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Original Contribution

Effects of seasonality and daylight savings time on emergency department visits for mental health disorders

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ABSTRACT

Objectives: Emergency Department (ED) utilization accounts for a large portion of healthcare services in the US. Disturbance of circadian rhythms may affect mental and behavioral health (MBH) conditions, which could result in increased ED visits and subsequent hospitalizations, thus potentially inducing staffing shortages and increasing ED wait time. Predicting the burden of ED admissions helps to better plan care at the EDs and provides significant benefits. This study investigates if increased ED visits for MBH conditions are associated with seasonality and changes in daylight savings time.
Methods: Using ED encounter data from a large academic medical center, we have examined univariate and multivariate associations between ED visits for MBH conditions and the annual time periods during which MBH conditions are more elevated due to changes in the seasons. We hypothesize that ED visits for MBH conditions increase within the 2-week period following the daylight savings time changes.
Results: Increased MBH ED visits were observed in certain seasons. This was especially true for non-bipolar depressive illness. We saw no significant changes in MBH visits as associated with changes in the daylight savings time.
Conclusions: Data do not provide conclusive evidence of a uniform seasonal increase in ED visits for MBH conditions. Variation in ED MBH visits may be due to secular trends, such as socioeconomic factors. Future research should explore contemporaneous associations between time-driven events and MBH ED visits. It will allow for greater understanding of challenges regarding psychiatric patients and opportunities for improvement.

1. Introduction

1.1. Background

Mental health is one of the major challenges faced in the United States. Nearly one in five adults currently lives with a mental illness (44.7 million in 2016) [1] and emergency department (ED) visits for mental and substance use disorders have been increasing annually [2] making it one of the fastest growing components of emergency medical practice [3]. During 2006–2013, ED visits for depression, anxiety or stress reactions have increased by 56% and for psychoses or bipolar disorders by 52% [4]. ED visits in the US for behavioral and mental health (MBH) disorders (ICD9 codes 290–319) have increased from 3.9% (5.3 million) in 2011 to 4.1% (5.7 million) in 2015 [5,6]. Moreover, between 2006 and 2014, total number of ED visits in the US has increased by 15% and the rate of visits per 100,000 persons has increased by 7% [7], which not only imposes high economic costs and hardship on self-paying individuals and insurance companies, but also stretches ED resources. Predicting the burden of ED admissions over time could contribute to better planning of care at the EDs and thus provide significant benefits.

MBH patients can consume a disproportionate share of ED resources by increasing length of stay pending transfer to a psychiatric facility or mental health clearance. Between 1992 and 2001, the number of documented mental health-related ED visits increased by 38%, compared to an 8% increase in overall ED usage [8]. Since 1950s the number of psychiatric hospital beds has dropped by over 96% and >17% since 2010 [9]. As a result, boarding times for psychiatric patients has been significantly longer averaging over 6.8 h compared to non-psychiatric patients [9,10] and these patients have been reported to experience extremely long length of stay compared to non-MBH patients [11]. Boarding times for psychiatric patients in Georgia EDs has been found to be as high as 34 h [10]. Furthermore, according to Zeller, chief of psychiatric emergency services at Alameda Health Systems in Oakland, CA, "*Boarding psychiatric patients in an emergency department is both poor medicine and expensive*", resulting in over $2000 in additional costs for treating psychiatric patients at the EDs [9,10]. As a result, these delays

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can induce staffing shortage, increased ED wait time, and even diversion. Long length of stay for mental health patients can also result in increased threats to provider safety due to agitation and anxiety, as well as reduced access to coping mechanisms and possibly delayed medications for psychosis [11]. It not only compromises the level of psychiatric care required for these patients while being boarded in the ED, but also results in delays and diverts ED resources for other ED patients due to overcrowding.

