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ORIGINAL ARTICLE

The burden of psychiatric illnesses in adult patients with beta-thalassemia: a 5-year nationwide inpatient evaluation in the United States

Krupa Patel[1] · Siddhi Bhivandkar[2] · Rupak Desai[3] · Todd Antin[4]

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Abstract

Beta-thalassemia (ß-thalassemia) is a frequently inherited monogenic disorder worldwide with severe physical and mental health comorbidities. The aim of this study is to evaluate the burden of psychiatric disorders in adult patients hospitalized with ß-thalassemia in the United States (US). We utilized the discharge data from the National Inpatient Sample (NIS) from 2010 through 2014 to identify hospitalized ß-thalassemia patients who are 18 years and older. We assessed categorical and continuous variables using chi-square test and Student's *t* test respectively. The burden of psychiatric disorders was assessed using descriptive statistics and represented in terms of frequency (*n*) and percentage (%). A *p* value threshold of < 0.05 was considered clinically significant. All statistical analyses were performed using SPSS version 22.0 (IBM Corp., Armonk, NY, USA). Of the 10,046 ß-thalassemia patients studied, 24.4% ($n = 2448$) reported psychiatric disorders. Mood disorders (15.2%; inclusive of 10.3% depression), followed by anxiety (9.4%), and substance abuse disorder (6.5%; 4.3% drug abuse, 2.2% alcohol abuse) were most prevalent. Comorbid mental illnesses increased the length of stay by 44.6% and total costs by 23.4%. All-cause mortality rate was reported at 1.9% in overall ß-thalassemia patients. This study highlights higher rates of psychiatric disorders such as depression and anxiety and correlated increases in length of stay and cost in hospitalized ß-thalassemia patients. To improve medical outcomes and curtail unnecessary health-care costs, implementation of an integrated care model can be considered.

Keywords Beta-thalassemia · Hemoglobinopathies · Psychiatric disorders · Depression · Anxiety · National (nationwide) inpatient sample

✉ Krupa Patel
patelkrupa24@gmail.com

Siddhi Bhivandkar
siddhi.bhivandkar@gmail.com

Rupak Desai
drrupakdesai@gmail.com; rdesa30@emory.edu

Todd Antin
drantin@pactatl.com

[1] Avalon University School of Medicine, 122-124 Santa Rosaweg, Willemstad, Curaçao

[2] Smolensk State Medical University, Ulitsa Krupskoy, 28, Smolensk, Smolenskaya Oblast, Russia 214019

[3] Atlanta VA Medical Center, 1670 Clairmont Rd, Decatur, GA 30033, USA

[4] Behavioral Health, Dekalb Medical Center, 2701 N Decatur Rd, Decatur, GA 30033, USA

Introduction

Beta-thalassemia (ß-thalassemia) is one of the most frequent monogenic disorders worldwide: an estimated 270 million people globally are carriers of hemoglobinopathies and around 70,000 are born annually with ß-thalassemia [1, 2]. Highest prevalence is seen in regions across the Mediterranean, Middle East, North Africa, Central and South Asia, and the Far East [3].

ß-thalassemias are inherited in an autosomal recessive pattern and caused by point mutations or partial deletions of the beta-globin gene on chromosome 11 [1, 3]. Phenotypic variants include ß-thalassemia minor, intermedia, and major. ß-thalassemia major, commonly known as Cooley's anemia, is the most severe homozygous form leading to signs and symptoms such as facial dysmorphisms, skeletal anomalies, hemolytic anemia, jaundice, gallstones, hepatosplenomegaly, and high-output congestive heart failure throughout a patient's lifespan [4].

While physical complications of ß-thalassemia have received a tremendous amount of attention, few studies have focused on the psychiatric complications of the disease. The general consensus among them is a high psychological burden with a predominance of depressive and anxiety disorders across all age groups of ß-thalassemia patients [5–8]. These studies, however, are limited by small sample sizes and mostly homogeneous population samples present in foreign countries.

According to the US (United States) Census Bureau, significant growth in the percentage of residents from thalassemia prevalent countries such as Saudi Arabia (93%), Bangladesh (37%), Iraq (36%), Egypt (25%), and Pakistan, India, and Ethiopia (each 24%) has occurred between 2010 and 2014 [9]. Due to the increasing diversity of the US population, thalassemia, which was once considered a rarity in the United States, has increased in prevalence by 7.5% in the past five decades [10]. Therefore, the aim of this study is to determine the prevalence and burden of psychiatric disorders in hospitalized ß-thalassemia patients in the US who are 18 and older.

