

Inpatient Hospital Costs for Celiac Disease in the United States in 2014

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Abstract Celiac disease (CD) is a rare autoimmune disease that affects approximately 0.5 to 1% of the United States (U.S.) population. Patients with CD have gastrointestinal disturbances resulting from eating gluten. The only treatment therapy available is maintaining a strict gluten free diet. Currently, there is not much published data detailing the direct cost of CD in the U.S. This study analyzed direct inpatient hospitalization costs of CD in the U.S. The Healthcare Cost and Utilization Project net (HCUPnet) was analyzed to determine the number of discharges, mean length of stay, mean cost per hospitalization, and total expenditures of several patient demographics in the U.S. for the year 2014. There were 805 discharges in 2014 in the U.S. The mean cost per hospitalization was \$9,247 (SD \$17,732) and the mean length of stay was 4.9 days. The aggregate cost of celiac in the U.S. in 2014 was \$7,413,355 (SD \$23,320,823). Different patient demographics resulted in variable costs and length of stay for patients. The mean cost of hospitalization for CD was lower than that of the general population in the U.S. across all disease states. With no approved cures or treatment, CD will contribute to health expenditures in the U.S. for the foreseeable future.

Keywords: *celiac disease, cost, health economics, epidemiology*

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1. Introduction

Celiac disease (CD) is an autoimmune disease that affects approximately 0.5 to 1% of the population in the United States (U.S.) [1,2,3]. CD causes gastrointestinal disturbances such as mucosal inflammation of the small intestine and architectural changes to the gastrointestinal tract to patients who ingest gluten [4,5]. Architectural changes include several different types of lesions to the small intestine including hyperplastic lesions, destructive lesions, and hypoplastic lesions as well as villous atrophy [4,5,6,7,8]. General symptoms that are observed include diarrhea, dyspepsia, abdominal pain, steatorrhea, weight loss, and malabsorption [4]. Patients can also present asymptotically or with non-intestinal symptoms such as osteoporosis, anemia, and dental issues [9]. There is evidence that shows strong correlation of family history of CD in patients [10,11]. Evidences also show that both adult and pediatric patients with CD tend to be shorter in height compared to the general population [12,13]. There is a higher prevalence of females with CD compared to males [14,15,16]. Currently there is no cure nor a U.S. Food and Drug Administration (FDA) approved drug for the treatment of CD. The main treatment therapy for patients with CD is a strict gluten free diet [17]. One hundred percent compliance with a strict gluten free diet may be difficult. Patients who unknowingly eat food contaminated with gluten, even with cross contamination, may suffer adverse effects which require medical treatment. In the United Kingdom, a sample of 3,646

patients saw their average annual health expenditure increase by an average of £310 [18]. A study performed in the U.S. found that patients with CD had on average \$3,964 more in medical expenses over a 4-year period compared to patients without CD [19]. Currently, there is not much published data regarding the direct cost of CD in the U.S.. This study tried to describe the direct cost of inpatient hospitalization for CD in the U.S. for the year 2014.

2. Material and Methods

An analysis was performed of the U.S. National Inpatient Sample (NIS) of the Healthcare Cost and Utilization Project Net (HCUPnet) for the year 2014 using the primary International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) diagnosis code: 579.0 celiac disease [20]. The Nationwide Emergency Department Sample (NEDS) of HCUPnet was also utilized to look at emergency room discharges in the U.S. for CD [20]. HCUPnet is the largest publicly available online query system of all-payer healthcare databases. HCUPnet is part of HCUP of the Agency for Healthcare Research and Quality (AHRQ). The patient demographics of sex, age, and geographic region were analyzed. Sex was categorized as either male or female. Age was organized into different groups such as 1 to 44 years, 45 to 64 years, and 65 to 84 years old. There was not enough data available to accurately describe the hospitalizations for patients 85 years and older. Geographic region was divided into Northeast, South, Midwest, and West as defined by the U.S. Census Bureau [21]. The outcomes that were measured were

number of discharges, length of stay (LOS) in days, mean cost per hospitalization in 2014 U.S. dollars, and total expenditure in 2014 U.S. dollars.

