IBD and the General Population

The second way to measure quality of life is to use a "generic" questionnaire, meaning a questionnaire that can be given to anyone and everyone, regardless of their health or whether they have a specific disease. This type of survey is very good for comparing quality of life across different diseases. It allows us to see what the normal level is for the general population, and then compare to individuals with a specific disease. It is important to note that the general population norm is made up of people with all kinds of levels of health and all kinds of diseases. This is not the same as "good health", it is instead "average health" for a mixture of people in the community – some will be very fit and healthy, and others will have various chronic diseases.

The most common generic quality of life tool is called the Short Form 36 (SF-36, so called because it has 36 questions, and is a shorter – but just as accurate – version of a longer questionnaire). Compared to the population norm, people with both CD and UC scored lower on the SF-36.[104] Scores were lowest for those with the most symptoms. Scores were significantly different for almost all of the eight different aspects of quality of life measured by the SF-36 (such as physical functioning, social functioning, mental health, etc.). Figure 1 compares the people with UC and CD to the standard population. The "general health" dimension was the worst compared to the standard population, followed by role-physical and role-emotional.

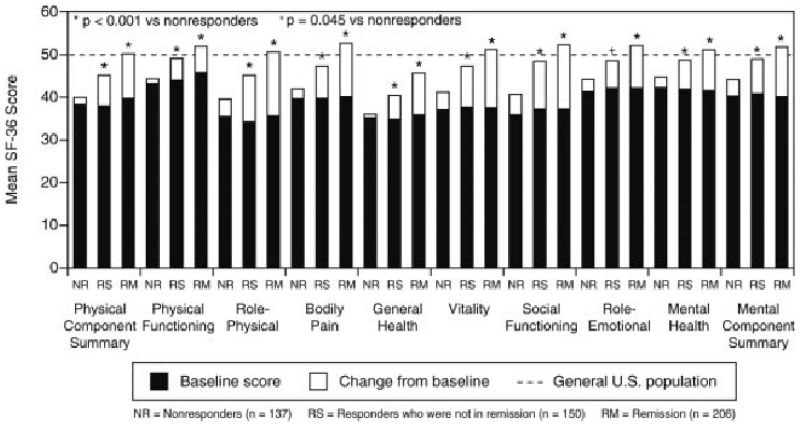
Figure 1: Standardized Scores for patients with UC and patients with CD, adjusted for age, sex, and educational level (0 = reference population)



PF = physical functioning, RP = role physical, BP = bodily pain, GH = general health, VT = vitality, SF = social functioning, RE = role emotional, MH = mental health

When people with IBD receive effective treatment, their quality of life can approach that of the general population. A study in UC measured the change in quality of life using the SF-36.[103] Study subjects who experienced remission with treatment had quality of life improvements that restored them to typical levels of quality of life, while those who did not respond had minimal improvement. In between these groups, the patients who had some response (but not a remission) had an intermediate improvement in quality of life (see Figure 2).

Figure 2: Mean Change in SF-36 Summary and Individual Scale Scores from Baseline to Week 30 by Response Status

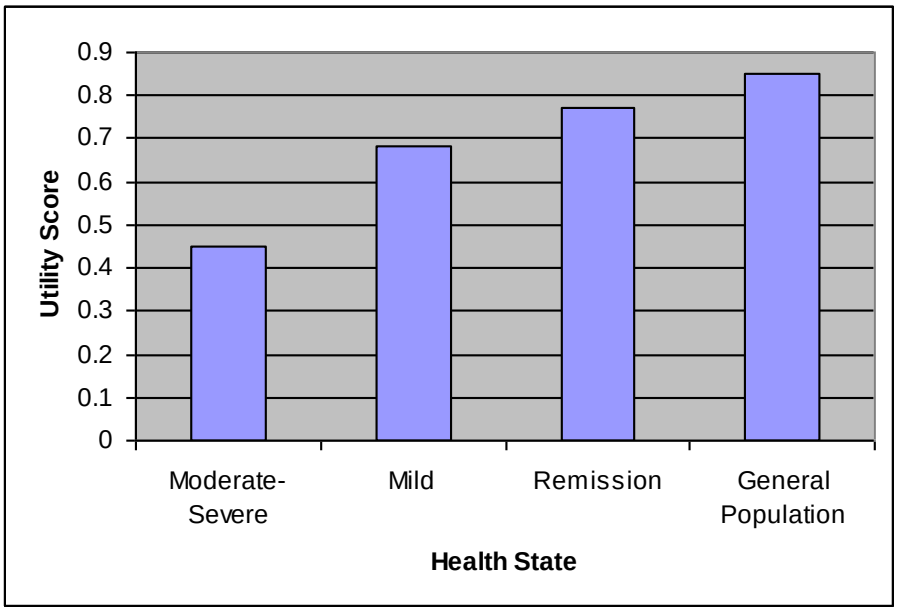


6.3 Utility

6.3.1 Utility Scores

A third type of quality of life questionnaire is known as a utility instrument. This is a generic quality of life questionnaire, because it can be given to anyone. It has two extra features. First, the resulting score is a single number; in comparison, the SF-36 gives a set of scores for each of the eight different aspects of quality of life that it measures. The single score makes comparisons easy. Second, the score has a specific meaning. The utility score is assigned with reference to a top and a bottom score. A top score of 1 is a state of perfect health. A bottom score of 0 is a state of death. Different diseases have scores in between 0 and 1, depending on how strongly people feel they would prefer one disease compared to another. For example, the average utility score for the US population is 0.85 – reflecting a mix of people and states of health, some good and some bad.[105] People with IBD score below the US average, even when they are in a state of remission. Only a few studies have used utility instruments in IBD, but they have found consistent results.[106,107] People with moderate to severe disease scored very low at 0.45, which indicates a very significant impairment in quality of life. People with mild disease scored at 0.68, typical of many chronic diseases; while people in remission scored 0.77 – still well below the population average (see Figure 3). Both of these studies were conducted in CD, but research has shown that quality of life impairment is similar for CD and UC.

Figure 3: Utility Scores for CD versus General Population



It is encouraging that effective treatment can restore utility values to higher levels. For example, a new biological for CD was noted to increase the utility score by 34% to achieve remission, and a further 7% to maintain remission.[108] These are very substantial gains in utility score, and hence quality of life.

