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Eating disorders in the U.S. Medicare population

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Abstract

Objective: The social and economic burden of eating disorders is significant and often financially devastating. Medicare is the largest public insurer in the United States and provides coverage for older adults and some disabled individuals. This study explores prevalence, sociodemographic and clinical characteristics, and health care spending for Medicare enrollees with eating disorders.

Method: A cross-sectional study was conducted with the nationally representative 20% sample of 2016 Medicare inpatient, outpatient, carrier, and home health fee-for-service claims and Medicare Advantage encounter records. Sociodemographic characteristics and comorbid somatic conditions were compared between individuals with versus without an eating disorder diagnosis. Mean spending was compared overall and separately for inpatient, outpatient, home health, and pharmacy claims.

Results: The sample included 11,962,287 Medicare enrollees of whom 0.15% had an eating disorder diagnosis. Compared to those without a 2016 eating disorder diagnosis, a greater proportion of individuals with an eating disorder were female (73.8% vs. 54.3%), under age 65 (41.6% vs. 15.5%), and dually eligible for Medicaid due to disability or low-income qualification (48.0% vs. 19.6%). Individuals with eating disorders had higher rates of comorbid conditions, with the greatest differences in cardiac arrhythmias (35.3% vs. 19.9%), arthritis (40.1% vs. 26.6%), and thyroid conditions (32.2% vs. 19.4%). Spending was higher for enrollees with eating disorders compared to those without overall (\$29,456 vs. \$7,418) and across settings.

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CONFLICT OF INTERESTS

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Discussion: The findings establish that eating disorders occur in the Medicare population, and that enrollees with these illnesses have risk factors associated with significant healthcare spending and adverse health outcomes.

Keywords

anorexia nervosa; binge-eating disorder; bulimia nervosa; eating disorders; healthcare costs; health expenditures; health insurance; health policy; Medicare

1 | INTRODUCTION

Eating disorders are serious psychiatric illnesses with significant morbidity and mortality (Halmi, 2018; Mehler, 2018; Mitchell, 2016). Among the somatic comorbidities of these conditions are cardiac complications including sudden cardiac death, impaired gastrointestinal and liver function, and reduced bone density (Mehler, 2018). Psychiatric comorbidities include affective disorders, anxiety disorders, and substance use disorders (Halmi, 2018). The social and economic burden associated with eating disorders is significant and can be financially devastating to individuals and families.

Research on the cost of eating disorders includes both cost-of-illness studies and those limited to healthcare expenditures. A systematic review by Stuhldreher et al. (2012) and subsequent studies across the globe (Bellows et al., 2015; de Oliveira, Colton, Cheng, Olmsted, & Kurdyak, 2017; Gatt et al., 2014; Lee, Hong, Park, Kang, & Oh, 2021; Samnaliev, Noh, Sonnevile, & Austin, 2014; Streatfeild et al., 2021; Tseng, Tu, & Chang, 2021; Watson et al., 2018) found that the costs related to eating disorders are substantial, burdensome, and likely underestimated. In the United States, Streatfeild et al. (2021)'s cost-of-illness study conservatively estimated the annual cost of eating disorders at \$64.7 billion—approximately \$11,800 per affected individual. This cost was calculated from a societal perspective, incorporating both direct costs such as healthcare spending, and indirect costs such as lost productivity and lost well-being. Although cost-of-illness studies estimate mean costs per affected individual, in the U.S. prices for healthcare services are negotiated between providers and insurers resulting in different costs for the same services depending on the payer. In addition, across payers there are differences in how much of the cost is borne by enrollees due to different copayment and coinsurance amounts.

American health insurance includes commercial plans and government-funded coverage. The two largest government programs are Medicaid and Medicare. Medicaid provides insurance primarily for low-income individuals. Medicare is a federal insurance program that covers adults aged 65 and older and provides coverage for qualifying individuals of any age with disabilities and those with end-stage renal disease. Approximately 85% of Medicare enrollees qualify based on age, and 15% based on disability status (Kaiser Family Foundation, 2021). When enrolling in Medicare, individuals either select traditional fee-for-service Medicare coverage administered by the federal government, or a Medicare Advantage (MA) plan managed by private insurance companies (Kaiser Family Foundation, 2019). There are also individuals enrolled in Medicare who qualify for Medicaid referred to as “dually eligible.” Individuals may become dually eligible either by qualifying for

Medicare first and then Medicaid, or vice versa. Approximately 18% of all Medicare enrollees are dually eligible for Medicaid (Medicare-Medicaid Coordination Office, 2020a).