Changes in seasonal and circadian patterns are pathogenic factors for affective disorders [12], which manifest at higher rates and intensities during certain times throughout the year. Seasonality may have an effect on MBH ED visits due to seasonal characteristics associated with many mental and behavioral health disorders. Literature suggests that seasons influence the levels of mental and behavioral symptoms and a significant portion of such patients experience seasonal vulnerability [13,14]. Furthermore, daylight savings time change has been found to affect the photoperiod and circadian rhythm [12] and, as a result, disrupt sleep patterns [15,16], influence mood [16,17], and even result in traffic accidents [18-20]. Hansen et al. [21] found that in Denmark transition from summer time to standard time during 1995–2012 was associated with an 11% increase in the incidence rate of acute hospital contacts for unipolar depressive episodes. Abreu [22] suggests that the literature has shown that as a result of changes in sleep duration, a large number of patients experience mood changes on the same day or the day after. Also, sleep duration decrease was found to be followed by a change in the direction of hypomania or mania and an increase of sleep duration was followed by a shift towards depression. Theoretically, a bipolar patient who experiences less sleep during a spring time change would more likely experience a manic episode while the same patient who would experience more sleep during the fall time change would experience a depressive episode [23]. These exacerbate symptoms that could lead to a mental health crisis. Such manifestations have the potential to significantly disrupt healthcare delivery operations including that of EDs by significantly increasing the volume of visits related to affective disorders and resources needed to service such patients. Understanding how seasonality and changes in daylight saving times impact ED visits for MBH patients will enable healthcare decision-makers to develop appropriate strategies to improve quality of care for these patients.

1.2. Importance

Impact of seasonality and daylight savings time on triggering MBH conditions has been studied extensively. Several studies have also explored the relationship between multiple hospital outcomes, such as length of stay, and MBH visits. However, there is a gap in the literature examining the relationship between ED MBH visits and seasonality and daylight savings time. We are studying whether there is MBH visit variation due to theoretical desynchronization of circadian rhythms caused by daylight savings time and seasonality. This study helps to fill this gap by exploring the statistical impact of seasonality and daylight savings time on ED MBH visits using a multi-year robust and rich dataset from a major southeastern hospital. Results of this study are of importance in that they can be used by healthcare providers to better serve patients likely to be affected by seasonality and daylight savings time changes. These results are also of importance to the healthcare administrators to better plan ED operations, allocate healthcare resources, and design alternative healthcare service delivery methods.

1.3. Goals of this investigation

This study focuses on affective disorders of bipolar and non-bipolar mood disorders. Its **objective** is to estimate the impact of seasonality and daylight savings time on ED visits for MBH conditions. We are exploring if EDs experience statistically significantly higher visits for MBH conditions during the time (season) identified in the literature as the annual time periods during which MBH conditions are more elevated due to changes in the seasons. Furthermore, we hypothesize that ED visits for MBH conditions increase during the time period immediately following the spring and fall daylight savings time changes.

2. Methods

2.1. Data collection

We use secondary de-identified data from the Augusta University Medical Center (AUMC) ED located in Augusta, GA at a latitude of 33. AUMC ED is the principal provider for emergency mental health services in catchment area of approximately 750,000 persons and serves both an urban and rural population. Data represents each ED adult (18 years of age or older) visit from January 2013 to October 2015. This study has been reviewed and approved by the Augusta University Institutional Review Board (ID 1255557-1).

2.2. Primary variables

2.2.1. MBH visit outcome variables

We construct MBH outcome variables in two ways. First we generate a dichotomous MBH variable (*icd_mental*), which takes on a value of one if a patient visits the ED for a MBH condition as classified in accordance with ICD-9 code ranges 290–319. Then we categorize MBH conditions into multiple categories. These categories are *manic disorders* (ICD9 codes 296.00–296.06, 296.10–296.16, 296.40–296.46, 296.50–296.56, 296.60–296.66, 296.7, 296.80–296.89), *depressive disorders* (ICD9 codes 296.20–296.26, 296.30–296.36, 311.00), *dementia, drugs, and schizophrenia* (ICD9 codes 290.00–290.39, 290.40–295.99, 303.00–303.93, 304.00–305.96) and *other mental health conditions* (ICD9 codes 296.90–296.99, 297.00–302.99, 306.00–310.99, 312.00–319.99).

The diagnosis of bipolar depression could be categorized either primarily on the basis of its bipolar features or on the basis of its depressive features. Therefore, we conducted our analyses separately under both assumptions by considering ICD9 diagnoses 296.1 (manic disorder recurrent episode), 296.3 (major depressive disorder recurrent episode), and 296.5 (bipolar I disorder, most recent episode (or current) depressed) as 'manic disorders and 'depressive disorders'.