Methods

Data source

We utilized the discharge data from the National Inpatient Sample (NIS) from 2010 through 2014. The NIS is a part of the Healthcare Cost and Utilization Project (HCUP), which is sponsored by the Agency for Healthcare Research and Quality (AHRQ). It is the largest nationwide all-payer hospital inpatient care database and ascertains national estimates (weighted analysis) of the delivery of care, addressing over 97% of all US inpatient population. Cross-sectional data is provided for almost eight million annual inpatient admissions and discharges from over 1050 hospitals. NIS represents a 20% stratified sample of all non-federal acute care hospitals from 45 states, with the exclusion of long-term acute care and rehabilitation hospitals. Each hospital admission contains one primary discharge diagnosis and up to 24 secondary diagnoses. The NIS data set is unweighted to minimize the margin of error and deliver more precise and stable national estimates. The exclusion of identifiers in the data rules out the need for approval of Institutional Review Board (IRB) [11].

Study population

Patients 18 and older with a primary discharge diagnosis of ß-thalassemia were extracted using International Classification of Diseases, Ninth Revision (ICD-9 CM) code 282.44 [9]. Clinical Classifications Software (CCS) codes were used to detect associated psychiatric ailments. CCS is a diagnosis and procedure categorization scheme that collapses multitudes of associated ICD-9 codes into a smaller number of clinically meaningful classes that have been standardized and extensively used in previous analyses of diagnoses and procedures.

Study variables

Patient-level characteristics

Among patient-level characteristics, we studied age (continuous and categorized as 18–44, 45–64, 65–84, and 85+), gender (male, female), race (White, African American, Hispanic, Asian/Pacific Islander, Native American, and Other), median household income for zip code of patient (expressed as quartiles), insurance status (Medicare, Medicaid, Private insurance, self-pay, no charge, and other), admission day (weekday vs weekend), elective vs non-elective admissions, and disposition of the patient (routine, transfer to short-term hospital, other transfers, home health care, against medical advice and all-cause in-hospital mortality). Using NIS data, gender-based prevalence for each psychiatric illness in hospitalized ß-thalassemia was evaluated.

Hospital-level characteristics

Hospital characteristics entered in analysis were hospital bed size (small, medium, large), location/teaching status of the hospital (rural, urban non-teaching, and urban teaching), region of the hospital (Northeast, Midwest, South and West), and control and ownership of the hospital (government, non-federal; private, non-profit; private, invest own).

Outcomes

The primary objective of interest was to identify psychiatric comorbidities in patients with ß-thalassemia. Clinical Classifications Software (CCS) diagnosis codes were utilized to identify 657 (mood disorders), 658 (personality disorders), 659 (schizophrenia and other psychotic disorders), 656 (impulse control disorders, not elsewhere classified), 651 (anxiety disorders), 650 (adjustment disorders), and 662 (suicide and intentional self-inflicted injury). In addition, substance-related disorders were identified using CCS codes of 660 (alcohol-related disorders) and 661 (substance-related disorders) [12]. CCS 657 (mood disorders) is inclusive of depression. ICD-9 codes 300.4, 301.12, 309.00, 309.1, and 311 were utilized to isolate depressive disorders from other mood disorders.

The secondary objective to compare outcome measures in hospitalized ß-thalassemia patients with psychiatric disorders and those without psychiatric disorders. Three outcome measures of hospitalization were considered: all-cause in-hospital mortality, length of stay (in days), and total hospital charges.

Statistical analysis

All analyses were performed using Social Sciences software (SPSS), version 22.0 (IBM Corp., Armonk, NY, USA). Complex survey procedures available within SPSS were applied in the analysis to consider design features of the complex sample survey such as clustering, stratification, and sampling weights. As results of all analyses were weighted, estimates should be representative of the national inpatient admissions. Univariate tests were applied to compare either the proportions or means for the mentioned outcomes between ß-thalassemia patients with and without psychiatric disorders. These tests consisted of Pearson chi-square test for categorical outcomes and Student's t test for continuous outcomes, respectively. A p value of < 0.05 was considered a threshold for a statistical significance.

Results

After applying weights to unweighted NIS database, we identified a total of 10,046 inpatient admissions, over the age of 18, with the discharge diagnosis of ß-thalassemia between the year 2010–2014. Prevalence of various psychiatric comorbidities in patients with ß-thalassemia was calculated to 24.4%, $N = 2448$. The most prevalent was mood disorders which were found in 15.2% of our population sample. Depression, which is included in mood disorders, was found in 10.3% of patients. In addition, 9.4% of patients reported anxiety disorder, and 6.5% reported substance abuse disorder (4.3% drug abuse, 2.2% alcohol abuse). Schizophrenia and other psychotic disorders were found in 1.6% of patients. Suicide and self-inflicted injury occurred in 1% of patients. Personality disorder, adjustment disorder, and impulse control disorder were least prevalent and were found in 0.9%, 0.4%, and 0.1% of the population sample respectively (Fig. 1).

