

ORIGINAL RESEARCH—CLINICAL

The Influence of Psychiatric Factors on Health-Care Resource Utilization in Patients With Gastroparesis: A National Population-Based Study



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BACKGROUND AND AIMS: Gastroparesis, characterized by delayed gastric emptying, leads to debilitating gastrointestinal symptoms and often experience comorbid psychiatric disorders, possibly linked to brain-gut network dysfunction. This adversely affects quality of life and necessitates medical care. We aimed to characterize the longitudinal impact of comorbid anxiety, depression, or bipolar disorder on health-care resource utilization in adults hospitalized primarily with gastroparesis. **METHODS:** A retrospective observational study using the 2016–2019 National Inpatient Sample Healthcare Cost and Utilization Project identified patients aged ≥ 18 years hospitalized with an index diagnosis of gastroparesis (International Classification of Diseases-10 code K31.84). The cohort was stratified based on the presence of comorbid psychiatric mood disorders (depression, anxiety, and bipolar spectrum disorders). We compared the frequency of computed tomography (CT) imaging, gastric emptying studies, endoscopic procedures, length of stay, and hospitalization costs. Chi-square and analysis of variance tests were used. **RESULTS:** Of 47,265 patients hospitalized with gastroparesis, 21,545 (45.6%) had comorbid psychiatric mood disorders. These patients had a higher mean Elixhauser comorbidity index (3.6 ± 1.8 vs 2.9 ± 1.8 , $P < .001$) and a longer median hospital stay (4, interquartile range: 2–6 vs 3, interquartile range: 2–6, $P < .001$). Adjusted analysis showed higher CT imaging frequency in this group (adjusted Odds ratio: 1.15; 95% confidence interval: 1.04–1.67). Although the frequency of endoscopic procedures, gastric scintigraphy, and total hospitalization costs were higher in the psychiatric comorbidity group, these differences were not statistically significant in univariable analysis. **CONCLUSION:** Nearly 50% of gastroparesis patients had concurrent psychiatric disorders and underwent more frequent CT imaging and had longer hospital stays. This underscores the importance of screening all gastroparesis patients for psychiatric disorders upon admission and exploring the effectiveness of incorporating psychosocial interventions into the treatment plan for gastroparesis patients.

Keywords: Gastroparesis; Psychiatric; Admission

Introduction

Gastroparesis is a digestive motility disorder characterized by delayed emptying of gastric contents without a mechanical obstruction.¹ Individuals with gastroparesis experience chronic symptoms such as premature fullness, persistent postmeal discomfort, chronic nausea, sporadic vomiting, abdominal pain, and fatigue. These symptoms overlap with postprandial distress syndrome, which is a recognized type of functional dyspepsia but can be distinguished based on delayed gastric emptying with scintigraphy, single-photon emission computed tomography, or magnetic resonance imaging.

Gastroparesis substantially burdens patients' quality of life, leading to increased hospitalization and economic consequences. The increasing number of gastroparesis-related hospitalizations in the United States reflects a rising prevalence of the condition and its significant economic impact.^{2,3} A recent study reported a standardized disease prevalence of 267.7 per 100,000 persons, based on meeting one of the following 3 criteria: (1) Diagnostic criteria: either 1 inpatient or at least 2 outpatient diagnoses of gastroparesis 30 days apart; (2) Gastric emptying scintigraphy criteria: having a gastric emptying scintigraphy test within 90 days of gastroparesis diagnosis date; (3) Symptoms criteria: having experienced typical symptoms of gastroparesis (nausea and/or vomiting, postprandial fullness, early satiety, bloating, or epigastric pain) at least 90 days before gastroparesis diagnosis date. The prevalence of "definite" gastroparesis (individuals who met all the 3

Abbreviations used in this paper: CT, computed tomography; GPOEM, gastric peroral endoscopic myotomy; ICD, International Classification of Diseases; OR, odds ratio.