To date, U.S.-based health services research examining direct healthcare spending for people with eating disorders has been primarily conducted in commercially insured populations (Dickerson et al., 2011; Huskamp et al., 2018; Mitchell et al., 2009; Striegel-Moore et al., 2005; Striegel-Moore, Leslie, Petrill, Garvin, & Rosenheck, 2000). Findings from those data include sustained increased healthcare costs for people with eating disorders following diagnosis compared to those without (Mitchell et al., 2009), and increased outpatient service utilization following a change in federal mental health policy that went into effect in 2010 (Huskamp et al., 2018). As a result of prior research focusing on the commercially insured, individuals aged 65 and older, low-income individuals, and those with significant disability are typically excluded. Prior research has established that increasing age is associated with increasing numbers of comorbid conditions as well as healthcare utilization and spending. In addition, in a 2011 study of Medicare enrollees, Joynt et al. found that a greater percentage of high-cost individuals (those in the highest 10% of spending) were originally eligible for Medicare due to receipt of disability insurance benefits (instead of age) than nonhigh-cost enrollees (33.7% vs. 24.2%). The median number of chronic conditions was also higher among high-cost enrollees (11.0 vs. 6.0) (Joynt et al., 2016). Understanding total spending (combined spending by the government and by enrollees) for those insured through Medicare is especially critical as their age or disability status may make them high-cost, high-need enrollees and increase the extent to which they experience the morbidity and financial effects of eating disorders.

Three clinical profiles of eating disorders have been noted in the older adult population—early-onset, chronic course without previous recovery; relapse after a period of remission; and late onset without a prior eating disorder diagnosis (Baker & Runfola, 2016). In a review of the literature on eating disorders in middle-age and older adults, Mangweth-Matzek and Hoek (2017) found that while eating disorders occur among older adults, there are few studies that capture incidence and prevalence. In addition, there is a dearth of research on the potential compounding effects of eating disorders and the aging process on morbidity and mortality.

To explore the occurrence of eating disorders within the Medicare population we identified three primary research questions; (a) What is the prevalence of eating disorder diagnoses among Medicare enrollees? (b) How do the sociodemographic and clinical characteristics compare between Medicare enrollees with and without an eating disorder diagnosis? (c) How does healthcare spending for individuals with eating disorders compare to those without eating disorders across the inpatient, outpatient, home health, and pharmacy settings?

2 | METHODS

To address our research questions, we performed an exploratory, descriptive cross-sectional study with the nationally representative 20% sample of 2016 Medicare inpatient, outpatient, carrier, pharmacy and home health fee-for-service claims and MA encounter records.

2.1 | Data

The data used in this study include individuals enrolled in fee-for-service Medicare and MA plans from 2016 obtained through the Research Data Assistance Center. The Medicare fee-for-service data is comprised of a 20% nationally representative sample of individuals that includes claims for covered services in inpatient, outpatient, carrier, and home health, settings. These files contain patient demographic information including Medicaid dual eligibility status, diagnosis and procedure codes, dates of service, charged dollar amounts, amounts paid, and provider information such as National Provider Identification numbers. Providers submit this information directly to the Centers for Medicare and Medicaid Services (CMS).

The MA data is from encounter records that also include inpatient, outpatient, carrier and home health settings. These data include similar information to the fee-for-service data, but do not include payment information. The information in these records is submitted by the MA Organizations (who sponsor the privately managed plans) rather than by providers. For both fee-for-service Medicare and MA enrollees with Part D prescription drug coverage, the data also include pharmacy claims.

2.2 | Sample

The total sample included 11,962,287 individuals, 8,028,870 enrolled in fee-for-service Medicare and 3,933,417 enrolled in MA plans. Individuals with eating disorders were identified as those with one or more claims or encounters with a diagnosis of anorexia nervosa (AN), bulimia nervosa (BN), binge-eating disorder (BED), other specified feeding or eating disorder (OSFED), and other unspecified feeding or eating disorder (OUSFED). Diagnoses were identified in the data using ICD-10 codes, F50.0x for AN, F50.2x for BN, F50.81 for BED, F50.8x for OSFED (excluding F50.81), and F50.9 for OUSFED. We considered diagnosis codes in any position on the outpatient, inpatient, carrier, and home health claims and encounter records.