Baseline characteristics

The comparison of baseline characteristics of hospitalized ß-thalassemia patients with and without psychiatric illness is presented in Table 1. The mean age in patients without psychiatric illness and patients with psychiatric illness was 49.8 (± 22.3) and 52.1 (± 19.7) respectively. Both the groups majorly consisted of patients aged 18–44 years (50.1% and 40.0%, $p < 0.001$). More females than males had a diagnosis of ß-thalassemia (69.6% vs 30.4%, $p = 0.001$). Most patients with psychiatric disorders were White, Medicare enrollees,

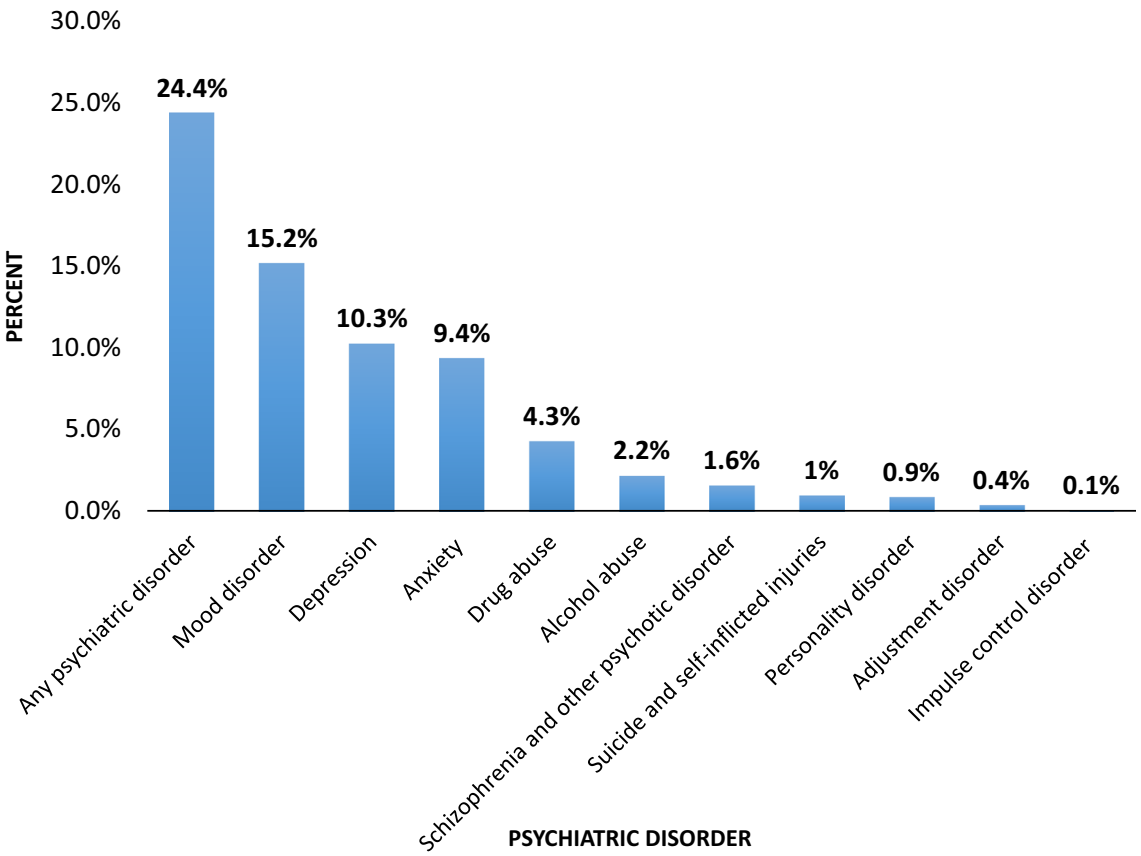


Fig. 1 Burden of psychiatric disorders in beta-thalassemia

Table 1 Characteristics of hospitalized beta-thalassemia patients with vs. without psychiatric illnesses

