

*Short Communication*

# Hospitalization Frequency Caused by Inflammatory Bowel Disease in Rural and Urban Inhabitants

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*Received: 19 August 2009*

*Accepted: 15 March 2010*

## Abstract

The purpose of our study was to analyze hospitalizations for inflammatory bowel disease noted in the Department of Gastroenterology, Medical University of Lublin. Cases of patients hospitalized in the Department of Gastroenterology, Medical University of Lublin in 1997-2007 were retrospectively analyzed. The material studied included patients' case histories and medical records that were used to select such patients whose hospitalizations were caused by ulcerative colitis and Crohn's disease. Analysis distinguished two groups: rural and urban inhabitants.

In 1997-2007 there were 1,825 hospitalizations for the inflammatory bowel disease noted at our clinic, which was 12.15% of all hospitalizations: 8.54% patients with ulcerative colitis and 3.61% with Crohn's disease. Among them, 30.47% were rural inhabitants while 69.53% of patients lived in towns.

The observation data demonstrated that there has been a significant increase of patients with inflammatory bowel disease in the last decade, and the patients originating in urban areas were more frequent than those from rural regions. This may be related to environmental differences between these two population groups.

**Keywords:** inflammatory bowel disease, ulcerative colitis, Crohn's disease, environmental factors, urban and rural inhabitants

## Introduction

Inflammatory bowel disease is a heterogenic group of ailments of unknown etiology affecting the alimentary tract. They have a chronic course with numerous remissions and recurrences. They mainly include ulcerative colitis and Crohn's disease. Recently a new type of disease was recognized, i.e. non-specific inflammatory bowel disease and microscopic bowel inflammation, which takes the form of collagen and lymphocytic bowel inflammation [1].

Inflammatory bowel disease occurs with different frequency in particular geographic regions and populations.

Hence environmental factors seem to be essentially involved in the etiopathogenesis of ulcerative colitis and Crohn's disease. Both diseases are more common among white populations of highly developed European countries and North America. Canada has the highest incidence and prevalence of Crohn's disease yet reported [2]. The incidence of ulcerative colitis has been constant, with ca. 10 cases per 100,000 population yearly noted. In the 1970s and 1980s the incidence of Crohn's disease saw a remarkable increase. At present it is 5/100,000 population noted yearly in the European Union [3]. In Poland there is no precise epidemiological data. Crohn's disease seems to occur several times less frequently than ulcerative colitis.

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Table 1. Hospitalization frequency caused by ulcerative colitis and Crohn's disease between 1997-2007.

Years	No. of total hospitalizations per year	Ulcerative colitis		Crohn's disease	
		No. of hospitalizations	%	No. of hospitalizations	%
1997	1,137	49	4.31*	11	0.96*
1998	1,220	85	6.96	14	1.15
1999	1,325	89	6.72	37	2.79
2000	1,315	108	8.21	37	2.81
2001	1,428	107	7.49	47	3.29
2002	1,605	129	8.03	52	3.24
2003	1,634	122	7.47	59	3.61
2004	1,556	144	9.25	56	3.60
2005	1,372	159	11.58	71	5.17
2006	1,082	118	10.91	72	6.65
2007	1,342	173	12.89	86	6.41
Total	15,016	1283	8.54**	542	3.61

\* $p < 0.001$  vs. 2002 and 2007 year

\*\* $p < 0.001$  vs. total hospitalizations (%) caused by Crohn's disease

The purpose of our study was to analyze hospitalizations for inflammatory bowel disease noted in the Department of Gastroenterology, Medical University of Lublin in rural and urban inhabitants.

### Materials and Methods

Cases of patients hospitalized in the Department of Gastroenterology, Medical University of Lublin in 1997-2007 were retrospectively analyzed. The material studied included patients' case histories and medical records, which were used to select such patients whose hospitalizations were caused by ulcerative colitis and Crohn's disease. Analysis distinguished two groups of patients: rural and urban inhabitants. Urban inhabitants included the residents of cities with 5,000 and more inhabitants. Residents living in less densely populated areas were regarded as rural inhabitants. Diagnosis of the inflammatory bowel disease was based on commonly recognized criteria.

### Results

In 1997-2007 there were 1,825 hospitalizations for inflammatory bowel disease noted at our clinic, which was 12.15% of all hospitalizations: 8.54% patients with ulcerative colitis and 3.61% with Crohn's disease. In 1997 there were 4,31% patients admitted for ulcerative colitis, in 2002 – 8.03% and in 2007 – 12.89% of all hospitalized cases. The number of admissions for Crohn's disease was the following: 0.96%, 3.24%, and 6.41% of all cases noted in

1997, 2002, and 2007, respectively. The results revealed a systematic increase in the number of hospitalizations caused by both diseases, which was statistically significant ( $p < 0.001$ ). The number of patients admitted for ulcerative colitis was statistically significantly more frequent than the number of hospitalizations for Crohn's disease observed during the decade of study ( $p < 0.001$ ). These results are presented in Table 1.