2.3 | Analysis

We compared sociodemographic characteristics and comorbid somatic conditions for individuals with versus without an eating disorder diagnosis. Sociodemographic characteristics examined include sex, age category (<40 years, 40–54 years, 55–65 years, 65–74 years and 75+ years), race, enrollment in MA, and dual eligibility for Medicaid. The presence of comorbid conditions was summarized using the Elixhauser Comorbidity Index (Elixhauser, Steiner, Harris, & Coffey, 1998). The current version of this measure includes 31 categories of comorbid conditions that are dichotomously indicated as present or not present. Higher scores on this index indicate a greater number of comorbid conditions.

We also examined the presence of specific comorbid gastrointestinal, cardiovascular, musculoskeletal, and endocrine conditions, comparing those with an eating disorder to those without, and by eating disorder diagnosis. A list of diagnosis codes can be found in Appendix A. We then stratified the results by age category to assess differences in the number and type of comorbid conditions within age categories among those with and without eating disorders.

To compare total spending between individuals with and without an eating disorder diagnosis, we calculated mean total spending, as well as mean inpatient, outpatient, home health, and pharmacy spending. Since we required some contact with the medical system to identify individuals with an eating disorder diagnosis, we also compared spending for individuals with an eating disorder diagnosis to spending for the subset of individuals without an eating disorder diagnosis with at least one medical or pharmacy claim. These calculations were conducted only for Medicare fee-for-service enrollees, as the MA encounter records do not contain payment information.

We used Pearson χ^2 tests to compare proportions of categorical variables and two-sided *t*-tests to compare means. We considered differences to be statistically significant if *p* values were below .05. This study was approved by the Johns Hopkins Bloomberg School of Public Health IRB (approval #11318). Data were extracted using SAS 9.4 and all analyses were conducted in Stata 16.

3 | RESULTS

Of the total 2016 sample, 0.15% had an eating disorder diagnosis. Compared to those without an eating disorder, a greater proportion of individuals with an eating disorder diagnosis were female (73.8% vs. 54.3%, *p* < .01), under age 65 (41.6% vs. 15.5%, *p* < .01), and dually eligible for Medicaid due to disability or low-income qualification (48.0% vs. 19.6%, *p* < .01) (Table 1). Of those with an eating disorder, demographic characteristics varied across diagnoses. People with BN were the youngest, with 73.9% under age 65, and 22.9% under age 40. This was followed by BED with 60.9% under age 65. Individuals with OSFED were the oldest with 36.5% over age 75 closely followed by those with AN with 35.4%. Dual eligibility for Medicaid was highest among people with BN (58.4%) and AN (50.4%).

3.1 | Comorbid conditions

A greater proportion of individuals with an eating disorder diagnosis had a high (six or greater) Elixhauser Comorbidity Index score compared to individuals without an eating disorder diagnosis (54.3% vs. 21.7%, *p* < .01) (Table 2). More than 50% of individuals with OSFED (56.3%), OUSFED (55.4%), and AN (52.5%) had high scores on the Elixhauser Comorbidity Index. A larger proportion of individuals with eating disorders, compared to those without, had each of the specifically examined conditions during 2016. The greatest percentage point differences between people with eating disorders and those without were in cardiac arrhythmias (35.3% vs. 19.9%, *p* < .05), arthritis (40.1% vs. 26.6%, *p* < .05) and thyroid conditions (32.2% vs. 19.4%, *p* < .05). Approximately twice the number of people with eating disorders had heart attacks compared to those without (3.7% vs. 1.9%, *p* < .01), and 3.2 times as many had irritable bowel syndrome (6.7% vs. 2.1%, *p* < .01) (Table 2).

When stratified by age group, a higher proportion of individuals with eating disorders had irritable bowel syndrome, heart arrhythmias, high cholesterol, arthritis, osteoporosis, thyroid disease, and diabetes across all ages (Table 3). There was no difference in occurrence of heart attacks between individuals with and without eating disorders in those under age 40 and between ages 40 and 54, but approximately 2.3 times as many people over 75 with

eating disorders had heart attacks than those without eating disorders (6.4% vs. 2.8%, $p < .01$).