Variables	Without psychiatric illness ($N = 7598$)		With psychiatric illness ($N = 2448$)		Overall beta-thalassemia ($N = 10,046$)		P value
	N	%	N	%	N	%	
Age in years							< 0.001
Mean age	49.8 ± 22.3		52.1 ± 19.7		50.3 ± 21.7		< 0.001
18–44	3807	50.1%	979	40.0%	4785	47.6%	
45–64	1343	17.7%	760	31.0%	2103	20.9%	
65–84	1927	25.4%	568	23.2%	2495	24.8%	
≥ 85	522	6.9%	141	5.8%	663	6.6%	
Indicator of sex							0.001
Male	2245	29.5%	807	33.0%	3052	30.4%	
Female	5354	70.5%	1640	67.0%	6994	69.6%	
Race							< 0.001
White	3268	45.3%	1243	54.9%	4511	47.6%	
American African	1788	24.8%	622	27.5%	2410	25.4%	
Hispanic	560	7.8%	210	9.3%	769	8.1%	
Asian and Pacific Islander	1059	14.7%	115	5.1%	1174	12.4%	
Native American	41	0.6%	5	0.2%	46	0.5%	
Other	499	6.9%	70	3.1%	569	6.0%	
Admission day							0.001
Weekday (Mon–Fri)	6106	80.4%	1892	77.3%	7998	79.6%	
Weekend (Sat–Sun)	1492	19.6%	556	22.7%	2048	20.4%	
Elective versus non-elective admission							< 0.001
Non-elective	5700	75.1%	2008	82.2%	7708	76.8%	
Elective	1893	24.9%	435	17.8%	2329	23.2%	
Disposition of patient							< 0.001
Routine	5523	72.7%	1519	62.1%	7042	70.1%	
Transfer to short-term hospital	144	1.9%	35	1.4%	179	1.8%	
Other transfers (SNF, ICF, other)	870	11.5%	459	18.8%	1329	13.2%	
Home Health Care	827	10.9%	375	15.3%	1202	12.0%	
Against Medical Advice (AMA)	65	0.9%	35	1.4%	99	1.0%	
All-cause mortality	164	2.2%	25	1.0%	189	1.9%	
Primary expected payer							< 0.001
Medicare	2652	35.0%	1117	45.6%	3769	37.6%	
Medicaid	1656	21.8%	515	21.0%	2171	21.6%	
Private including HMO	2816	37.1%	666	27.2%	3482	34.7%	
Self-pay/no charge/other	464	6.1%	150	6.1%	614	6.1%	
Median household income national quartile for patient ZIP Code[#]							<0.001
0–25th	1704	23.2%	724	30.8%	2428	25.0%	
26–50th	1668	22.7%	569	24.2%	2236	23.0%	
51–75th	1772	24.1%	522	22.2%	2294	23.6%	
76–100th	2211	30.1%	534	22.7%	2745	28.3%	
Bed size of hospital[¥]							< 0.001
Small	971	12.8%	386	15.8%	1356	13.5%	
Medium	2021	26.7%	531	21.7%	2552	25.5%	
Large	4590	60.5%	1526	62.5%	6116	61.0%	
Location/teaching status of hospital							0.343
Rural	465	6.1%	135	5.5%	599	6.0%	
Urban non-teaching	2011	26.5%	676	27.7%	2688	26.8%	

Table 1 (continued)

Variables	Without psychiatric illness ($N = 7598$)		With psychiatric illness ($N = 2448$)		Overall beta-thalassemia ($N = 10,046$)		P value
	N	%	N	%	N	%	
Urban teaching	5106	67.3%	1631	66.8%	6737	67.2%	
Region of hospital							< 0.001
Northeast	2055	27.0%	633	25.9%	2688	26.8%	
Midwest	1133	14.9%	532	21.7%	1666	16.6%	
South	2557	33.7%	814	33.2%	3371	33.6%	
West	1853	24.4%	469	19.2%	2322	23.1%	
Control/ownership of hospital							0.008
Government, non-federal	992	13.1%	341	13.9%	1332	13.3%	
Private, non-profit	5877	77.5%	1825	74.7%	7702	76.8%	
Private, invest-own	713	9.4%	276	11.3%	989	9.9%	
Outcomes							
All-cause mortality	164	2.2%	25	1.0%	189	1.9%	< 0.001
Length of stay (days)	4.7 ± 5.1		6.8 ± 9.8		5.2 ± 6.7		< 0.001
Total hospital charges (USD)	43,960 ± 71,126		54,250 ± 79,598		46,475 ± 73,417		< 0.001

[#] A quartile classification of the estimated median household income of residents in the patient's ZIP Code, Derived from https://www.hcup-us.ahrq.gov/db/vars/zipinc_qrtl/nisnote.jsp