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criteria) was 21.5 per 100,000 persons.⁴ Gastroparesis is commonly diagnosed between 40 and 45.5 years of age, with 67%–88% of cases occurring in females.⁵

Multiple risk factors have been linked to increased risk of gastroparesis, including diabetes mellitus, neurogenic disorders such as Parkinson's disease, iatrogenic causes, viral infections including hepatitis B virus, herpes virus, and bacterial infections like salmonella gastroenteritis.¹ Among individuals with gastroparesis, 24% had combined anxiety and depression, 12.4% experienced severe anxiety, 21.8%–23% had depression, and 50% exhibited somatization.⁵ Worsening depression and anxiety scores have been linked to increased severity of gastroparesis on patient-reported assessments.⁶

Recent research indicates a rise in hospitalization rates and prolonged inpatient stays among individuals with gastroparesis.⁷ Repeated testing adds to the costs and potential risks in gastroparesis care.⁸ This calls for efforts to prioritize improving patient well-being and reducing unnecessary interventions. This study aims to explore the influence of psychiatric factors on health-care resource utilization in patients hospitalized with gastroparesis.

Methodology

We performed a retrospective cross-sectional study using the National Inpatient Sample, Healthcare Cost and Utilization Project, Agency for Healthcare Research and Quality database (2016–2019) to assess the role of psychiatric mood disorders on health-care resource utilization in gastroparesis hospitalization.⁹ The NIS is an all-payer American health-care database representing around 20% of all hospital admissions in the United States. We identified hospitalization incidents with a primary diagnosis of gastroparesis using the International Classification of Diseases, Tenth Edition Revision, and Clinical Modification (ICD 10) codes (Table A1). Sample size was determined by the availability of patients with an ICD-10 diagnosis of gastroparesis within the specified timeframe. Patients younger than 18 years were excluded from the study. We stratified the study population into two cohorts based on the presence or absence of ICD codes for comorbid psychiatric disorders (anxiety, depression, bipolar, and adjustment spectrum disorders) (Figure 1).

Baseline demographic and hospitalization characteristics (age, sex, race, median quartile income, hospital region, hospital teaching status, and primary payer) were obtained. The comorbidities and Elixhauser comorbidity index were subsequently compared between the two cohorts.

The outcomes studied were the length of stay, total hospital charges, frequency of endoscopic procedures, computed tomography (CT) abdomen, and nuclear medicine gastric emptying study.

Statistical Analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 28.0 (IBM Corporation, Armonk, NY). Continuous variables are presented as mean and standard deviation, while categorical variables are reported as numbers (N) and percentages (%). A two-tailed approach was used for statistical analysis, with a significance threshold set at a *P*-value below <.05. Patient's baseline

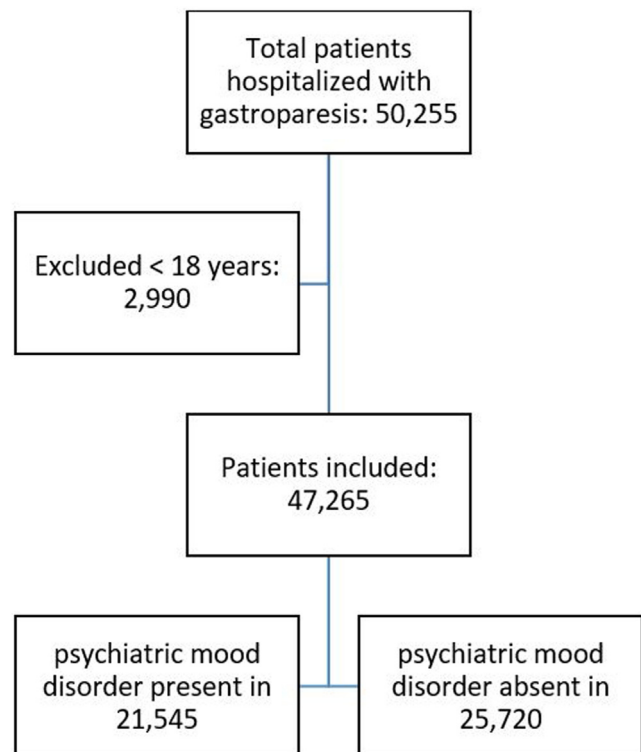


Figure. Selection and stratification of our patient population.