3.2 | Spending

Overall, when combining inpatient, outpatient, home health, and pharmacy expenditures, mean spending for Medicare fee-for-service enrollees with eating disorders (\$29,456) was approximately four times greater than for those without eating disorders (\$7,418, $p < .01$) and three times greater than for those without an eating disorder and at least one medical or pharmacy claim (\$9,834, $p < .01$) (Figure 1). For inpatient spending, mean spending for eating disorders was significantly higher than for people without an eating disorder (\$12,843 vs. \$3,046, $p < .01$) and for individuals without an eating disorder who had at least one medical or pharmacy claim (\$12,843 vs. \$4,046, $p < .01$). Individuals with eating disorders also had higher spending in the outpatient (\$9,686), home health (\$1,295), and pharmacy claims (\$5,638) compared with all other enrollees without an eating disorder (\$1,635, \$439, and \$2,265, all $p < .01$) and those without an eating disorder who had at least one medical or pharmacy claim (\$2,165, \$581, and \$3,002, all $p < .01$).

4 | DISCUSSION

In the United States, Medicare is the largest payer of healthcare services, providing coverage to more than 60 million adults. Historically, eating disorders research has concentrated on adolescents and young adults, such that the occurrence of these conditions is understudied in the Medicare program. This study of the presence and cost of eating disorders within Medicare enrollees finds prevalence similar to commercially-insured populations and higher costs than for those without eating disorders (Striegel-Moore et al., 2000). However, the prevalence is lower than has been found in U.S. population samples (Hudson, Hiripi, Pope, & Kessler, 2007; Udo & Grilo, 2018). Underdiagnosis of eating disorders has been shown to occur among individuals with higher weight status, non-Whites, and males (Sonneville & Lipson, 2018; Strother, Lemberg, Stanford, & Turberville, 2012); population rates may be underestimated in this sample. In addition, while individuals under age 65 comprise roughly 16% of all Medicare enrollees, they represent approximately 42% of enrollees with any eating disorder diagnosis, a reflection of the extent to which many individuals with eating disorders are qualifying for Medicare due to disability status.

Among Medicare enrollees, individuals with eating disorders are medically complex. More than half have greater than six comorbid conditions. Prior research has shown that higher numbers of comorbidities adversely impact survival and increase spending in Medicare enrollees (Fillenbaum, Pieper, Cohen, Cornoni-Huntley, & Guralnik, 2000; Keeney et al., 2020; Kriegsman, Deeg, & Stalman, 2004). Furthermore, eating disorders are associated with elevated mortality. One study of characteristics and survival of individuals with eating disorders found that the leading causes of death were diseases of the respiratory system; followed by injury, poisoning, and certain other consequences of external causes; and diseases of the digestive system (Demmler, Brophy, Marchant, John, & Tan, 2020). Understanding the prevalence of eating disorders in the Medicare population and commonly

co-occurring conditions will allow for better identification of high-need cases and care management both by individual clinicians and across specialties.

Compared to enrollees without eating disorders, approximately 2.4 times as many enrollees with eating disorders are dually eligible for Medicare and Medicaid. Generally, dually eligible individuals experience higher rates of chronic illness and many have significant social risk factors for adverse health outcomes (Medicare-Medicaid Coordination Office, 2020b). They also account for a disproportionately high degree of spending. This population also faces bureaucratic challenges with the need to coordinate across the federal Medicare program and state-run Medicaid programs. It is likely that care coordination between Medicare and Medicaid benefits for individuals with eating disorders will be challenging.

Medicare beneficiaries with an eating disorder diagnosis had more than \$20,000 higher average healthcare expenditures than their counterparts without an eating disorder diagnosis in 2016. The spending for Medicare enrollees with eating disorders impacts the federal budget and has direct implications for individuals. Out-of-pocket costs for enrollees vary but are typically comprised of premiums, deductibles and subsequent cost-sharing (copayments and coinsurance). Individuals with multiple chronic conditions, at least one inpatient hospitalization, and poorer self-reported health had higher out-of-pocket spending. Cubanski, Koma, Damico, and Neuman (2019) note that for enrollees with five or more chronic conditions 14% of their income was spent on out-of-pocket healthcare costs compared to only 8% among those with no chronic conditions. The increased spending across settings for people with eating disorders, and the higher proportion with greater than six comorbid conditions, suggests high out-of-pocket spending for individuals with eating disorders. While some Medicare enrollees may have supplemental insurance (private insurance plans that cover certain costs not paid by Medicare such as copayments, coinsurance, and deductibles), these costs may be a significant burden to the individual or family.