[¥] The bed size cutoff points divided into small, medium, and large have been done so that approximately one-third of the hospitals in a given region, location, and teaching status combination would fall within each bed size category. Derived from https://www.hcup-us.ahrq.gov/db/vars/hosp_bedsize/nisnote.jsp

and had non-elective admissions. ß-thalassemia was found to be least prevalent in Asians and Pacific Islanders (12.4%), Hispanic (8%), and Native Americans (0.5%). A decrease in percentage for Asians and Pacific Islanders Native Americans was noted when the psychiatric illness was accounted for. The majority (30.8%) of patients with psychiatric disorders belonged to the lower (0–25th quartile) median household income group. As compared to patients without psychiatric illnesses, those with psychiatric illnesses required more frequent transfer to other facilities (skilled nursing facility (SNF), intermediate care facility (ICF), other), and home health care.

Figure 2 shows the prevalence of psychiatric illnesses in patients with ß-thalassemia diagnosis, stratified by gender. Overall, the prevalence of psychiatric disorders is higher in males (26.5%) compared to females (23.5%). Females were more likely to have mood disorders (15.7%), depression (10.5%), and anxiety (9.5%) while drug abuse (6.8%), alcohol abuse (3.9%), and schizophrenia and other psychotic disorders (2.3%) were most common in males. Rates of suicide and self-inflicted injuries were higher in females (1.2%) than in males (0.7%)

Hospital characteristics

Patients with a diagnosis of ß-thalassemia, both with and without psychiatric illnesses, visited urban teaching hospitals more often than rural or urban non-teaching hospitals. In regard to ownership of the hospital, private non-profit institutions owned the majority. The regional prevalence of ß-thalassemia patients was highest in the South and Northeast regions and lowest in the Midwest.

Outcomes in hospitalized ß-thalassemia patients with psychiatric disorders vs. those without psychiatric disorders

To evaluate the financial burden, we analyzed the in-hospital mortality, length of stay (LOS), and average total charges of hospitalizations incurred in ß-thalassemia patients with psychiatric illnesses. Psychiatric illnesses did not increase the all-cause mortality in ß-thalassemia patients as compared to those without psychiatric illness (1.0% vs. 2.2%, $p < 0.001$). The length of stay (6.8 ± 9.8) and total hospital charges (54,250 ± 79,598) were reported to be higher in patients with psychiatric illnesses. Psychiatric conditions in thalassemia were associated with higher length of stay (>mean) on multivariate linear regression analysis after adjusting for age and sex (adjusted beta = 1.775, 95% CI = 1.43–2.12, $p < 0.001$). The psychiatric conditions in ß-thalassemia were linked to higher (>mean) total hospital charges after controlling for age and sex (adjusted OR = 1.45, 95% CI = 1.30–1.63, $p < 0.001$).