2.2.2. Seasonality variable

We have reviewed the literature [13,14] to identify the seasons when MBH conditions are especially elevated. Based on earlier findings we constructed categorical seasonality variable (season) with the following categories: November–March is classified as Fall/Winter, April–July is classified as Spring/Summer and August–October is classified as off-season.

2.2.3. Daylight savings time variable

During 2013–2015, the United States has observed the following daylight savings times: March 10–November 3, 2013, March 9–November 2, 2014, and March 8–November 1, 2015 [24]. We have constructed a categorical variable that corresponds to the 2-week after the beginning date and 2-weeks after the end date of each year in our sample. Remaining days were groups into the 'non-season' category. In total we had 6 categories: 2013 spring, 2013 fall, 2014 spring, 2014 fall, 2015 spring, and off-season. We hypothesize that MBH conditions should elevate in the aftermath of time changes and will manifest within the two weeks of the time change [19]. We also constructed another categorical variable that corresponds to 2-weeks before and after these daylight savings time beginning and end dates. Here we explore if MBH conditions start to manifest as daylight savings time nears and afterwards.

We also control for patients *gender* (male, female), *race* (white, black, other), *age* (18–24, 25–30, 31–40, 41–50, 51–65, and over 65), and *health insurance status* (private, public, self-pay, and other).

2.3. Empirical analyses

To examine univariate and multivariate associations between seasonality and daylight savings time and ED MBH visits, we first examine the statistical relationship between MBH visits and time periods of interest (i.e. seasons, daylight savings time). We use Pearson's Chi-squared or Fisher's Exact statistics to explore if statistical differences exist among categories.

Then, we constructed multivariate regression models to estimate the impact of time periods of interest and socio-demographic factors on MBH visits. The model for the dichotomous MBH variable is estimated using a logistic regression and odds ratios are reported. The model for categorical MBH variable is estimated using a multinomial logistic regression and the Relative Risk Ratio (RRR) is reported. RRR is similar to the Odds Ratio and indicates how the risk of the outcome falling in the comparison group compared to the risk of the outcome falling in the referent group changes with the variable in question. All analyses were conducted using STATA 14.

3. Results

3.1. Study cohort description

Throughout the study period, January 2013 to October 2015, a total of 139,598 encounters were registered, of which, 6932 (5%) were for mental and behavioral health conditions (ICD9 codes 296–319). About one fifth of these visits were for manic (6.8%, n = 472) and depressive disorders (13.7%, n = 951), while rest were for dementia/drugs/schizophrenia (37.9%, n = 2626) and other mental disorders (41.6%, n = 2883). Majority of MBH patients were male (54%), white (51%), and almost equally distributed across age ranges.

3.2. Main results

3.2.1. Univariate associations

Table 1 summarizes univariate associations between ED visit status (mental and behavioral health (MBH) vs. non-MBH) by major demographics. Results indicate that MBH and non-MBH visits rates were statistically different for all demographics. Compared with non-MBH visits, men (59%), whites (25–40%), 18–24 year olds, and those with public insurance or self-paying had higher odds of visiting the ED for a mental or behavioral health diagnosis. Furthermore, MBH visits in triage 2 level (triage 1 is the most severe and triage 5 is the least life-threatening) were 20 times higher compared top non-MBH visits.

Additional analyses (not reported) found significant difference in visit rates during Winter 2013 and Spring/Summer 2013 seasons (identified in the literature for elevated levels of MBH issues) compared to non-season visits. No significantly different associations were reported for other seasons/years. We did not find any significant associations related to the daylight savings time (DST; 2 and 3 weeks after DST; 1 and 2 weeks before and after DST; 2 weeks before DST vs 2 weeks after DST; 3 weeks before DST vs 3 weeks after DST).

Table 2 reports distribution of ED visits for non-MBH conditions and separate MBH conditions during each season identified in the literature for elevated levels of MBH issues. Results show that the greatest season-to-season variability of visits are for depressive and dementia/drugs/schizophrenia disorders. These two also exhibit annual downward trends, which is more prominent in depressive disorders. Test results also indicate significant differences in the groups when grouped by season-year but not in aggregate seasons. We also examined the associations by DST variables (indicated with Table 1 discussion), but no significant associations were found. The top ten ICD9 conditions in the other mental disorder category were 300.9 (n = 936), 300.0 (n = 770), 298.9 (n = 277), 307.81 (n = 124), 296.9 (n = 97), 312.9 (n = 81), 310.2 (n = 72), 307.9 (n = 51), 300.01 (n = 49), and 301.3 (n = 49).