The proportion of individuals with most conditions increased with age in those with and without an eating disorder diagnosis. Individuals with eating disorders had higher rates for most conditions across age groups. Momen et al. (2021) found bidirectional risk between eating disorders and 12 categories of general medical conditions including neurological, infectious, immune, respiratory, gastrointestinal, skin, musculoskeletal, genitourinary, circulatory, endocrine, congenital, and injury. Other studies have found associations between eating disorders and gastrointestinal disorders (Santonicola et al., 2019), autoimmune disorders (Raevuori et al., 2014; Zerwas et al., 2017), and cardiovascular disease (Sardar et al., 2015; Tith et al., 2019). Understanding the relationships between somatic conditions and eating disorders could help identify individuals with complex medical and psychiatric needs.

The findings in this study establish that people with eating disorders covered through Medicare are high-cost and medically complex. From a policy perspective, consideration should be given to the ways that Medicare benefit design and coverage do or do not promote access to specialty eating disorder treatment. For example, as of November 2021, Medicare only provides coverage for nutrition services to individuals with diabetes or kidney

disease and those who have had a kidney transplant in the previous 36 months (Centers for Medicare & Medicaid Services, 2021b). If an individual with an eating disorder is covered by Medicare, they currently cannot access these services unless they can afford to pay the full cost out of pocket or have additional insurance that covers the cost.

In addition, CMS has explored options for ways to increase quality of care and decrease costs for medically complex, high-cost enrollees. One approach CMS has implemented is care coordination—including accountable care organizations and patient-centered medical homes (Agency for Healthcare Research and Quality, 2021; Centers for Medicare & Medicaid Services, 2021a). Neither model has been specifically tested in an eating disorder population, but both provide mechanisms for clinicians to bill for typically uncompensated care coordination which could improve health outcomes.

There are several strengths of this research. This is one of few studies of eating disorders utilizing healthcare claims data, allowing comparison of expenditures between people with eating disorders and those without. The use of Medicare data provides insight into adults aged 65 and older and those who qualify through disability status, a population that is often excluded from other research. The 20% sample of Medicare data provides a nationally representative sample of Medicare enrollees, and the inclusion of MA encounter data allows us to examine demographics and comorbid conditions of a wider sample that includes those who choose privately managed plans.

The findings need to be considered in light of several limitations. These data came from a single year (2016); prevalence and treatment patterns for people with eating disorders may differ in different years. Furthermore, the data in this study reflect Medicare claims and encounters for services rendered, thus only representing utilization and spending patterns for individuals with at least one claim or encounter with an eating disorder diagnosis. The ICD-10 code for BED is a subcode of OSFED. A relatively large number of individuals received only the main OSFED code, potentially underestimating the occurrence of BED. In order to compare the clinical and sociodemographic profiles of individuals with and without eating disorders we conducted a series of statistical tests. As the number of statistical comparisons increases, so does the possibility of statistically significant results due to chance. However, we addressed this potential limitation by also calculating sharpened false discovery rates and, after applying this false discovery rate correction, found that each of the results reported as statistically significant based on the *p* value remained statistically significant (Anderson, 2008). Finally, this is one of the first years of MA encounter data released to researchers and it may have missing records.

The findings in this study establish that eating disorders occur in the Medicare population, and that enrollees with these illnesses have risk factors associated with higher spending and adverse health outcomes. Future research should look at patterns of healthcare utilization and spending in individuals with eating disorders across multiple years to better understand the relationship between eating disorders and comorbid somatic conditions. Another important area for future research is access to treatment or this population, including research on acceptance of Medicare by eating disorder specialists across the country, the settings (inpatient hospital, residential, outpatient, etc.) in which patients are receiving

care for their eating disorders, the capacity of eating disorder specialists and facilities to accept new patients, and the out-of-pocket costs incurred by patients. Understanding where individuals with eating disorders are obtaining treatment and how insurance coverage impacts their treatment options is crucial to ensuring that they can access appropriate care and minimize adverse health outcomes.