Section 7: Conclusions and Recommendations

Summary:

- *Afflicting nearly 201,000 persons in Canada in 2008, IBD is more common than multiple sclerosis or HIV, about as common as epilepsy or Type 1 diabetes, and somewhat less common than rheumatoid arthritis or schizophrenia.*

- *The total cost of IBD in Canada in 2008 is at least $1.8 billion. This is composed of direct medical costs ($753 million, 41% of total costs) plus indirect societal costs ($1,064 million, 59% of total costs). The average per-person cost is just over $9,000 per year.*

- *Total costs are higher for CD, due to greater patient numbers. Per person costs are also higher for CD, due to more frequent hospitalizations and more costly medications: $9,950 per person per year for CD, and $7,900 for UC.*

- *There are many challenges for people with IBD in the current environment, ranging from lack of awareness of IBD as a chronic disease, to social stigma, to lack of equity in access to expensive medications:*

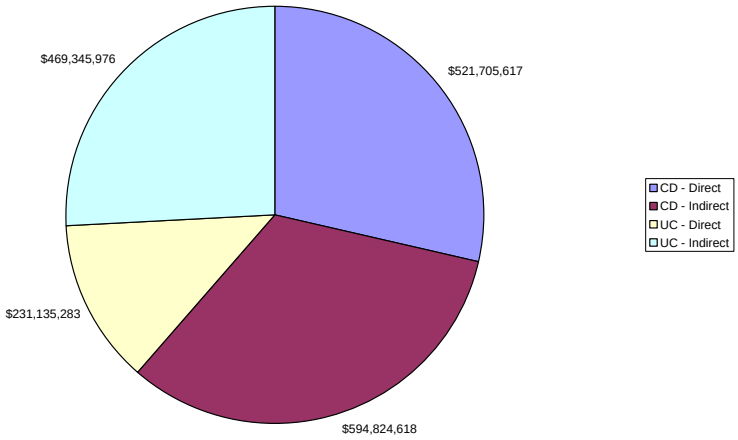
    - *Awareness of IBD – as a chronic disease with unnecessary social stigma*
    - *Diagnosis of IBD – including late diagnosis and inappropriate diagnosis*
    - *Access to IBD specialists and procedures – patients face regional disparities in access to care*
    - *Access to IBD medications – these costs can be prohibitive, but funding is inequitable across the country*
    - *Employment issues – IBD employees are vulnerable due to their youth and lack of seniority for employment protection*
    - *Support for people with IBD and their caregivers – there is an absence of community-based delivery of support, particularly for parents*
    - *Research, ongoing monitoring and evaluation – into the "cause, care and cure" of IBD, and to improve estimates of prevalence and costs*

- *The CCFC recommends a long-term national vision for the future, to include government, media and the general public. The goals are to change community perceptions and attitudes to IBD, reduce stigma and recognize IBD as a chronic disease within federal, provincial and territorial chronic disease strategies and frameworks.*

7.1 Costs Summary

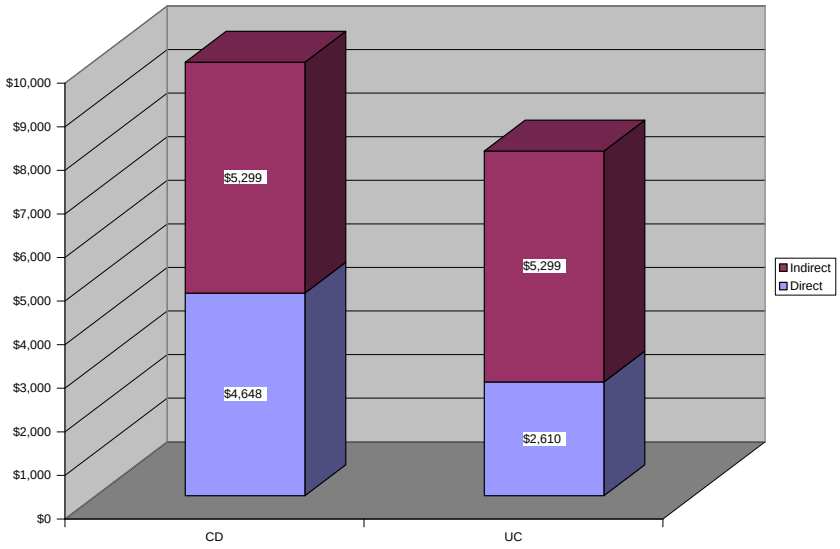
Total annual costs in IBD are $1.8 billion. Figure 1 reflects both the distribution of the disease (more people have CD than UC) as well as the distribution of costs (more frequent hospitalizations and more expensive medications for CD). Indirect costs (from societal losses and personal expenses) are higher than direct medical costs. Both are conservatively estimated and may be at the low end of potential costs.

Figure 1: Total IBD Costs



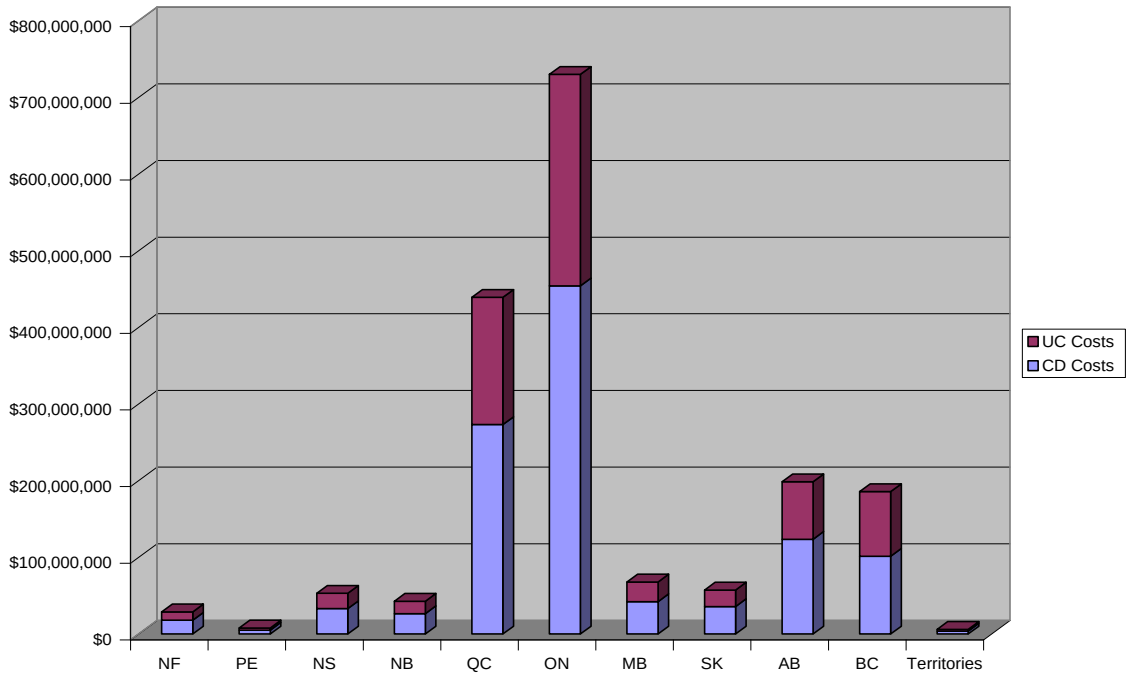
Per-person annual costs are shown in Figure 2; for the average person with IBD, annual costs exceed $9,000 - $5,300 in indirect costs, and between $2,610 and $4,650 in annual excess medical costs.