LOS of 3.7 days and patients aged 65 to 84 years old who had a mean LOS of 6.3 days.

3. Results

3.1. Discharges

The HCUPnet analysis indicated that there were 805 inpatient hospital discharges in 2014 in the U.S. with the primary diagnosis of CD (Table 1). There were also an additional 752 emergency room visits with the primary diagnosis of CD in 2014 in the U.S. There were 510 females discharged from the hospital for CD compared to 295 males. There were 125 patients discharged aged 1 to 17 years old, 230 patients discharged aged 18 to 44, 170 patients discharged aged 45 to 64, and 245 patients discharged aged 65 to 84 years old. The number of discharges for each geographic region were as follows: 190 in the Northeast, 290 in the South, 175 in the Midwest, and 150 in the West.

3.2. Length of Stay

The mean LOS per hospitalization for patients with CD in 2014 in the U.S. was 4.9 days. The mean LOS ranged from 4.5 days to 5.2 days for all patient demographics except patients aged 18 to 44 years old who had a mean

3.3. Mean Cost

The mean cost per hospitalization for patients with CD was \$9,247 (Standard Deviation {SD} \$17,732) (Chart 1). This is lower than the mean cost of hospitalization for the general population in the U.S. across all disease states (\$10,885). The mean cost per hospitalization varied slightly by gender with males having a mean cost of \$10,699 (SD \$22,963) compared to females with a mean cost of \$8,403 (SD \$12,692). Patients aged 65 to 84 years old had the highest mean cost compared to all other age groups with a cost of \$10,830 (SD \$19,879). The next age group with the highest mean cost was patients aged 1 to 17 years old with a mean cost of \$10,612 (SD \$19,789), followed by patients aged 45 to 64 years old costing \$8,764 (SD \$18,423) per hospitalization, and lastly patients aged 18 to 44 years old having a mean cost of \$7,174 (SD \$9,600). The geographic region with the highest mean cost per hospitalization was the West at \$12,937 (SD \$18,224). The Northeast was second with a mean cost of hospitalization of \$10,072 (SD \$24,081). The South had the third highest mean cost per hospitalization of \$8,055 (SD \$12,091) and lastly the Midwest had a mean cost of \$7,315 (SD \$7,461). The aggregate cost of CD in the U.S. in 2014 was \$7,413,355 (SD \$23,320,823).

Table 1. The number of discharges, length of stay (in days), mean cost per hospitalization (in \$), and total expenditure (in \$) for each patient demographic analyzed

Demographic		Number of Discharges	Length of Stay (Days)	Mean Cost (\$)	Total Expenditure (\$)
All Discharges		805	4.9	9,247	7,413,355
Sex	Male	295	5.2	10,699	3,125,404
	Female	510	4.7	8,403	4,287,951
Age	1-17	125	4.5	10,612	1,302,617
	18-44	230	3.7	7,174	1,661,171
	45-64	170	4.7	8,764	1,489,868
	65-84	245	6.3	10,830	2,607,188
Region	Northeast	190	4.8	10,072	1,913,759
	South	290	5.2	8,055	2,335,920
	Midwest	175	4.3	7,315	1,293,849
	West	150	5.1	12,937	1,869,827