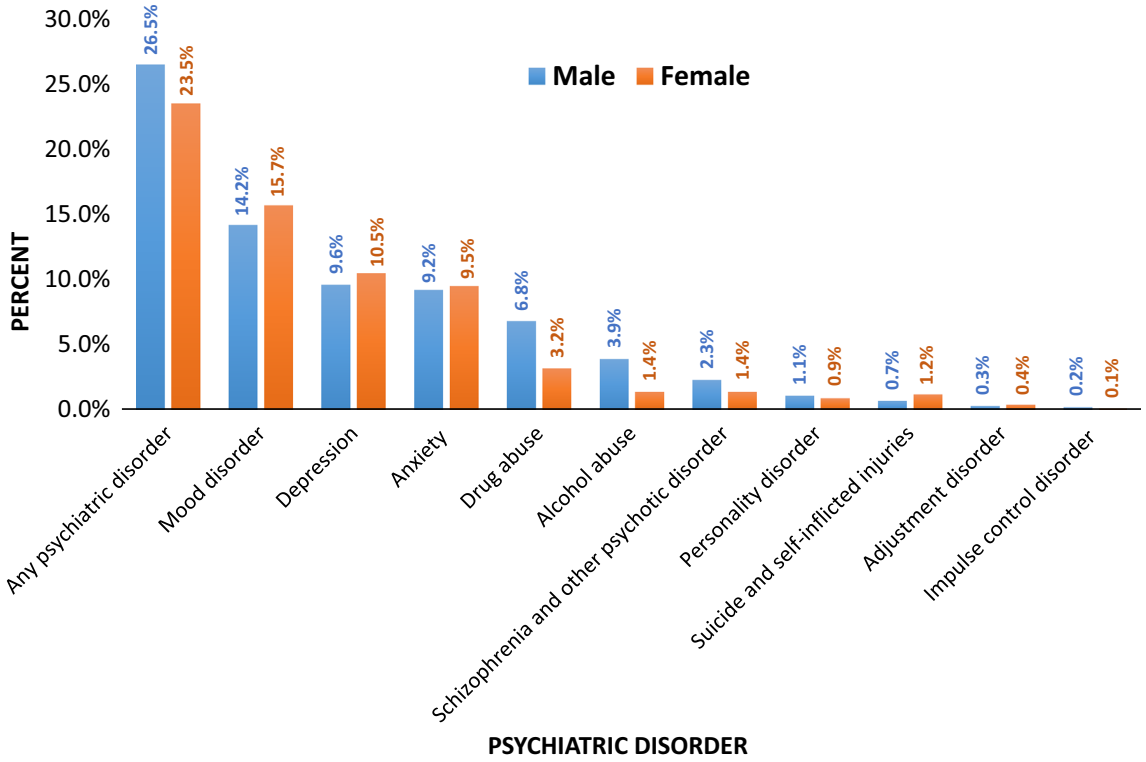


Fig. 2 Gender-wise distribution of the burden of psychiatric disorders in beta-thalassemia

Discussion

To our knowledge, this is the first study in the US that utilizes the NIS database to assess the burden of psychiatric disorders in adult patients hospitalized with ß-thalassemia. The overall prevalence of psychiatric comorbidities in this study was 24.4%; depression and anxiety were most prevalent. Although males had a higher overall rate of psychiatric comorbidity, rates of depression and anxiety were greater in females. Progression of age and greater median household income correlated with lower rates of psychiatric comorbidities. Whites, Hispanics, and African Americans reported psychiatric disorders more than Asian and Pacific Islanders and Native Americans. Furthermore, a quantifiable increase in health resource utilization including the length of stay and cost of care was noted in those with comorbid psychiatric disorders.

According to the National Institute of Mental Health (NIMH), approximately 17.8–18.6% (5-year average—18.22%) of adults in the general US population experienced mental illness from 2010 through 2014 [13]. In contrast, hospitalized ß-thalassemia patients during that time period had a 25% greater rate of overall psychiatric illness when compared to the general population. Depression and anxiety were the most common mental disorders in both the general population (5.9%, 6.3% respectively) and hospitalized ß-thalassemia patients (10.3%, 9.4% respectively) [15]. Previous studies on ß-thalassemia patients corroborate these findings, albeit in different age groups [7, 8, 14, 15].

The overall rate of psychiatric disorders is adults hospitalized with ß-thalassemia (24.4%) and higher prevalence of depression and anxiety is most similar to other chronic diseases such as sickle cell disease (SCD) (29%), chronic obstructive pulmonary disease (COPD) (28.4%), and diabetes mellitus (DM) (28%) [16–18]. SCD patients report a greater burden of depression due to recurrent and unpredictable episodes of vaso-occlusive crisis [19]. To the contrary, COPD and diabetes mellitus patients report a greater burden of anxiety than depression as a result of dyspnea, tobacco use, and nicotine dependence in COPD patients and fear of hypoglycemic episodes, invasive self-care behaviors, and development of complications in DM patients [20, 21].

According to previous research, quality of life (QOL) in ß-thalassemia patients showed a negative impact in all domains but greatest in psychological health [22]. Factors contributing to compromised QOL in ß-thalassemia are different outward appearance (skeletal abnormalities), poor physical well-being (multi-organ complications, a lifelong necessity of blood transfusions and medical care), and educational/career obstacles (excessive absenteeism due to medical visits) [23–28]. Such disease-imposed impediments on the personal, social, educational/career, and financial aspects of a patient's life negatively impact mental health [27–29].