Figure 2: Per-Person Annual Costs



The cost of IBD broken down by province reflects the size of the population in each province, plus differences in the geographic distribution of the disease (particularly a relatively low rate in British Columbia).

Figure 3: IBD Costs by Province



7.2 International Comparison of IBD Costs

It can be useful to compare Canadian costs of IBD to the costs in other countries. However, there can be large differences in the costs that are reported, for many different reasons. First, total costs depend on the total number of individuals with IBD. Greater numbers of individuals with IBD mean greater costs. Canada has one of the highest prevalence rates of IBD in the world, so Canadian costs might be expected to be high. Second, different researchers will use different methods and data to determine costs. Depending on the accuracy of the data, and the types of costs that are included, results may not be directly comparable across countries. Finally, prices of items can differ between countries. For expensive items like hospitalization, this would have an impact.

Recently, the Australian Crohn's and Colitis Association (ACCA) conducted a comprehensive report on the costs of IBD in Australia.[109] Unlike the situation in Canada, they did not have reliable Australian data on prevalence of IBD, which was an important limitation. They determined that there were approximately 61,000 individuals with IBD in Australia (with a population of about 20 million, this is a prevalence of 0.3%). For these individuals, the total financial cost of IBD was approximately $500 million. Health care costs were a total of $79 million in 2005 in Australia.

Indirect costs totaled $417 million (but included $91 million in 'deadweight costs' also known as transfer costs which are often not included in a burden of illness study). Excluding transfer costs, the corrected total cost would be $406 million – or approximately $6,600 per individual with IBD. By comparison, Canadian costs are conservatively estimated at $9,000 per person per year.

Also recently reported was an overview of CD costs in the United States and other Western countries.[110] This paper found that the average per-patient cost in the United States was reported to US $18-19,000 per person with CD in 2006, and EUROS 3,000-7000 in other Western countries (approximately $5-11,000 Canadian dollars). There was tremendous variation in the inclusion of items (e.g. productivity), prices of items (e.g., hospitalization) and the quality of the research that was reviewed. It was found for both CD and UC that the majority of health care costs stemmed from hospitalizations among the minority of people who required them.[111,112] Much of the data used in the overview were not recent and pre-dated the extensive use of biologicals, with their impact on increased medication cost but reduced hospitalization costs.

7.3 Comparison of Canadian Prevalence with Other Diseases

It is important to provide a context of the prevalence of IBD compared to other chronic diseases in Canada. One should look to other chronic diseases which occur in working age adults for a point of comparison. Many chronic diseases are uncommon in younger individuals, but dramatically more common in older people; these are less appropriate as comparisons.

With a prevalence of nearly 201,000 people, IBD is:

- more common than multiple sclerosis (66,000)[113] or HIV (58,000)[114]
- about as common as epilepsy (198,000)[115] or Type 1 diabetes (240,000)[116]
- not as common as rheumatoid arthritis (300,000)[117] or schizophrenia (300,000).[118]

7.4 Challenges and Future Directions

This section provides an overview which integrates this report's findings to assist in ongoing consultations with stakeholders. The challenges posed by current service delivery for persons with IBD are significant and vary from province to province. The challenges faced by persons with IBD, family members and caregivers are found, however, in all provinces and Canadian territories. The common challenges include but are not limited to dimensions of awareness (orphan and/or chronic disease?), diagnosis and assessment, services delivery, research and evaluation, policy and planning.

7.4.1 Awareness

The following problems in relation to awareness provide a starting point for communications effort across Canada:

- The prevalence estimates outlined in this document make it clear that CD and UC are not "orphan diseases" in the technical sense[119]. Low awareness and lack of understanding,

however, make IBD feel orphaned from the family of diseases typically considered to be chronic diseases (e.g. diabetes, arthritis, asthma, etc.).

- While there is consensus that CD and UC are chronic diseases, the variability of symptoms and time course tend also to "orphan" IBD from other chronic diseases. A chronic care model modified to suit the episodic nature of IBD would be beneficial to help coordinate care and for engagement of public and private funders.
- General community awareness levels are low, with frequent misunderstanding between IBD and irritable bowel syndrome (IBS).
- Stigma is often associated with the conditions because of the nature of symptoms.
- Toilet access can be an issue when:
    - Toilets in social settings are kept locked and a key is required that may take time to acquire.
    - School settings may give rise to misperceptions (e.g., teacher perceptions that a child is trying to skip class rather than having a real need) which are perhaps best resolved by conversations between parents and teachers.
    - There is no national action plan similar to the new effort in Australian community settings where a national "Can't Wait" campaign to raise awareness of the urgency related to IBD has been implemented to facilitate near-immediate access to toilet facilities. Twenty years ago, the CCFC launched a similarly-titled campaign which lasted ten years. It ended due to liability coverage, lack of sponsorship to cover costs as well as security and health concerns. These challenges confront an attempt to re-launch a Canadian "Can't Wait" campaign.

7.4.2 Diagnosis

The evidence suggests that late diagnosis and inappropriate investigation and management are substantial problems with IBD. Spray et al.[120] found, based on referrals to specialists, a median delay of 47 weeks for CD and 66 weeks for those without diarrhea; in UC the median was 20 weeks but was three years in the worst cases. In a similar setting but for children only, Heikenen et al.[121] had similar findings (7.1 months for CD and 6.7 months for UC). In terms of symptoms, a study conducted by Rath et al.[122] found that 38% of CD patients had an interval of more than a year between onset of symptoms and diagnosis. Pimentel et al. [123] found people could be symptomatic for years before diagnosis (a prodromal period of 7.7±10.7 years for CD and 1.2±1.8 years for UC), due to insidious onset as well as delays after presentation.