demographics and hospitalization characteristics were compared between the two groups. Categorical and continuous data were analyzed using chi-square and analysis of variance tests, respectively. Age, sex, race, and primary payer were included as covariates to adjust for baseline differences when comparing frequency of CT imaging. Sensitivity analysis stratified psychiatric comorbidities into anxiety, depression, and coexisting disorders to evaluate their independent associations with health-care utilization.

This study did not require institutional review board approval as it did not involve patient-level data.

Results

A total of 47,265 patients hospitalized with gastroparesis were included in the study, with 21,545 (45.6%) having comorbid psychiatric mood disorders (Figure 1). These psychiatric disorders were categorized as anxiety (31.5%), depression (24.8%), bipolar (5.7%), and adjustment disorder (4.9%). The mean age was 48.5 years, and the majority (77.6%) of the patients were females. Approximately 50% of the hospitalizations were from the southern region of the United States. Several demographics and hospitalization characteristics significantly varied between the two cohorts (Table 1).

Patients with gastroparesis and concurrent psychiatric disorders exhibited a lower average age (47.2 years vs 49.5 years, $P < .001$), a higher likelihood of being female (84.0% vs 72.3%, $P < .001$), and a higher representation of Caucasian individuals (74.7% vs 60.4%, $P < .001$). Baseline comorbidities and Elixhauser comorbidity comparison

Table 1. Baseline Demographics and Hospitalization Characteristics in Patients With Gastroparesis (Weighted Analysis)

| | Gastroparesis with psychiatric mood disorder (n=21,545) | Gastroparesis without psychiatric factors (n=25,720) | P-value |
|-------------------------|---|--|---------|
| Mean age (y, SD) | 47.2 (15.8) | 49.5 (17.6) | |
| Age (y) | | | <.001 |
| <30 | 3010 (14.0%) | 3790 (14.7%) | |
| 30–60 | 14,035 (65.1%) | 14,735 (57.3%) | |
| >60 | 4500 (20.9%) | 7195 (28%) | |
| Race | | | <.001 |
| Caucasian | 16,085 (74.7%) | 15,525 (60.4%) | |
| African American | 2860 (13.3%) | 5980 (23.3%) | |
| Hispanics | 1460 (6.8%) | 2340 (9.1%) | |
| Others | 630 (2.9%) | 1205 (4.7%) | |
| Unknown | 510 (2.4%) | 670 (2.6%) | |
| Sex | | | <.001 |
| Male | 3450 (16.0%) | 7125 (27.7%) | |
| Female | 18,085 (84.0%) | 18,590 (72.3%) | |
| Location | | | |
| Rural | 1265 (5.9%) | 1955 (7.6%) | |
| Urban nonteaching | 4405 (20.4%) | 5995 (23.3%) | |
| Urban teaching | 15,875 (73.7%) | 17,770 (69.1%) | |
| Region | | | <.001 |
| Northeast | 3680 (17.1%) | 3665 (14.2%) | |
| Midwest | 4290 (19.9%) | 4435 (17.2%) | |
| South | 10,115 (46.9%) | 13,295 (51.7%) | |
| West | 3460 (16.1%) | 4325 (16.8%) | |
| Median household income | | | <.001 |
| 1st Q | 6335 (29.8%) | 8585 (33.8%) | |
| 2nd Q | 5820 (27.4%) | 6850 (27%) | |
| 3rd Q | 5275 (24.8%) | 5665 (22.3%) | |
| 4th Q | 3810 (17.9%) | 4275 (16.8%) | |
| Primary payer | | | <.001 |
| Medicare | 8865 (41.1%) | 10,315 (40.1%) | |
| Medicaid | 4895 (22.7%) | 5310 (20.6%) | |
| Private | 6395 (29.7%) | 8050 (31.3%) | |
| Self-pay/other | 1365 (6.3%) | 2025 (7.9%) | |
| Disposition | | | <.001 |
| Routine | 16,655 (77.3%) | 20,005 (77.8%) | |
| Facility/home health | 4390 (20.4%) | 4995 (19.4%) | |
| AMA | 435 (2.0%) | 600 (2.3%) | |
| Died | 45 (0.2%) | 115 (0.4%) | |