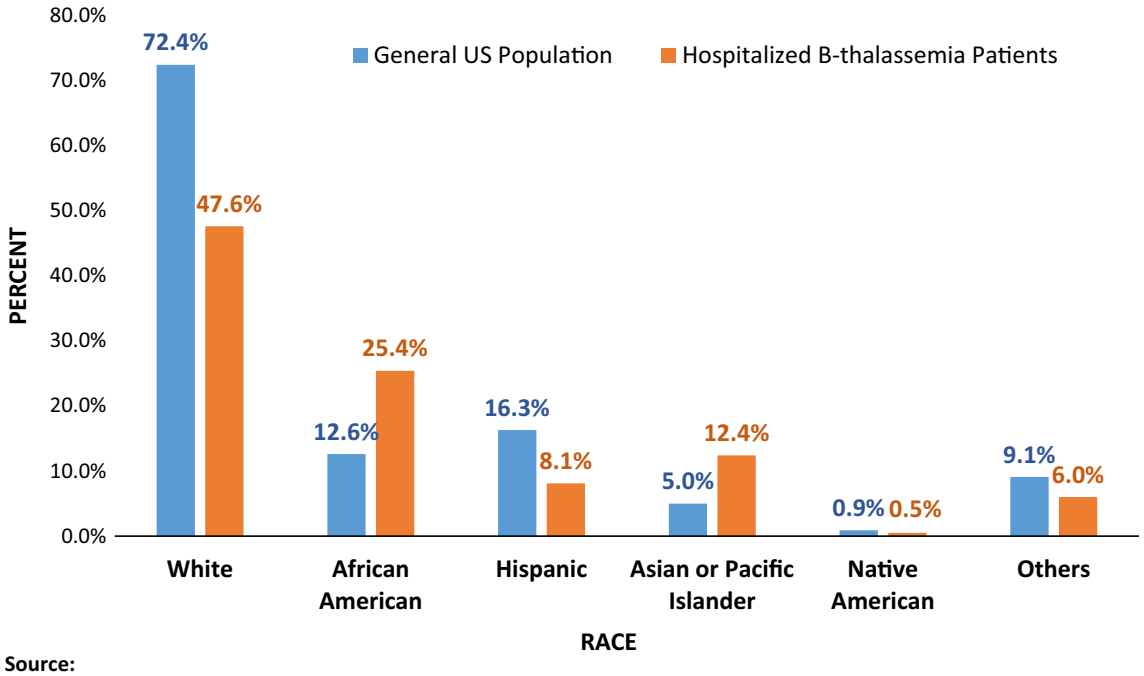
A bidirectional link between physical and mental health is appreciated in patients with chronic disorders such as ß-thalassemia. Chronic illness severely impacts QOL and increases the risk of psychiatric disorders in patients, which subsequently leads to more frequently reporting of medical symptoms [30]. Poor self-care (improper diet and nutrition, insufficient exercise, lower treatment compliance for medical conditions, and a greater tendency for smoking) coupled with pathophysiology of depressive and anxiety disorders (hyperactivity of the hypothalamic-pituitary-adrenal axis, hypercortisolemia, pro-inflammatory milieu, increased free radicals with oxidative stress, decreased insulin sensitivity, and impaired glucocorticoid receptor function) can further worsen physical morbidity [30–32].

The negative correlation identified between age and presence of psychiatric illness in this study is consistent with the World Health Organization (WHO) data of declining global prevalence of depressive disorders and anxiety disorders after 65 and 49 years of age, respectively [14]. Additionally, people above 80 years of age had the lowest rates of depression and anxiety, which supports our study's findings of psychiatric illness in only 5.8% of patients above 85 years of age [14]. Progression of age is beneficial as older adults have less familial and financial responsibilities in addition to greater psychosocial reserve capacity, higher global affective well-being, and broad coping repertoire compared to their younger counterparts [33].

Despite the autosomal recessive inheritance pattern of ß-thalassemia, our study reported more than twice as many women were hospitalized than men in both groups (with and without psychiatric illness). This disparity can be attributed to the higher burden of chronic conditions in women ages 18 through 64 and a longer lifespan when compared to men [34]. Gender stratification of ß-thalassemia patients with psychiatric comorbidity showed higher rates of overall psychiatric disorders in men although rates of anxiety and depression were higher in women (9.4% and 3.26% greater than in men respectively). WHO data also confirms a higher prevalence of depressive and anxiety disorders in women throughout all age groups [14]. In our study, the higher rate of overall psychiatric disorders in men can be associated with greater burden of substance abuse (drug abuse—112% greater and alcohol abuse—178% greater than women).

Upon comparison with the racial distribution of the general US population, ß-thalassemia risk was 100% greater in African Americans and 150% greater in Asian Americans and Pacific Islanders (Fig. 3). When psychiatric illness was taken into consideration in our study, all races except Asian and Pacific Islander and Native Americans saw an increase in the prevalence of psychiatric disorders. Psychiatric stigma and common themes such as the notion that all illnesses have a somatic component (no discernment is made between mental and physical disorders), supernatural, religious, moralistic, and magical approaches to illness and behavior, and the utilization of traditional medicinal practices could explain the disparity seen in Asians, Pacific Islanders, and Native Americans [35, 36].

Although a correlation was not identified with overall ß-thalassemia patients and median household income,



Source:
Race, Combinations of Two Races, and Not Hispanic or Latino: 2010". 2010 Census Summary File 1.
United States Census Bureau. 2010; "Overview of Race and Hispanic Origin: 2010" (PDF). United States Census Bureau.