- Patients may be slow to present in part due to lack of information/awareness and stigma (Grandbastien et al.[124]).
- Symptoms may mimic functional disease (IBS) leading to misdiagnosis and delays.
- There can be a lack of awareness within the primary care community and emergency departments, which can impede diagnosis. At least some of the delay in diagnosis is due to the patient and the GP not recognizing the symptoms and emphasizes the importance of education.
- Differential diagnosis may be difficult for CD and UC.
- Not only do CD and UC elevate the risk of colorectal cancer but their symptoms can delay a diagnosis of colorectal cancer.

- Inflammatory bowel diseases are increasing in incidence, so health professionals may not have seen much of it previously.
- Access to endoscopy, gastroenterologists and radiology shows significant regional variation making it difficult for some Canadians to be assessed.
- Access to gastroenterologists (i.e. medical specialists in gastrointestinal disease) is likely to get worse in Canada for the foreseeable future. Demographics indicating greater numbers of these specialists approaching retirement and limited training and residency opportunities drive this trend.[125]

7.4.3 Access to IBD Medication

- Currently available treatments can have substantial side effects contributing to or exacerbating other chronic illnesses such as osteoporosis and arthritis.
- The cost of IBD medications can be prohibitive, with difficulty variability in access to reimbursement between provincial formularies, forcing some patients into surgeries (with their associated impacts) that might otherwise be avoidable.
- Particular access issues relate to biological therapies, due to the high cost and differential equity of access patterns in different jurisdictions. Access may depend on the insurance status of the patient – those with private health insurance may be able to obtain a limited supply – while those without depend on variable local hospital and provincial/territorial policies.

7.4.4 Health Services

- There are significant regional disparities in diagnosis and treatment across and within provinces and territories. It would be worthwhile identifying the areas most in need of attention.
- With declining numbers of gastroenterologists, poor referral practices to IBD specialists will likely be exacerbated.
- Wait times for and access to endoscopy are issues which have an impact on the delay preceding confirmed diagnosis.

7.4.5 Employment Issues

- Crohn's disease and ulcerative colitis can have long-term impacts on employment prospects, particularly due to the age of onset early in life; these demographic factors also mean that the person may not have built up adequate leave entitlements and pension contributions, in comparison to diseases with later onset where more leave is able to be taken, which can then act to impede dismissal.
- There is poor employment protection against redundancy and demotions due to time required away from work, and reports of job loss due to illness are common.
- The effect of symptoms – fatigue, diarrhea, pain and the secondary effects of medications – are not well understood or catered for in the workplace.
- There can be poor information and support for employers and employees in relation to IBD.

7.4.6 Support for People with IBD and their Caregivers

- There is a need for support for families dealing with a child with IBD, in particular in relation to sibling issues and strain on the parents' relationship with each other.
- Currently there is no public funding of community based delivery of support services for people with Crohn's or colitis. Foundations raising funds for these efforts are limited and are not active in many parts of Canada.

7.4.7 Research, Ongoing Monitoring and Evaluation

- There is a need for more research into the 'cause, care and cure' of IBD, given current knowledge limitations, the scope for future gains and the clear trends of rising incidence rates.
- There is a need to further investigate the epidemiological observation that the incidence of CD is increasing (for currently unknown reasons) fairly rapidly, that is, within generations rather than over generations.
- Environmental trigger research is a promising area for research efforts – especially when the factors may be modifiable.
- Prevalence estimate updates and new estimates for remaining provinces using the administrative database methodology would provide improved national estimates.
- National estimates will further be improved by establishing modified and tested pediatric prevalence estimation approaches.
- Studies measuring the direct and indirect costs by severity of illness, updating the costs/practice patterns associated with biologicals, more current hospitalization rates (post-impact of biologicals), and new methods to measure of other direct costs (non health care professionals, labs, etc) will, help to improve economic impact estimates for IBD.

7.5 National Strategy

This section provides a framework for elements of a longer term national vision about future action that government, academia and the private sector could jointly pursue in disease management of Crohn's and ulcerative colitis, following from the challenges identified in the previous section.

7.5.1 Community Awareness

It is recommended that programs be developed and implemented to raise awareness and common understanding of CD and UC across government, media and the general public. In particular such programs should aim for a change in community perceptions and attitudes to IBD and a reduction in stigma.

Given the significant prevalence of IBD in Canada and its associated economic costs, it is recommended that Crohn's disease and ulcerative colitis be incorporated into federal, provincial and territorial chronic disease strategies/frameworks along with other common chronic diseases.

Given the often episodic nature of signs and symptoms associated with IBD, such government strategies/frameworks should reflect the unique challenges IBD poses.

7.5.2 Diagnosis

It is recommended that education programs be developed and implemented to raise awareness and knowledge across the medical and health sector, and particularly for family physicians, general practitioners and emergency physicians to assist with earlier and more accurate differential diagnosis, reduce misdiagnosis and reduce the long lags between onset of symptoms and diagnosis with treatment.

7.5.3 Access to IBD Medications

Recent research suggests that current treatment protocols should be reconsidered with the idea of using biological therapies sooner. Cost effectiveness studies will likely justify modified practice guidelines when they take as well as other, newer, medications into account the full direct and indirect costs of IBD[126]. Better access to biological therapies can improve management of some of the most debilitating symptoms of IBD that prevent participation in employment and other forms of community life.

7.5.4 Health Services

It is recommended that referral practices to IBD specialists be reviewed to ensure timely access to specialist care, and geographical areas of need are identified, together with strategies for enhancing services to meet the specific needs of Canadians disadvantaged by geographical location (i.e., rural and remote Canadians), ethnicity or in terms of socioeconomic status. There needs to be continuing attention to workforce development both metropolitan and rural locations. Access to endoscopy should be a particular focus. It is also recommended that care may be better coordinated by implementing adapted chronic disease management approaches to facilitate more seamless, flexible and multidisciplinary care. Such approaches aim toward supporting people in the community and reducing rates of hospitalization in the long run.

It is recommended that residency positions be expanded for gastroenterology to head off a looming shortage of IBD specialists in Canada. Furthermore, undergraduate and family medicine programs in Canadian medical schools should ensure adequate exposure to Crohn's disease and ulcerative colitis within their curricula. For further issues related to healthcare human resource planning in gastroenterology, please visit the website of the Canadian Association of Gastroenterology (www.cag-acg.org).