Among the 1,825 patients hospitalized in 1997-2007 due to inflammatory bowel disease, both ulcerative colitis and Crohn's disease, 556 (30.47%) were rural inhabitants while 1,269 patients (69.53%) lived in towns. In the whole analyzed period the numbers of hospitalizations caused by ulcerative colitis and Crohn's disease were higher in urban inhabitants than in rural inhabitants. In 1997 the 67.35% of total ulcerative colitis hospitalizations were urban inhabitants and the remaining 32.65% rural inhabitants. The respective figure changed to 67.44% and 32.56% in 2002, and to 68.21% and 31.79% in 2007. In 1997-2007 the number of hospitalizations caused by Crohn's disease in urban inhabitants was similarly higher than in rural ones. In the analyzed period the hospitalizations caused by inflammatory bowel disease were more than 2-times more frequent in urban inhabitants as compared to rural inhabitants. The differences were statistically significant ( $p < 0.001$ ). These data are shown in Table 2.

### Discussion

The incidence of the inflammatory bowel disease varies geographically and racially. Both ulcerative colitis and

Table 2. Frequency of hospitalizations caused by ulcerative colitis and Crohn's disease in rural and urban inhabitants between 1997-2007.

Years	No. of ulcerative colitis hospitalizations		No. of Crohn's disease hospitalizations	
	In rural inhabitants n (%)	In urban inhabitants n (%)	In rural inhabitants n (%)	In urban inhabitants n (%)
1997	16 (32.65%)	33 (67.35%)	2 (18.18%)	9 (81.82%)
1998	24 (28.24%)	61 (71.76%)	2 (14.29%)	12 (85.71%)
1999	29 (32.58%)	60 (67.42%)	12 (32.43%)	25 (67.57%)
2000	27 (25.00%)	81 (75.00%)	9 (24.32%)	28 (75.68%)
2001	38 (35.51%)	69 (64.49%)	11 (23.40%)	36 (76.60%)
2002	42 (32.56%)	87 (67.44%)	16 (30.77%)	36 (69.23%)
2003	49 (40.16%)	73 (59.84%)	22 (37.29%)	37 (62.71%)
2004	34 (23.61%)	110 (76.39%)	20 (35.71%)	36 (64.29%)
2005	48 (30.19%)	111 (69.81%)	22 (30.99%)	49 (69.01%)
2006	35 (29.66%)	83 (70.34%)	21 (29.17%)	51 (70.83%)
2007	55 (31.79%)	118 (68.21%)	22 (25.58%)	64 (74.42%)
Total	397 (30.94%)	886 (69.06%*)	159 (29.36%)	383 (70.66%*)

\*p<0.001 vs. number of hospitalization (%) in rural inhabitants

Crohn's disease are more common among the white population. Traditionally both diseases are thought to be typical for Western societies [4, 5]. In those countries their incidence has been increasing since the early 1950s [6, 7]. Contrary to other parts of the world, i.e. East Europe, South America, Asia, and the Pacific region, the incidence of bowel inflammation had been low and rare until the last decade. There has been a turn in the epidemiology of bowel inflammation in recent years. In the countries where they used to be rare their incidence has been progressing. However, in Western European countries and in North America the amount of inflammatory bowel disease has stabilized or increased only slightly and the incidence of ulcerative colitis has decreased [8].

Increased incidence of Crohn's disease in the population is observed with the movement from the south to the north, and to a lesser degree from the east to the west, which traditionally has been explained by the lifestyle of the Western countries [9, 10]. However, there are ethnic groups, e.g. the Jewish population, where it has a higher prevalence than among the rest of the local population [11, 12].

The results of epidemiological research in France found that incidences of inflammatory bowel disease had stabilized and remains constant in the north regions, but in the southern parts of the country it has increased remarkably. Thus the north-south gradient of incidence has been decreasing. Investigations by Nerich et al. carried out in France assessed the incidence of Crohn's disease as 8.2 cases per 100,000 population and ulcerative colitis at 7.2 per 100,000 population. Crohn's disease incidence differs between the north and south, but there was no geographical difference observed in the case of ulcerative colitis [13].

There are reports that show increased incidence of inflammatory bowel disease in Scandinavia. Epidemiological studies carried out among the adult population of Stockholm aged 16-90 found a considerably increased incidence of Crohn's disease in 1990-2001. The study noted 1,389 cases: 689 cases among women and 700 cases among men [3]. Similarly, researchers from Denmark observed increased incidences of non-specific bowel inflammatory disease in Copenhagen (city and county) in 2003-05 [14].

There is a similar tendency among children. In Finland the numbers of inflammatory bowel disease increased two times in that age group in the 1987-2003. There were 604 cases diagnosed: 34% Crohn disease, 52% ulcerative colitis, and 14% undetermined colitis [15]. Also, a study in the Czech Republic confirmed increased incidence of Crohn's disease among children <15 years in 1990-2001, and a study in Croatia detected a similar trend among the adult population along the northern coast of the country [16, 17].

In India, where Crohn's disease was considered rare, the incidence among adults has increased considerably in the last 10 years, especially in the southern parts [18].

The data quoted above confirm our results as we also observed an increased number of hospitalizations caused by both Crohn's disease and ulcerative colitis.