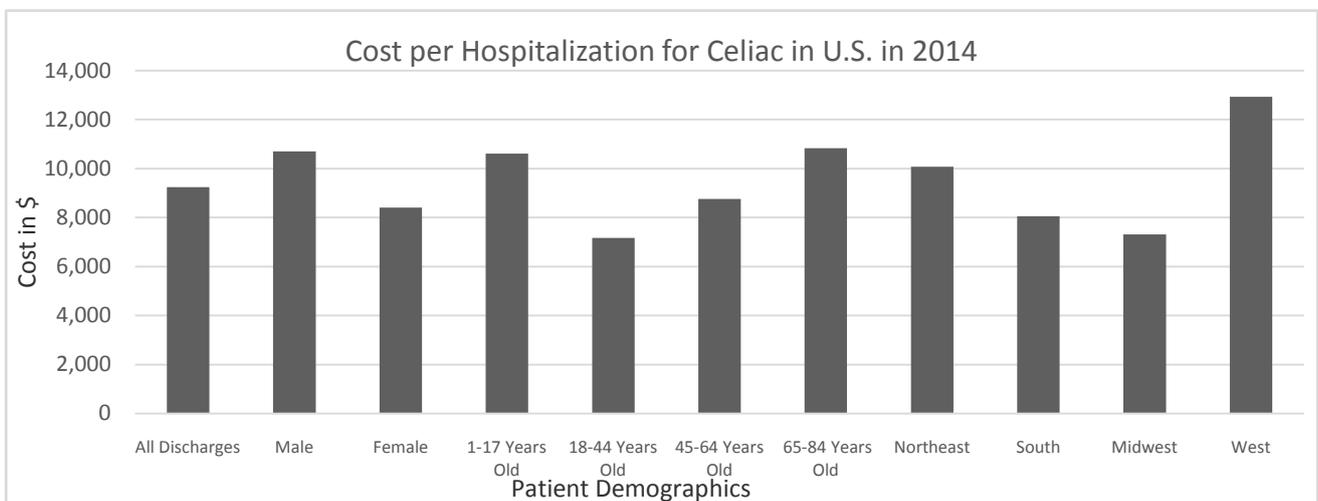


Chart 1. The mean cost of hospitalization for Celiac Disease in the United States in 2014 broken down into specific patient demographics. Costs are in U.S. dollars

4. Discussion

The cost of hospitalization for CD in 2014 was lower than the cost of hospitalization in the general population across all disease states. CD is estimated to be underdiagnosed and patients may have CD without even knowing it [22,23,24]. They may present to the hospital with an episode of general symptoms such as dyspepsia or malabsorption not knowing that it is secondary to CD. The cost of hospitalization for dyspepsia and malabsorption were very similar with dyspepsia costing \$9,154 per hospitalization in 2014 and intestinal malabsorption costing \$9,029 per hospitalization [20]. These are both very close to the mean cost of hospitalization for CD of \$9,247. In 2014 there were more hospitalizations for CD in females compared to males, which is consistent with previous evidence that CD is more common in women [14,15,16]. In this study, males had a higher cost per hospitalization compared to females (\$10,699 vs \$8,403) as well as a longer mean length of stay (5.2 days vs 4.7 days). A previous study found that males with CD had medical expenses on average more than \$10,000 more than males without CD [19]. There is some evidence that CD is more severe in males which might explain the higher mean cost and longer mean LOS in males for 2014 [25,26]. In 2014, the South had the highest number of hospital discharges with CD per geographic region with the Northeast having the second highest. This is not consistent with a recent study that showed that the risk of CD in the Northeast was more than twice that of the South [27]. One reason that may explain the differing results is that this study only looked at hospitalizations whereas Unalp-Arida A, et al. looked at incidence of CD in the U.S.. There may be an unknown reason that caused more patients in the South to be hospitalized due to complications with their CD compared to the Northeast, despite the higher prevalence of CD patients in the Northeast. Depending on the geographic region of a patient with CD, the cost of hospitalization may vary. The West had the highest cost of hospitalization for CD followed by the Northeast, which is consistent with the highest cost of hospitalization in the general population of all disease states in the U.S. in 2012 [28].

Further research is needed to find explanations as to why certain patient demographics and characteristics for CD result in different LOS and cost per hospitalization. Additional research is needed to analyze to cost of CD in the U.S. in the inpatient and outpatient settings.

5. Conclusion

The mean cost of hospitalization for CD in the U.S. was lower than that of the general population in the U.S. across all disease states. Different patient demographics and characteristics resulted in variable length of stays and costs per hospitalization.

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