7.5.5 Employment Issues

It is recommended that programs be developed aimed at retention and specific adaptation of existing jobs for people with CD and UC. Such programs should involve innovative strategies such as workplace environment adaptation, job restructuring or tailoring, part-time and flexible work-from-home options, and transport assistance, as appropriate. Rehabilitation and workers' compensation models should be considered for integration into job retention policy and programs.

Existing employer incentive schemes could be extended to include employers supporting workers with IBD in job retention programs. Education and awareness strategies should be developed to counter workplace misperceptions and discrimination against people with IBD-related needs. These education and awareness strategies should encourage employers and employees to identify and implement positive long-term solutions.

7.5.6 Support for People with IBD and Their Caregivers

It is recommended that counseling, support, youth and family programs are designed and delivered to assist people with IBD and their family and caregivers, particularly respite care to assist employed caregivers. Support and respite services should be flexible, age-appropriate, lifestyle-friendly, timely and available over the long-term. Improved multi-disciplinary team-based case management input would help ensure good planning and packaging of services.

It is recommended that people with IBD and their caregivers use emerging web-enabled technologies and applications to form social networks to organize support and share information. Virtual communities can provide timely emotional support and connections that will allow improved self-management. Applications providing means of sharing and exchanging information should also do so in a manner that does not sacrifice privacy.

7.5.7 Research, Ongoing Monitoring and Evaluation

It is recommended that research and development efforts further investigate the epidemiological observation that the incidence of IBD is increasing, with particular emphasis on environmental trigger research because such factors may be modifiable. Furthermore, Federal and provincial research funding agencies are encouraged to partner with and augment the work of non-governmental IBD research funding organizations including the CCFC. With a few exceptions (notably the CIHR), IBD research occurring in Canada is funded by the NGO/charitable sector. Government agencies also have an important role to play.

List of Appendices:

Appendix A: List of CCFC Board of Directors 2007/08

National President	**Victoria Prince Toronto, ON**
National Past President	**Randy Sabourin Mississauga, ON**
National Secretary	**Nick Westlind Toronto, ON**
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Appendix B: FAST FACTS – The Burden of IBD in Canada

About Inflammatory Bowel Disease (IBD)

- IBD is a group of disorders that cause the intestines to become inflamed and ulcerated. This is caused by an abnormal response of the body's immune system.
- The main forms of IBD are Crohn's disease (CD) and ulcerative colitis (UC).
- There is no cure for IBD; therapy is directed at achieving and maintaining freedom from symptoms. Most people require ongoing medication; when this fails, surgery is often required.
- IBD is a lifelong disease, usually starting in early adulthood in otherwise healthy, active individuals.
- IBD imposes a significant impact on quality of life through ongoing symptoms, reduced ability to work, social stigma, management of toilet access issues, difficulty with physical intimacy and restriction in career choices.

IBD in Canada

- There are nearly 201,000 Canadians living with IBD: 112,000 with CD and 88,500 with UC.
- Over 9,200 new cases are diagnosed every year – 5,100 with CD and 4,100 with UC.
- Canada has among the highest reported prevalence (number of people with CD or UC) and incidence (number of new cases per year) of IBD in the world.
- IBD can be diagnosed at any age, but has a typical age of onset in the twenties.
- People with CD and UC have elevated risk of developing colorectal cancer.
- People with CD face a significantly elevated risk of premature death (47% higher) than the general public.

Comparisons

- IBD is about three times more common than multiple sclerosis or HIV; about as common as Type I diabetes or epilepsy; and somewhat less common than schizophrenia or rheumatoid arthritis.
- Compared to the general population, quality of life in IBD is low across all dimensions of health; even people with normalized symptoms have a quality of life below average, due to fears and concerns about disease progression.

Economic Costs of IBD

- Economic costs for IBD are conservatively estimated at $1.8 billion per year in Canada in 2008 (over $9,000 per person with IBD every year).
- Direct medical costs totaled over $700 million per year. They are dominated by hospitalizations ($345 million), followed by medications ($162 million) and physician visits ($134 million). Costs are higher for CD than for UC, due to more frequent hospitalizations and greater use of newer, expensive drugs.
- Indirect costs (to society and to the patient, including loss of productivity) are greater than direct medical costs: over $1 billion per year. Indirect costs are dominated by lower labor participation rates (long term work loss: $746 million per year), followed by patient out of pocket expenses ($239 million) and then short-term work absences ($138 million). These costs are similar between CD and UC.

Areas of greatest challenge

There are many challenges for people with IBD in the current environment, ranging from lack of awareness of IBD as a chronic disease, to social stigma, to lack of equity in access to expensive medications:

- Awareness of IBD – as a chronic disease with unnecessary social stigma
- Diagnosis of IBD – including late diagnosis and inappropriate diagnosis
- Access to IBD specialists and procedures – patients face regional disparities in access to care
- Access to IBD medications – these costs can be prohibitive, but funding is inequitable across the country
- Employment issues – IBD employees are vulnerable due to their youth and lack of seniority for employment protection
- Support for people with IBD and their caregivers – there is an absence of community-based delivery of support, particularly for parents
- Research, ongoing monitoring and evaluation – into the "cause, care and cure" of IBD, and to improve estimates of prevalence and costs

Recommendations for a National Vision

- The CCFC recommends a long-term national vision for the future, to include government, media and the general public. The goals are to change community perceptions and attitudes to IBD, reduce stigma and recognize IBD as a chronic disease within federal/provincial/territorial chronic disease strategies/frameworks.

About the CCFC

The Crohn's and Colitis Foundation of Canada (CCFC) is a voluntary, not-for-profit, medical research foundation dedicated to finding the cure for Crohn's disease and ulcerative colitis, commonly referred to as inflammatory bowel disease (IBD). To achieve our mission, the Foundation is committed to raising funds for medical research. Medical research is the best hope for finding a cure for Crohn's disease and ulcerative colitis.

The CCFC invests over 80% of its fundraising proceeds in research and education. To date, CCFC has invested nearly $56 million in major medical research projects and is one of the world's leading sources of non-governmental funding of IBD research.

To learn more about the CCFC, visit www.ccfc.ca.