Public significance statement: The present study found that, in 2016, eating disorders occurred in 0.15% of U.S. Medicare enrollees, similar to rates found in commercially-insured populations. These enrollees had more somatic comorbidities and greater spending than enrollees without eating disorders. Further research is needed to assess this population's access to specialty eating disorder treatment and the trajectory of morbidity and mortality over time.

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APPENDIX A: INCLUDED ICD-10 DIAGNOSIS CODES

Condition	ICD-10 codes
Arthritis	M15.x, M16.x, M17.x, M18.x, M19.x
Osteopenia	M85.80
Osteoporosis	M80.0x, M80.8x, M81.0, M81.6, M81.8
Hip fracture	M84.459x, M84.359x
Irritable bowel syndrome	K58.x
Celiac disease	K90.0
Nonceliac gluten sensitivity	K90.41
Barrett's esophagus	K27.7x
Ulcerative colitis/Crohn's disease	K51.x
Heart arrhythmia	I44.1–I44.3, I45.6, I45.9, I47.x –I49.x, R00.0, R00.1, R00.8, T82.1, Z45.0, Z95.0
High cholesterol	E78.x
Heart attack (MI)	I21.x
Thyroid disease	E00.x–E03.x, E89.0
Diabetes mellitus	E10.x, E11.x, E13.x

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from ResDAC. Restrictions apply to the availability of these data, which were used under license for this study.

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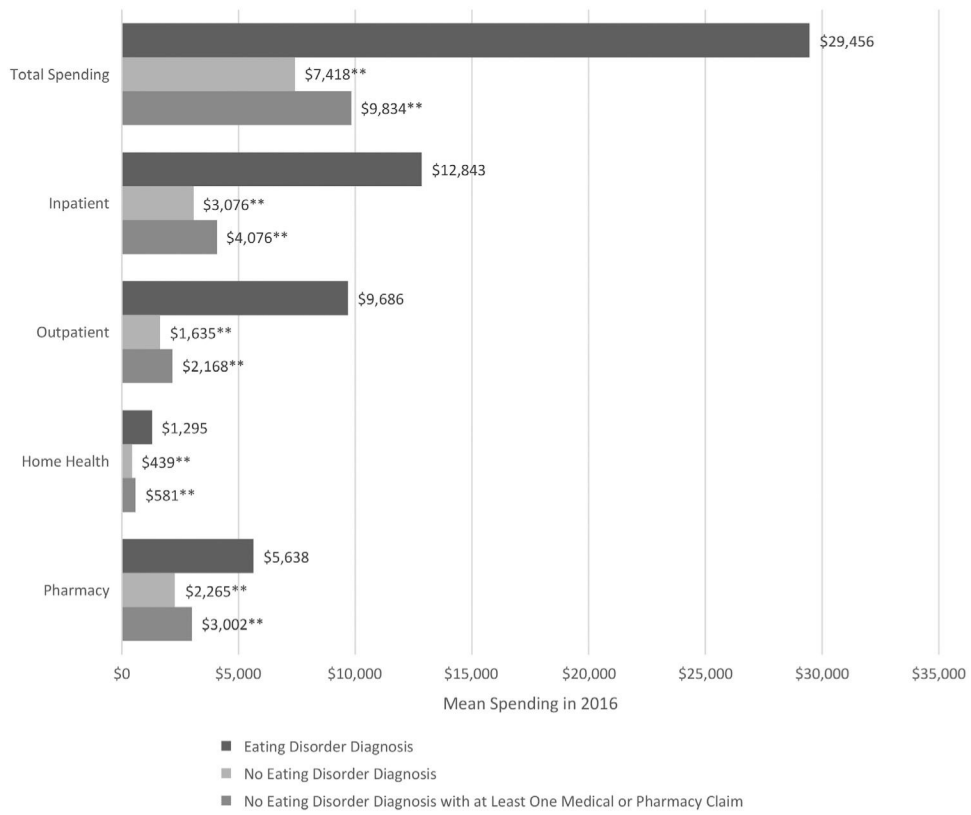


FIGURE 1. Healthcare spending for fee-for-service Medicare enrollees with an eating disorder diagnosis compared to those without. * $p < .05$; ** $p < .01$. Statistically significant difference comparing mean spending for individuals with an eating disorder diagnosis (reference group) to those without and to those without who have at least one medical or pharmacy claim

Demographic characteristics of individuals with and without eating disorder diagnoses in the 2016 20% sample of fee-for-service Medicare claims and Medicare Advantage encounter data