AMA, against medical advice; SD, standard deviation.

between the two groups is depicted in [Table 2](#). A higher mean Elixhauser comorbidity index was observed in those with psychiatric disorders (3.5 ± 1.8 vs 2.9 ± 1.8 , $P < .001$), while the prevalence of diabetes mellitus was relatively lower (11.8% vs 18.8%, $P < .001$).

The proportion of patients getting inpatient endoscopic procedures (11.8% vs 12.2%, odds ratio [OR] = 0.97, 95% CI: 0.92–1.24) and gastric emptying scintigraphy (0.2% vs 0.2%, OR = 1.01, 95% confidence interval (CI): 0.66–1.55) were comparable between the patients with and without psychiatric disorders ([Table 3](#)). The median length of stay was statistically longer in those with psychiatric disorders (4 days vs 3 days, $P < .001$), as shown in [Table 4](#), and they were more frequently subjected to CT imaging (0.7% vs 0.5%, OR = 1.33, 95% CI: 1.05–1.68). On multivariable analysis, patients with psychiatric disorders have higher

chances of getting CT imaging (adjusted Odds ratio: 1.15 (1.04–1.67), $P = .24$) after adjusting for age, sex, race, and primary payer. The total median hospital charges were higher in group with concurrent psychiatric disorder (\$29,726 vs \$29,176). However, the difference was not statistically significant between the two groups. Sensitivity analysis was performed for CT imaging frequency and length of hospital stay among gastroparesis patients with an exclusive diagnosis of anxiety, depression, and coexistent disorder ([Tables A2 and 3](#)).

Discussion

The findings from our study demonstrate that gastroparesis imposes a substantial burden on patients and the health-care system. This increase in hospitalizations for

Table 2. Comparing Comorbidities in the Two Groups of Patients With Gastroparesis (Weighted Analysis)

| Comorbidities | Gastroparesis with psychiatric mood disorder (n=21,545) | Gastroparesis without psychiatric mood disorder (n=25,720) | P-value |
|--|---|--|---------|
| Congestive heart failure | 1370 (6.4%) | 2205 (8.6%) | <.001 |
| Cardiac arrhythmias | 2950 (13.7%) | 3700 (14.4%) | .031 |
| Valvular disease | 525 (2.4%) | 700 (2.7%) | .052 |
| Chronic pulmonary disease | 5690 (26.4%) | 4640 (18.0%) | <.001 |
| Hypothyroidism | 3570 (16.6%) | 2810 (10.9%) | <.001 |
| Renal failure | 2055 (9.5%) | 3920 (15.2%) | <.001 |
| Obesity | 3495 (16.2%) | 3160 (12.3%) | <.001 |
| Weight loss | 5050 (23.4%) | 5460 (21.2%) | <.001 |
| Fluid and electrolyte disorders | 10,720 (49.8%) | 12,955 (50.4%) | .184 |
| Deficiency anemia | 1220 (5.7%) | 1540 (6.0%) | .133 |
| Diabetes mellitus | 2540 (11.8%) | 4840 (18.8%) | <.001 |
| Hypertension | 9895 (45.9%) | 12,490 (48.5%) | <.001 |
| Elixhauser comorbidity score mean (SD) | 3.5 (1.8) | 2.9 (1.8) | .001 |

SD, standard deviation.