Appendix C: Technical Supplement for Section 3 – Epidemiology

3.2 Prevalence

3.2.1 CCHS Survey

Table 1: CCHS Survey – Prevalence Findings, CD and UC[127]

Region	CD		UC		Total IBD	
	Number of Cases	Cases per 100,000	Number of Cases	Cases per 100,000	Number of Cases	Cases per 100,000
NF	3,243	722.3	1,696	377.7	4,939	1100.0
PE	607	516.6	1,242	1057.0	1,849	1573.6
NS	5,167	649.1	4,990	626.9	10,157	1276.0
NB	1,719	269.4	3,745	587.0	5,464	856.4
QC	19,214	296.8	17,243	266.4	36,457	563.2
ON	37,807	357.7	45,617	431.6	83,424	789.3
MB	3,003	321.0	3,669	392.2	6,672	713.2
SK	3,429	435.2	4,045	513.3	7,474	948.5
AB	8,397	312.6	13,576	505.4	21,973	818.1
BC	9,688	269.0	17,014	472.3	26,702	741.3
Territories	186	243.1	320	418.3	506	661.4
National	92,460	340.8	113,156	417.1	205,616	757.8

CCHS Survey 2005

3.2.2 Database Study

Table 2: Database Study – Prevalence Findings, CD and UC[128]

Province	Prevalence per 100,000	Female: Male Ratio	Urban: Rural Ratio
Crohn's Disease			
NS	318.5	1.44	0.85
MB	271.4	1.53	1.52
SK	263.8	1.48	1.08
AB	283.0	1.26	1.13
BC	160.7	1.23	N/A
Total (incl. BC)	233.7	1.33	1.05
Total (excl. BC)	279.2		
Ulcerative Colitis			
NS	247.9	1.03	0.84
MB	248.6	1.21	1.53
SK	234.3	0.98	1.01
AB	185.0	0.99	1.44
BC	162.1	1.05	NA
Total (incl. BC)	193.7	1.05	1.13
Total (excl. BC)	211.1		

Bernstein et al 2006

3.2.3 Estimated Current Prevalence

Current prevalence was estimated by starting with the point prevalence on July 1, 2000 from the Bernstein 2006 data (Table 2). The prevalence and incidence from BC were applied only in BC, while the Canadian averages excluding BC were applied to all other jurisdictions. Net incidence was added each year, based on longitudinal data on the change in prevalence in Manitoba (Bernstein 1999). Total incidence for IBD was 29 but net incidence was 17 (with the balance due to death and migration). As well, changes in population growth were factored into the analysis.

Table 3: Estimated 2008 Prevalence, CD and UC (Best Estimate)

Region	Number of Cases		
	CD	UC	IBD Total
NF	1,808	1,381	3,188
PE	495	378	873
NS	3,324	2,539	5,863
NB	2,669	2,038	4,708
QC	27,466	20,973	48,439
ON	45,660	34,864	80,524
MB	4,244	3,240	7,484
SK	3,588	2,740	6,329
AB	12,421	9,484	21,904
BC	10,201	10,648	20,849
Territories	373	285	658
National	112,249	88,570	200,819

As an alternative analysis, prevalence was estimated from the 2005 CCHS survey. Survey results (sampled from 27 million Canadians) were simply extrapolated to a current Canadian population of 33 million, without considering net incidence. This resulted in an upper estimate of 251,698 (0.76% of the population) – 113,182 cases of CD and 138,516 cases of UC.

3.3 Incidence

Table 5: Annual Incidence Rates[128]

Province	Annual Incidence Rate (per 100,000)	
	CD	UC
NS	20.2	19.2
MB	15.4	15.4
SK	13.5	10.4
AB	16.5	11.0
BC	8.8	12.9
Total	13.4	11.8
Total (excl. BC)	16.3	12.9

Bernstein et al 2006

3.3.2 Pediatric Epidemiology

Table 6: Pediatric Epidemiology[128]

Province	CD		UC	
	Incidence per 100,000	Prevalence per 100,000	Incidence per 100,000	Prevalence per 100,000
NS	12.0	47.3	5.7	26.7
MB	6.9	30.5	4.5	18.8
SK	7.9	32.2	4.2	18.1
AB	9.4	71.1	4.1	30.7
BC	5.4	35.8	3.2	17.5

Bernstein et al 2006

3.4 International Comparison

For CD (Table 7), incidence rates in Europe range from 1.6 to 11.6/100,000[128] but are estimated at 7.0/100,000 in northern versus 3.9/100,000 for southern Europe.[129] Incidence rates in southern areas (including Asia, Africa and South America) are lower, at <1.0 to 4.2/100,000 person-years.[128,130] Prevalence estimates for northern Europe range from 27 to 48/100,000,[128] although an individual study has reported as high as 214/100,000 in the UK.[130] Recall that the incidence rate in Canada is approximately 16.3/100,000 with a 2008 prevalence estimated at 338/100,000. Recent studies in the US and New Zealand have found disease occurrence that approach Canadian levels.

Table 7: International Comparison, Crohn's Disease

Location	Incidence per 100,000	Prevalence per 100,000
Europe[128]	1.6 – 11.6	27 – 48
North Europe[129]	7.0	up to 214
South Europe[129]	3.9	
Southern Areas[128,130]	<1.0 – 4.2	
Minnesota[131]	7.9	174
United States[132]		201
Canterbury, NZ[133]	16.5	155
Canada[128]	16.3	338

For UC (Table 8), incidence rates in Europe range from 6.3 to 15.1/100,000[128] but are estimated at 11.8/100,000 in northern versus 8.7 in southern Europe.[129] Incidence rates in southern areas (including Asia, Africa and South America) are lower, at <1.0 to 6.0/100,000.[128,130] Prevalence estimates for northern Europe range from 58 to 157/100,000,[128] although an individual study has reported as high as 243/100,000 (in a different study from the UK).[130] Recall that the incidence rate in Canada is 12.9/100,000 with a 2008 prevalence around 267/100,000. As with CD, recent studies in the US and New Zealand have found disease occurrence that approach Canadian levels.