TABLE 1

	No ED N = 11,944,313	By eating disorder diagnosis					
		Any ED N = 17,974	AN N = 3,223	BN N = 1,650	BED N = 793	OSFED N = 7,510	OUSFED N = 6,959
Enrolled in Medicare Advantage (%)	32.9%	31.1% **	30.2%	30.4%	30.8%	29.6%	31.7%
Female (%)	54.3%	73.8% **	79.8%	86.6%	81.1%	71.0%	73.7%
Age (%)							
<40 years	2.2%	9.6% **	11.4%	22.9%	12.9%	7.3%	11.4%
40–54 years	5.2%	17.3% **	17.4%	33.7%	26.2%	14.4%	19.2%
55–64 years	8.2%	14.7% **	13.9%	17.3%	21.8%	14.1%	15.8%
65–74 years	48.3%	26.9% **	21.9%	19.0%	32.0%	27.8%	28.3%
75+ years	36.2%	31.6% **	35.4%	7.1%	7.1%	36.5%	25.4%
Dual eligible (%)	19.6%	48.0% **	50.4%	58.4%	44.5%	46.3%	48.7%
Race (%)							
White	74.6%	73.9% *	77.2%	80.7%	82.9%	72.1%	74.6%
Black	10.4%	13.1% **	8.9%	7.8%	7.9%	15.0%	12.9%
Hispanic	9.0%	8.7%	8.9%	6.8%	5.7%	8.8%	8.2%
Other/unknown	5.9%	4.3% **	5.0%	4.7%	3.5%	4.2%	4.3%

Note: This table reports the percent of individuals for each column that meet the row demographic or clinical characteristic. For example, 32.9% of individuals without an eating disorder diagnosis were enrolled in Medicare Advantage.

* p .05

** p .01 statistically significant difference within row for individuals with any eating disorder diagnosis compared to individuals without. We used Pearson χ^2 tests to compare proportions.

Abbreviations: AN, anorexia nervosa; BN, bulimia nervosa; BED, binge-eating disorder; OSFED, other specified feeding or eating disorder; OUSFED, other unspecified feeding or eating disorder.

TABLE 2

Comorbid somatic conditions of individuals with and without eating disorders

	By eating disorder diagnosis						
	No ED N = 11,944,313	Any ED N = 17,974	AN N = 3,223	BN N = 1,650	BED N = 793	OSFED N = 7,510	OUSED N = 6,959
Mean Elixhauser Comorbidity Index score (SD)	1.7 (0.8)	2.4 (0.7) **	2.4 (0.8)	2.2 (0.8)	2.2 (0.7)	2.4 (0.7)	2.4 (0.7)
Elixhauser Comorbidity Index score (%)							
Low (0–2)	48.4%	14.8% **	16.8%	22.8%	20.4%	13.1%	13.6%
Medium (3–5)	29.9%	30.9% **	30.7%	38.4%	40.7%	30.6%	31.0%
High (6+)	21.7%	54.3% **	52.5%	38.8%	38.8%	56.3%	55.4%
Gastrointestinal							
Irritable bowel syndrome	2.1%	6.7% **	9.3%	11.7%	7.4%	5.7%	6.9%
Celiac disease	<1%	<1%	<1%	1.1%	1.3%	<1%	<1%
Gluten sensitivity	<1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Barrett’s esophagus	<1%	<1%	<1%	0.2%	0.0%	<1%	<1%
Ulcerative colitis	<1%	1.2% **	1.5%	1.1%	0.9%	1.3%	1.1%
Cardiovascular							
Heart arrhythmia	19.9%	35.3% *	37.1%	23.6%	18.0%	36.3%	35.8%
High cholesterol	57.0%	61.1% *	51.9%	47.3%	61.8%	64.5%	61.3%
Heart attack	1.9%	3.7% **	3.8%	1.7%	<1%	3.9%	3.7%
Musculoskeletal							
Arthritis	26.6%	40.1% *	35.5%	28.1%	40.2%	41.7%	41.0%
Osteopenia	5.0%	6.1% **	7.1%	6.9%	5.8%	6.2%	5.5%
Osteoporosis	10.0%	16.3% *	24.4%	13.5%	9.6%	15.9%	14.1%
Hip fracture	<1%	<1%	<1%	0.4%	0.0%	<1%	<1%
Endocrine							
Thyroid disease	19.4%	32.2% *	33.0%	29.8%	31.9%	32.7%	31.4%
Diabetes	27.6%	38.1% *	26.5%	25.2%	41.4%	41.5%	39.8%

Note: This table reports the percent of individuals for each column that have a diagnosis of the row somatic condition. For example, 2.1% of individuals without an eating disorder diagnosis had a diagnosis of irritable bowel syndrome. We calculated Elixhauser Comorbidity Index scores based on outpatient, inpatient, and carrier/encounter records.