3.2.2. Multivariate associations

Table 3 reports partial results from multivariate regression models examining associations between MBH visits (binary dependent variable) and major demographics, seasonality, and DST variables. Using stepwise regression approach, we estimated 4 models. Model 1 (not reported) includes only major demographic variables. Consistent with results from Table 1, results in this model indicate that men, whites, 18–24 year olds, and those with public insurance or self-paying had higher odds of visiting ED for MBH diagnosis. Model 4 (not reported) included a variable controlling for the effect of '*2 weeks before and after DST*'. It did not improve the model (Akaike information criterion (AIC) test) and was not statistically significant.

Table 1
Descriptive statistics and univariate associations with mental and behavioral health (MBH) visits in the emergency department, N = 139,598.

Variables	Non-MBH visit		MBH visit		Pearson's X^2 p-value	Univariate odds ratio	95% CI	p-Value
	N	%	N	%				
Gender								
Female	80,436	57.62	64,299	46.06	0.000	1.00		
Male	59,162	42.38	75,299	53.94		1.59	1.52–1.67	0.000
Race								
White	53,675	38.45	70,678	50.63	0.000	1.00		
Black	80,604	57.74	63,643	45.59		0.60	0.57–0.63	0.000
Other	5,319	3.81	5,277	3.78		0.75	0.66–0.86	0.000
Age								
18–24	19,432	13.92	26,928	19.29	0.000	1.00		
25–30	22,908	16.41	22,210	15.91		0.70	0.65–0.76	0.000
31–40	29,483	21.12	30,251	21.67		0.74	0.69–0.80	0.000
41–50	23,369	16.74	22,489	16.11		0.69	0.64–0.75	0.000
51–65	30,321	21.72	28,157	20.17		0.67	0.62–0.72	0.000
Over 65	14,071	10.08	9,562	6.85		0.49	0.44–0.55	0.000
Triage								
Level 1	3,085	2.21	852	0.61	0.000	1.00		
Level 2	16,905	12.11	93,098	66.69		20.06	14.77–27.26	0.000
Level 3	64,913	46.50	34,941	25.03		1.96	1.44–2.67	0.000
Level 4	48,287	34.59	8,613	6.17		0.65	0.47–0.89	0.008
Level 5	6,422	4.60	2,094	1.50		1.19	0.83–1.71	0.342
Insurance								
Private	32,582	23.34	25,700	18.41	0.000	1.00		
Public	52,182	37.38	59,148	42.37		1.44	1.34–1.54	0.000
Self-pay	40,972	29.35	47,910	34.32		1.48	1.38–1.59	0.000
Other	13,862	9.93	6,840	4.90		0.63	0.55–0.71	0.000

Table 2
Univariate Associations with Mental and Behavioral Health Emergency Department Visits, N = 139,529; row percent.

Variables	Non-mental	Manic disorder	Depressive disorder	Other mental disorders	Dementia Drugs Schizophrenia	Pearson's X^2 p-value	Ratio of MBH to non-MBH visits
Seasonality by year							
Non-season	95.10	0.33	0.74	1.93	1.89		0.051
2013 Winter	94.65	0.33	0.65	2.37	2.01		0.057
2013 Spring/Summer	94.53	0.46	0.90	2.01	2.10		0.058
2013/14 Fall/Winter	94.89	0.36	0.84	2.07	1.84	0.000	0.054
2014 Spring/Summer	95.20	0.28	0.66	2.05	1.81		0.050
2014/15 Fall/Winter	95.40	0.34	0.48	2.06	1.72		0.048
2015 Spring/Summer	95.27	0.27	0.44	2.17	1.86		0.050
Seasonality, aggregate							
Non-season	95.10	0.33	0.74	1.93	1.89		0.052
Fall/Winter	95.03	0.34	0.66	2.14	1.83	0.445	0.052
Spring/Summer	94.99	0.34	0.67	2.08	1.93		0.053

Reported results indicate that during Winter and Spring/Summer of 2013 there were statistically higher visits for MBH conditions compared to the off-season. Higher visits were also reported 2 weeks after the DST in the Spring and Fall of 2013. Data did not show any statistically significant differences during 2014 or 2015 in both variables.