Table 8: International Comparison, Ulcerative Colitis

Location	Incidence per 100,000	Prevalence per 100,000
Europe[128]	6.3 – 15.1	58 – 157
North Europe[129]	11.8	up to 243
South Europe[129]	8.7	
Southern Areas[128,130]	<1.0 – 6.0	
Minnesota[131]	8.8	214
United States[132]		238
Canterbury, NZ[133]	7.6	145
Canada[128]	12.9	267

3.5 Mortality

3.5.1 Crohn's Disease

Table 9: Studies Included in CD Mortality Meta-Analysis

Author	Location	Time Period	Patients	Deaths	Average Follow-Up	SMR (range)
Positive Studies						
Ekbom 1992[134]	Uppsala Sweden	1965 – 1983	1,469	179	10	1.6 (1.4 – 1.9)
Persson 1996[135]	Stockholm Sweden	1955 – 1990	1,251	174	15	1.51 (1.29-1.75)
Palli 1998[136]	Florence Italy	1978 – 1996	231	23	10.1	1.36 (0.9 – 2.0)
Jess 2002[137]	Copenhagen Denmark	1962 – 1997	374	84	17	1.3 (1.10-1.56)
Wolters 2005[138]	Europe, Israel	1991 – 2004	380	37	10	1.85 (1.30-2.55)
Masala 2006[139]	Florence, Italy	1978 – 2001	231	37	15.4	1.51 (1.06-2.08)
Jess 2006[140]	Minnesota US	1940 – 2004	314	56	14	1.2 (0.9-1.6)
Negative Studies						
Probert 1992[141]	Leicestershire UK	1972 – 1989	610	32	9	0.72 (0.49-1.01)
Cottone 1996[142]	Palermo Italy	1973 – 1987	325	9	7.8	0.97 (0.4-1.8)
Farrokhyar 2001[143]	Midlands UK	1978 - 1993	196	23	8.3	0.94 (0.59-1.40)

ACCA 2006

SMR = standardized mortality ratio

3.5.2 Ulcerative Colitis

Table 10: Studies Included in UC Mortality Meta-Analysis

Author	Location	Time Period	Patients	Deaths	Average Follow-Up	SMR (range)
Positive Studies						
Persson 1996[135]	Stockholm Sweden	1955 – 1990	1,547	255	15	1.37 (1.20-1.54)
Farrokhyar 2001[143]	Midlands UK	1978 – 1993	356	41	8.3	1.03 (0.79-1.40)
Winther 2003[144]	Copenhagen Denmark	1962 – 1997	1,160	261	19	1.05 (0.92-1.19)
Negative Studies						
Probert 1993[141]	Leicestershire UK	1972 – 1989	1,014	92	8.5	0.93 (0.75-1.14)
Davoli 1997[145]	Rome Italy	1970 – 1989	508	27	10.5	0.98
Palli 1998[136]	Florence Italy	1978 – 1996	689	47	10.1	0.62 (0.4-0.8)
Masala 2006[139]	Florence Italy	1978 – 2001	689	81	15.2	0.70 (0.56-0.88)
Jess 2006[137]	Minnesota US	1940 – 2004	378	62	14	0.8 (0.6-1.0)

ACCA 2006

SMR = standardized mortality ratio

Appendix D: Technical Supplement for Section 4 – Direct Costs

4.2 Inpatient Costs

Table 1: Excess Inpatient Resource Utilization

Resource	Frequency of Use/Year		Average Length of Stay (days)	
	CD	UC	CD	UC
Hospitalization – IBD	9%	4%	11.4	12.5
Hospitalization – non-IBD*	3%	3%	15.8	15.8
Surgery – IBD hosp.	59%	74%		
Surgery – non-IBD hosp.	67%	66%		

*People with IBD had a 10% annual rate of hospitalization compared to a 7% rate of hospitalization for people without IBD; thus, the net excess hospitalization was 3%.

Costs were assigned using Ontario prices for hospitalizations and physician services. The most common gastrointestinal hospitalization was for "major intestinal and rectal procedure", with an average length of stay of 12.1 days and a cost of $15,424 (2008 CDN$).[146] This corresponds closely with the length of stay from the database study. This cost was pro-rated by the expected number of days of hospitalization. Physician fees are not included in the cost of a hospitalization, although all other aspects of care are included (procedures, nursing, room and board, etc). Two specialist physician visits (e.g. surgeon, gastroenterologist) were assigned to each day in hospital.[147] The physician fee associated with a surgical resection was added to CD hospitalizations that involved surgery, and the physician fee associated with a surgical colostomy was added to UC hospitalizations that involved surgery. The total cost of each hospitalization was $15,587 for CD, $16,851 for UC, and $21,231 for non-IBD hospitalizations.

Overall, annual hospitalizations cost $229 million for Canada's 112,000 people with CD, and $116 million for Canada's 88,500 people with UC, for a total of $345 million (Table 2). This worked out to a cost of $2,040 per person with CD, and $1,311 per person with UC. Note that these data were from 2001, and thus largely pre-dated most of the impact of biologicals in the reduction of hospitalization.

Table 2: Inpatient Costs

Resource	Price per Unit		Number of Hospitalizations		Total Cost
	CD	UC	CD	UC	
Hospitalization – IBD	$15,587	$16,851	7,020	2,640	$229 million
Hospitalization – non-IBD	$21,231		2,340	1,980	$116 million
TOTAL for all Canadians with IBD in 2008					$345 million

4.3 Outpatient Costs: Physician Services

Table 3: Excess Outpatient Physician Utilization and Costs

Resource	Frequency of Use/Year	
	CD	UC
Physician visit – IBD	5.8	3.8
Physician visit – non-IBD*	2.6	2.6
Outpatient surgery	33%	35%
Outpatient surgery	14% (non-IBD patients)	
Total per Patient	$710	$610
Total in Canada	$80 million	$54 million

*People with IBD had 12.2 annual physician visits compared to 9.6 annual visits for people without IBD; thus, the net excess visits (for non-IBD reasons) was 2.6 visits.

Costs associated with physician visits are also presented in Table 3. People with IBD are most likely to depend on a specialist for their care. Therefore the physician visits were priced as specialists visits ($127.50 for the first visit, and $58.25 per subsequent visit).[60] An outpatient surgery was assumed to be a colonoscopy and was priced accordingly ($548.25).[148] People with CD required physician visits costing $80 million per year, while people with UC required $54 million, for a total of $134 million in physician visits in 2008. This worked out to a cost of $710 per person with CD, and $610 per person with UC.

Appendix E: Technical Supplement for Section 5 – Indirect Costs

5.2 Short-term Work Losses

Table 1 (next page) lists the nine studies that report data on short-term work losses.[149] Note that most studies used different reporting time periods (e.g. work loss over 4 weeks or over 6 months). This required some adjustment for the results to be in a standard format: the number of days missed per person per year. The diversity in the collection and reporting of results required a meta-analysis to determine an average estimate of the expected sick leave per employed person with IBD.

On average, 43% of employed people with IBD took time off work per year, and each employed person with IBD took 7.2 days off per year due to IBD. These papers reported an average rate of employment of 60%; this is almost identical to the labour participation reported by people with IBD in Manitoba.[150]

To convert this to a Canadian cost, the total number of days lost per person can be multiplied by the number of people with disease, the percentage in active employment, and the mean daily wage rate.