gastroparesis may reflect an increased prevalence of diabetes mellitus or gastroparesis, changes in diagnostic criteria, severity, and treatment of gastroparesis, or better recognition and diagnosis of this disorder.¹⁰ Jung et al reported that 25% of their patients with gastroparesis in Olmsted County required therapeutic interventions such as tube feeding, parenteral nutrition, or Botox injection, most of which were associated with inpatient stays.¹¹ Though vomiting and pain were the main reasons for these encounters, surrogate markers of pain did not predict repeat hospitalizations. Most tests were confirmatory in nature, with their results having no impact on the course of treatment. About 10% of patients exceeded an annual radiation exposure of 20 mSv at least once.⁸

Gastroparesis exhibits a spectrum of severity, from cases manageable with dietary restrictions to severe instances requiring substantial health-care interventions, such as endoscopic, surgical therapies, or supplementary nutrition.¹² Notably, the past two decades have witnessed an increase in emergency room visits and hospitalizations among individuals diagnosed with gastroparesis.^{2,3} In 1995, gastroparesis resulted in economic costs of \$47.7 million as a primary diagnosis and \$863.3 million as a secondary diagnosis in the United States. By 2004, these expenses had notably increased to \$208.3 million for primary diagnoses

and \$3.3 billion for secondary diagnoses.² In 2004, the total charges for hospitalization in patients with gastroparesis were \$20,573 when listed as the primary diagnosis and \$24,965 as the secondary diagnosis. In our study, the total hospitalization charges for gastroparesis as a primary diagnosis were approximately \$29,000, showing comparability across the studied cohorts. Hospitalization duration and imaging frequency were notably higher in patients with psychiatric problems.

A study utilizing the International Business Machines exploratory database from 1999 to 2002 reported prevalence rates of 37.62% for anxiety, 42.17% for depression, and 6.55% for bipolar disorders among gastroparesis patients.¹³ Our study found similar results for anxiety (31.5%) and bipolar disorder (5.7%), but a relatively lower prevalence of depression (24.8%) and adjustment disorders (4.9%).

It was reported that Gastroparesis Cardinal Symptom Index scores >3 were related to higher Beck Depression Inventory (≥ 20) and State-Trait Anxiety Inventory scores for the state ($Y1 \geq 46$).⁶ Psychological dysfunction remains consistent, showing no variation based on either the etiology or the degree of gastric retention. It was also reported that moderate to severe depression and the use of anxiolytics at baseline were negative predictors of symptomatic

Table 3. Comparison of Length of Stay and Hospitalization Cost

| Outcomes | Gastroparesis with psychiatric mood disorder (n=21,545) | Gastroparesis without psychiatric mood disorder (n=25,720) | P-value |
|---|---|--|---------|
| Length of stay (d): Median (IQR) | 4 (2–6) | 3 (2–6) | <.001 |
| Total hospitalization cost (in dollars): Median (IQR) | 29,726 (18,020–53,059) | 29,176 (17,306–51,412) 3140 | .762 |

IQR, interquartile range.

Table 4. Comparison of Health-Care Resource Utilization Including Procedures and Imaging Studies

| Outcomes | Gastroparesis with psychiatric mood disorder (n=21,545) | Gastroparesis without psychiatric mood disorder (n=25,720) | Odds ratio | P-value |
|-----------------------|---|--|----------------------------|---------|
| Endoscopic procedures | 2555 (11.8%) | 3140 (12.2%) | OR-0.97; 95% CI-0.916–1.24 | .257 |
| CT imaging | 150 (0.7%) | 135 (0.5%) | OR-1.33; 95% CI-1.05–1.68 | .018 |
| Gastric scintigraphy | 40 (0.2%) | 45 (0.2%) | OR-1.01; 95% CI-0.66–1.55 | .968 |

improvement at follow-up. In contrast, antidepressant use was a positive predictor.¹⁴ Mental interventions have been shown to be effective in postsurgical gastroparesis patients with lower postintervention depression scores.¹⁵