Inflammatory bowel diseases were traditionally considered common to the Western world, primarily to the developed countries of Northern Europe and America. Epidemiological data showed a higher occurrence in industrialized countries in comparison to rural regions [19-21]. It seems that environmental factors and lifestyles can play important roles in the incidence of both ulcerative colitis and Crohn's disease [22, 23]. Inflammatory bowel diseases are recognized to be a response to envi-

ronmental triggers in genetically susceptible individuals. In Crohn's disease genetic factors are now better known, since several susceptibility genes or anonymous loci have been identified, including CARD15/NOD2, 5q31 and 5p13 loci, TNFSF15, ATG16L1, IL23R, IRGM, and others [24-29].

Environmental risk factors playing a causative role in inflammatory bowel disease remain largely unknown. One important environmental factor is smoking. Smoking is found to be protective against ulcerative colitis and, after the onset of the disease, might improve its course, decreasing the need for colectomy. In contrast, smoking increases the risk of development of Crohn's disease and aggravates its course [30].

Data from the literature indicate that inflammatory bowel disease may be associated with a high socioeconomic status [31]. More specifically, it is known that Crohn's disease is linked to one or more familial environmental factors related to a modern Western way of life, domestic hygiene, diet, and infectious agents. An association of Crohn's disease with good standards of domestic hygiene in childhood (such as hot running water) has been reported [32]. Several studies reinforced these findings by the observation that "traveller" populations, which have poorer living standards, are at a lower risk of developing Crohn's disease [33, 34]. Generally it is assumed that urban residents possess better living conditions than rural inhabitants. Crohn's disease patients typically do not live on large farms and drink unpasteurized milk, rarely have pets in childhood, but more frequently use tap water. Gent et al. [32] observed that Crohn's disease was more common in subjects whose first houses had a hot-water tap and separate bathroom. These findings may explain why the incidence of Crohn's disease has increased in developed countries and in urban inhabitants over the past 50 years.

The hygiene hypothesis postulates that a more sanitary childhood environment should prevent the host from developing tolerance to organisms that may present later in life, with the subsequent development of inflammatory bowel disease, particularly Crohn's disease [35], while exposure to enteric bacteria and infections in early life may reduce the incidence of inflammatory bowel disease. Consequently, the higher incidence of Crohn's disease can be a byproduct of an overly clean environment [33]. Then, there is no doubt that economic development leading to improved hygiene and other changes in lifestyle (a "Westernized lifestyle") may play a role in the increase in inflammatory bowel disease [30].

Recently, it has been suggested that refrigerated food could be involved in inflammatory bowel disease development [36]. The study of Malekzadeh et al. [37] supports the opinion that Crohn's disease is associated with, among other household factors, exposure to domestic refrigeration during childhood. Epidemiological data allow assessment of familial environmental risk factors related to Western lifestyle, diet, bacteria, and domestic hygiene. All findings point to refrigeration as a potential risk factor for Crohn's disease. Furthermore, cold-chain development paralleled the outbreak of Crohn's disease during the 20<sup>th</sup> century.

The cold chain hypothesis suggests that psychotrophic bacteria such as *Yersinia* spp and *Listeria* spp contribute to the disease. These bacteria have been identified in Crohn's disease. From a molecular perspective, the disease is a result of a defect in host recognition by pathogenic bacterial components that usually escape the immune response, which results in an excessive host response to these bacteria [38]. An additional recent theory has suggested a breakdown in the balance between putative species of "protective" versus "harmful" intestinal bacteria - this concept has been termed *dysbiosis*, resulting in decreased bacterial diversity [30]. The urban diet contains natural contaminants and food additives that may contribute to immune reactions and provoke bowel inflammation [39].

All above factors suggested that the differences between the incidence of inflammatory bowel diseases in urban and rural inhabitants exist.

Some studies have evaluated the relationship between place of residence and incidence of inflammatory bowel disease. Living in an urban zone was associated with a higher risk for both ulcerative colitis and Crohn's diseases [40]. Manousos et al. [21] reported that average incidence among women living in rural areas was lower than that among women living in urban areas. In contrast to these findings are the results of the study presented by Ladas et al. [4] in the Greek population. They found that the incidence between urban and rural populations was similar, whereas the incidence in semi-rural populations was slightly increased. Similarly, Monferrer Guardiola et al. [41] presented that frequency of incidence of inflammatory bowel disease has no dependence on the place of residence in Spanish people. The ratio in the urban population and rural inhabitants was similar.

Our study was the first attempt to assess whether frequencies of hospitalizations caused by inflammatory bowel disease differ in rural and urban inhabitants in Polish people. Our results show that ulcerative colitis hospitalizations and Crohn's disease hospitalizations were significantly statistically more frequent in urban inhabitants than in rural inhabitants, which may be related to environmental determinants, diet, and the life-style differences between urban and rural regions.

We conclude that there was a significant increase of patients with inflammatory bowel disease in the last decade, and the patients originating in urban areas were more frequent than those from rural regions. This may be related to environmental differences between these two population groups.

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