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.01 statistically significant difference within row for individuals with any eating disorder diagnosis compared to individuals without. We used Pearson χ^2 tests to compare proportions and two-sided t -tests to compare means. We do not report statistically significant differences for rows where the prevalence of the condition is below 1% both for individuals with any eating disorder diagnosis and individuals without.

Abbreviations: AN, anorexia nervosa; BN, bulimia nervosa; BED, binge-eating disorder; OSFED, other specified feeding or eating disorder; OUSFED, other unspecified feeding or eating disorder.

TABLE 3
Comparison of comorbid somatic conditions of individuals with and without eating disorders by age group

	≤40 years		40–54 years		55–64 years		65–74 years		75+ years	
	No ED	Any ED	No ED	Any ED	No ED	Any ED	No ED	Any ED	No ED	Any ED
Gastrointestinal	n = 257,943	n = 1,720	n = 619,823	n = 3,104	n = 974,837	n = 2,646	n = 5,772,442	n = 4,833	n = 4,319,268	n = 5,671
Irritable bowel syndrome	2.0%	10.5% ^{**}	2.7%	9.7% ^{**}	2.5%	8.5% ^{**}	1.9%	5.6% ^{**}	2.1%	3.9% ^{**}
Celiac disease	<1%	<1%	<1%	0.7% ^{**}	<1%	<1%	<1%	<1%	<1%	<1%
Gluten sensitivity	<1%	0%	<1%	0%	<1%	0%	<1%	0%	<1%	0%
Barrett's esophagus	<1%	<1%	<1%	<1%	<1%	0%	<1%	<1%	<1%	<1%
Ulcerative colitis	<1%	1.4% ^{**}	<1%	<1%	<1%	1.1% ^{**}	<1%	1.3% ^{**}	<1%	1.3% ^{**}
Cardiovascular										
Heart arrhythmia	8.8%	24.1% ^{**}	11.9%	22.5% ^{**}	15.4%	27.3% ^{**}	13.9%	31.8% ^{**}	30.9%	52.5% ^{**}
High cholesterol	17.8%	26.6% ^{**}	39.7%	47.8% ^{**}	52.4%	63.1% ^{**}	54.8%	70.3% ^{**}	65.7%	70.1% ^{**}
Heart attack	<1%	<1%	1.3%	1.3%	2.1%	2.7% [*]	1.4%	3.8% ^{**}	2.8%	6.4% ^{**}
Musculoskeletal										
Arthritis	5.8%	12.7% ^{**}	18.8%	30.1% ^{**}	27.5%	45.4% ^{**}	22.7%	44.2% ^{**}	33.9%	47.9% ^{**}
Osteopenia	<1%	2.9% ^{**}	1.3%	3.3% ^{**}	2.8%	6.3% ^{**}	5.4%	8.9% ^{**}	5.8%	6.1%
Osteoporosis	1.1%	4.6% ^{**}	2.9%	7.8% ^{**}	6.1%	15.2% ^{**}	8.1%	18.6% ^{**}	14.9%	22.9% ^{**}
Hip fracture	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
Endocrine										
Thyroid disease	8.9%	20.1% ^{**}	14.4%	28.6% ^{**}	17.1%	33.8% ^{**}	16.5%	33.3% ^{**}	25.3%	36.0% ^{**}
Diabetes	11.2%	21.1% ^{**}	25.3%	31.6% ^{**}	33.6%	41.4% ^{**}	25.2%	42.3% ^{**}	30.6%	41.7% ^{**}

Note: We used Pearson χ^2 tests to compare proportions. We do not report statistically significant differences for rows where the prevalence of the condition is below 1% both for individuals with any eating disorder diagnosis and individuals without.

* p .05

** p .01 statistically significant difference by age group within row for individuals with any eating disorder diagnosis compared to individuals without.