Traditionally, gastroparesis management emphasized motor aspects, but there is a growing recognition of a sensory component to patient complaints. Some individuals experience pronounced symptoms despite mild delays in stomach emptying, while others may endure significant delays with comparatively muted manifestations.¹³ Following gastric peroral endoscopic myotomy (GPOEM), patients experiencing favorable clinical response demonstrated a substantial reduction in gastroparesis-related hospitalizations from an average of 8.2 ± 12 in the 6 months before to 0.7 ± 1.5 in the 6 months after. Psychiatric medication use was linked to a higher risk of GPOEM failure (OR = 1.33, 95% CI: 0.11–1.01; $P = .052$).¹⁶ Addressing psychiatric factors is crucial, especially in refractory cases, in addition to considering surgical or endoscopic interventions like GPOEM, pyloroplasty, or gastric electrical stimulation.

The most important finding of this study is that approximately half of the patients admitted with gastroparesis had comorbid psychiatric mood disorders. These patients underwent CT scans more frequently, had longer hospital stays, and incurred higher costs compared to those without psychiatric mood disorders. Based on these findings, we recommend screening all admitted gastroparesis patients for psychiatric mood disorders upon admission and consulting psychiatric specialists as early as possible.

Limitations

Our study has several limitations. Initially, it is important to note that this study relied on the NIS database, which depends on the precision of billing codes entered by health-care providers. Inconsistent or inaccurate usage of billing codes may distort the reported prevalence of psychiatric disorders in gastroparesis patients and impact the study's outcomes. Additionally, the study could not specifically address the severity and current management of these psychiatric disorders. The NIS database solely encompasses hospitalized gastroparesis patients, omitting data from those exclusively treated in outpatient settings.

Prior studies have indicated a positive correlation between anxiety and depression levels and the severity of gastroparesis symptoms.^{6,17,18} However, our study, limited

by its constraints, was unable to assess the severity of gastroparesis, anxiety, and depression, precluding us from making specific comments on this aspect. Despite its limitations, a notable strength of this study lies in its capacity to evaluate demographics and outcomes on a national scale.

Conclusion

Patients diagnosed with gastroparesis cope with significant physical, psychological, and social aspects to deal with debilitating symptoms. Many of them visit an emergency care and undergo multiple diagnostic tests. While often reassuring, such negative findings do not necessarily alter patient management. All patients admitted with gastroparesis should be screened for psychiatric mood disorders. Collaborative initiatives are essential to enhance the well-being and quality of life for individuals with gastroparesis while also aiming to minimize the occurrence of potentially unnecessary or harmful interventions. Incorporating psychosocial interventions could improve the overall care plan for gastroparesis patients. Our study provides valuable insights into the relationship between gastroparesis and comorbid psychiatric conditions. However, these findings should be interpreted in light of the limitations mentioned, and further research is warranted to address these gaps. Enhancing the comprehensiveness of our understanding of this complex medical interplay will ultimately improve the management and care of patients with gastroparesis.

Supplementary Materials

Supplementary material associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.gastha.2025.100620>.

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Authors' Contributions:

Study conception and design: Karan Sachdeva, Qiang Cai. Data collection: Karan Sachdeva. Analysis and interpretation of results: Karan Sachdeva. Manuscript preparation (initial draft): Karan Sachdeva, Daniyal Raza. Manuscript preparation (critical review): All authors.

Conflicts of Interest:

The authors disclose no conflicts.

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Ethical Statement:

Institutional review board approval was not required as the data were obtained from deidentified, publicly available database.

Data Transparency Statement:

The data, analytic methods, and study materials generated or analyzed during the current study will be made available to other researchers upon reasonable request. The data will be shared upon request from the corresponding author at qiang.cai@lsuhs.edu.

Reporting Guidelines:

This study followed the STROBE guidelines for observational research to ensure complete reporting. Standard ethical and scientific research protocols were adhered to throughout the study.