The average wage rate was determined from Statistics Canada while the number of people with disease was obtained from this report (Section 3). In 2007, the national average weekly wage rate was $770.82.[151] Given an average 3% increase over the past four years, this would correspond to $793.95 per week in 2008 (or $158.79 per day).

Table 2: Short-term Work Losses Due to IBD, Canada 2008

Number of days of sick leave per employed person with IBD	7.2 days
Average daily wage rate in 2008	$158.79
Cost of short-term work losses per employed person with IBD	$1,143.29
Employment rate in people with IBD	60%
Number of persons with IBD in Canada in 2008	201,00
Estimated number of employed persons with IBD	120,500
Total annual cost of short-term work losses (120,500 employed persons at $1,143.29 per person per year)	**$138 million**

Table 1: Summary of Short-Term Work-Loss Studies[72]

	ABS (2004-5)[152]	**Bassi (2004)[153]**		**Blomqvist (1997)[154]**	**Boonen (2002)[155]**		**Pinchbeck (1988)[156]**	**Sorensen (1987)[157]**	**Stark (2006)[158]**		**Wyke (1988)[159]**	
Country	Australia	UK		Sweden	Netherlands		Canada	Denmark	Germany		UK	
Year of study	2004-5	2000		1994	2000			1984	2004		1979	1985
Disease	IBD	CD	UC	IBD	CD	UC	CD	CD	CD	UC	IBD	
Data source	Community based	University hospital based		National registers & surveys	Hospital register		Hospital & physician recruited	Hospital recruited	Organization recruited		Hospital recruited	
# with IBD	-	172	284	N/A	282	359	2430	106	241	242	170	144
Mean age	43	46		N/A	37	44		44	41	43	43	48
% Male	44%	41%		N/A	38%	52%		40%	35%	45%	52%	51%
% Employed	65%	39%	39%	-	62%	69%		65%	63%	67%	68%	65%
% using sick leave	8.1% over 2 weeks	50% over 6 mo.	32% over 6 mo.	12% of cases	29% over 1 yr.	41% over 1 yr	50% over 1 yr	72% used < 11 days	14% over 4 wk	15% over 4 wk	42% over 1 yr	46% over 1 yr
Forecasted % sick leave per year	43%	57%	39%	-	29%	41%	50%	-	41%	42%	42%	46%
Days leave per sick person	1.61 over 2 weeks	-	-	-	16.7 over 1 yr	10.1 over 1 yr	19.8 over 1 yr	-	1.4 over 4 wks	1.7 over 4 wks	-	-
Days leave per employed person per yr	9.0	-	-	5.4	4.9	4.2	9.9	-	7.8	9.3	-	-

ACCA 2007

5.3 Long-term Work Losses

Table 3 (next page) lists the seven studies that report data on long-term work losses.[72]

Table 4 presents a range of values for long-term work losses, using the most important of these different studies: the meta-analysis, the two Canadian studies, and the American survey.

Table 4: Long-term Work Losses Due to IBD, Canada 2008

Average weekly wage rate in 2008	$793.95
Average yearly wage rate in 2008	$41,285.40
Number of persons with IBD in Canada in 2008	144,000
Meta-analysis[72]	
Percent reduction in labour participation due to IBD	13%
Total annual cost of long-term work losses (26,100 employed persons at $41,285.40per person)	**$1,078 million**
Manitoba Survey[150]	
Percent reduction in labour participation due to IBD	9%
Total annual cost of long-term work losses (18,100 employed persons at $41,285.40 per person)	**$746 million**
Canadian Survey[160]	
Percent reduction in labour participation due to IBD	3%
Total annual cost of long-term work losses (6,000 employed persons at $41,285.40 per person)	**$249 million**
American Survey[161]	
Percent reduction in labour participation due to IBD	12%
Total annual cost of long-term work losses (24,100 employed persons at $41,285.40 per person)	**$995 million**

Table 3: Summary of Long-term Work Loss Studies[72]

	ABS (2003)[162]	ABS (2004-5)[152]	Bernstein (2001)[150]		Longobardi (2003a)[160]	Longobardi (2003b)[161]	Sorensen (1987)[157]	Boonen (2002)[155]	
Country	Australia	Australia	Canada		Canada	US	Denmark	Netherlands	
Year of Study	2003	2004-05	1995-96		1999	1999	1984	2000	
Diseases	IBD	IBD	IBD	IBD	IBD	IBD	CD	CD	UC
Data Sources	SDAC	NHS	IBD Register	Health Administration data linked with census	Canadian National Population Health Survey (NPHS)	National Health Interview Survey (NHIS)	Hospital recruited	Hospital register	
Number with IBD	101	65	2,476	80	187	187	106	282	359
Number of Controls	36,140	25,841	14,177	26,082	10,704	23,462	75	1,504	1,504
Average Age	-	43	42	35.9	42.7	42.2	44	37.3	43.6
Proportion Male	-	44%	45%	48%	37%	34%	65%	38%	52%
Proportion Employed (IBD)	62.7%	65%	59%	67%	71%	68%	65%	62%	69%
Proportion Employed (Controls)	74%	74%	68%	77%	82%	85%	64%	70%	73%
Estimated Relative Risk	0.84	0.87	0.86	0.87	0.87	0.8	1.02	0.89	0.95
Confounders Controlled	No	No	Age	Age	Various	Various	None	Age	Age

5.3.3 Premature Mortality

Of the 27 deaths per year in CD, assuming that 60% of people with IBD are employed, then there would be 16 deaths per year in employed people with CD. The average age at death was 49 for those who died before age 65; this corresponds to 16 years of lost employment. Taking the average weekly wage in Canada, and applying a 5% discount rate to convert future costs into present-day dollars, there would be a productivity loss of $456,000 per person, or $7.3 million for the 16 premature deaths each year (Table 5).

Table 5: Costs from Premature Mortality

Annual deaths from CD in people under 65)	27
Employment rate in people with CD	60%
Annual wage rate	$41,285.40
Number of years of lost employment	16
Cost per premature death (discounted at 5%)	$456,126.74
Total cost due to premature mortality	**$7 million**

5.4 Caregivers

Table 6: Parental Caregiver Work Losses

Number of People < 20 with IBD in Canada, 2008	4,900
Days of Work Loss per Parent	7.2 days
Labour participation rate	81.5%
Daily wage rate, employed	$158.79
Daily wage rate, non-employed* (minimum wage, ON)	$65.62
Total cost of work loss in parents	**$5 million**

*Minimum wage ($8.75/hour) in Ontario, 7.5 hours/day[163]

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