Fig. 3 Racial distribution of general US population vs hospitalized beta-thalassemia patients in the US

stratification for psychiatric illness comorbidity revealed a negative correlation with median household income. A majority of ß-thalassemia patients (30.8%) with psychiatric illness were found in the lowest median household income quartile (0–25th). According to the social drift hypothesis, mental illness drifts an individual into poverty through increased health expenditure, reduced productivity, and loss or difficulty in maintaining employment whereas social causation hypothesizes mental illness as a direct result of poverty due to factors such as heightened stress, malnutrition, social exclusion, and decreased social capital [29]. The burden of disease severity and management in ß-thalassemia patients increases the risk for psychiatric disorders which could lead to poverty (social drift hypothesis). Additionally, migration from thalassemia prevalent countries to the US with limited finances along with the added burden of chronic disease can lead to stresses (health, economical, educational) and subsequently depressive and anxiety disorders (social causation hypothesis).

Greater health resource utilization among ß-thalassemia hospitalizations with mental illness was noted in this study. Length of stay increased by 44.6% in patients with mental illness ((LOS in patients without mental illness (4.7 days) vs those with mental illness (6.8 days)). HCUP's 2012 statistical brief report also shows greater length of stay in the general US population with mental illness (LOS in the general US population with no mental illnesses—4.8 days vs those with the diagnosis of mental illness—8.3 days) [37]. Additionally, total hospital costs increased by 23.4%; total charges were higher in hospitalized ß-thalassemia patients with mental disorders than patients without (54,250 USD vs 43,960). Factors like improper self-care, difficulty stabilizing mental health patients, delay in discharge due to addressing social care problems, the discovery of the mental disorder during admission or waiting for evaluation and treatment by liaison psychiatry services could be important contributors in increasing LOS and healthcare costs in patients with comorbid mental disorders [38].

The all-cause mortality in the general US population in the year 2010 and year 2014 was 0.75% and 0.72% respectively [39]. All-cause mortality in overall hospitalized ß-thalassemia patients is 1.9%, approximately 2.6-fold greater than the general population. Previous research on ß-thalassemia patients has shown a decreasing survival rate with the progression of age and an all-cause mortality rate of 1.5% in age group of 9 months–33 years [40]. Higher all-cause mortality rate in this study is justified as the study sample consisted of patients above 18 years of age with a mean age of 50.3 years. When psychiatric illness was accounted for, all-cause mortality decreased nearly 2-fold which is inconsistent with previous studies on patients with chronic diseases [41–45]. Mortality rates in ß-thalassemia patients with comorbid psychiatric illness could be skewed by underdiagnosed due to racial stigma of mental health in the patient population in addition to a small portion of total sample representing overall mortality rate—191/10046 patients.

The findings of our study should be interpreted with knowledge of the limitations of the databases used to acquire the data. First, the study relied on an administrative database using ICD-9-CM codes that are susceptible to misclassification of the diagnosis. Second, NIS represents a purely inpatient sample and uses discharges as units of analysis, which are de-identified. This could lead to underrepresentation of the actual burden in the overall ß-thalassemia population. However, the prime strength of our investigation lies in the national portrayal of the dataset, which provided an extensive sample size with a uniform gathering of information, over the span of 5 years.

NIMH and WHO were the primary sources used to obtain psychiatric illness rates in the general population. The general population comprises of individuals with other physical ailments, which could contribute to elevated rates of mental illness [34]. Future studies should utilize a large disease-free control for psychiatric risk comparison with hospitalized ß-thalassemia patients. The rates of anxiety and depression in the US general population were acquired using WHO 2015 data as we were unable to locate 2010–2014 data. As recent trends have been rising for depression and anxiety, comparison of WHO 2015 data to our study's 2010–2014 data may have slightly affected the comparison between general population and ß-thalassemia patients. Despite the limitations of this study, we were successful in illustrating significant elevations in overall psychiatric disorders and depression and anxiety (25% elevated rates of psychiatric disorders in hospitalized ß-thalassemia patients, 175% greater rates of depression and 149% for anxiety) even when compared to a control group that was not disease-free.

Conclusion

In conclusion, our national estimates provide strong population-based statistics on the clinical and financial burden of psychiatric disorders and analysis of age, gender, racial, and income differences in adult patients hospitalized with ß-thalassemia. We believe a collaborative effort from primary care practitioners, medical specialists, and mental health providers can provide the best result and lead to an improvement in detection of psychiatric disorders, treatment, management, and economic burden of ß-thalassemia on the healthcare system.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Also, the clinical data obtained retrospectively using the database were deidentified, so the study was exempt from an IRB approval.

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