Table 4 reports partial results from multivariate multinomial logistic regression models associations between MBH visits (multi-categorical dependent variable) and major demographics and seasonality and DST variables. Results for each MBH disorder is compared to non-MBH visits (referent group). Using stepwise regression approach, we estimated 4 models. Model 1 (not reported) includes only major demographic variables. Model 2 adds seasonality variable to the list of demographic variables described in Table 1, and Model 3 adds additionally a variable controlling for the possible effect of increased MBH visits 2 weeks after DST. Here we hypothesized that MBH visits may increase during the 2 week period after the DST time change. For the latter (not reported), we saw select statistically significant effects only for the *other mental disorders* (OMD) and *dementia*, *drugs*, *and schizophrenia* (DDS) visits compared to non-MBH visits. For example, in the OMD visits were statistically higher 2 weeks after 2013 Fall (RRR = 1.44) DST time change and were lower 2 weeks after 2013 Spring (RRR = 0.68) DST time change compared to non MBH visits. Moreover, DDS visits were statistically different only during 2014 Spring DST time change (RRR = 0.63).

Table 3
Multivariate associations with mental and behavioral health emergency department visits, odds ratios. Dependent variable: visit for MBH condition (*binary*).

Variable	Model 2 Odds ratio	Model 3 Odds ratio
Seasonality (ref. off-season)		
2013 Winter	1.110**	1.148***
2013 Spring/Summer	1.126***	1.126***
2013/14 Fall/Winter	1.056	1.046
2014 Spring/Summer	0.99*	0.99
2014/15 Fall/Winter	0.952	0.958
2015 Spring/Summer	0.974	0.974
2 weeks after DST (ref. before DST)		
2013 Spring		0.796**
2013 Fall		1.237**
2014 Spring		0.878
2014 Fall		0.917
2015 Spring		1.01
Constant	0.061***	0.061***
N	139,598	139,598
Pseudo R^2	0.028	0.028
Significance of model test (p)	0.000	0.000
Log likelihood	−26,799.823	−26,794.482
AIC	53,635.645	53,634.963

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

Model 4 (not reported) included a variable controlling for the effect of '*2 weeks before and after DST*'. It did not improve the model (AIC test) and was not statistically significant. Model 2 was preferred using the AIC.

Table 4
Multivariate associations with specific categories of mental and behavioral health emergency department visits, relative risk ratio[a]. Dependent variable: visit for different MBH conditions (*multi-categorical*).

Variable	Model 2	Model 3
Manic disorders		
Seasonality (ref. off-season)		
2013 Winter	1.011	1.064
2013 Spring/Summer	1.440**	1.440**
2013/14 Fall/Winter	1.108	1.05
2014 Spring/Summer	0.862	0.862
2014/15 Fall/Winter	1.061	1.009
2015 Spring/Summer	0.811	0.811
Depressive disorders		
Seasonality (ref. off-season)		
2013 Winter	0.888	0.924
2013 Spring/Summer	1.235**	1.235**
2013/14 Fall/Winter	1.16	1.176
2014 Spring/Summer	0.898	0.898
2014/15 Fall/Winter	0.651***	0.656***
2015 Spring/Summer	0.589***	0.589***
Other mental disorders		
Seasonality (ref. off-season)		
2013 Winter	1.253***	1.321***
2013 Spring/Summer	1.065	1.065
2013/14 Fall/Winter	1.087	1.048
2014 Spring/Summer	1.069	1.069
2014/15 Fall/Winter	1.07	1.097
2015 Spring/Summer	1.127*	1.127*
Dementia, drugs, and schizophrenia		
Seasonality (ref. off-season)		
2013 Winter	1.067	1.073
2013 Spring/Summer	1.092	1.092
2013/14 Fall/Winter	0.973	0.99
2014 Spring/Summer	0.966	0.966
2014/15 Fall/Winter	0.928	0.923
2015 Spring/Summer	0.997	0.997
N	139,529	139,529
Log likelihood	−32,218.35	−32,200.04
AIC	64,580.701	64,584.08

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.
[a] This table reports the Relative Risk Ratio (RRR) from a multivariate logistic regression, which, similar to the Odds Ratio, indicates how the risk of the outcome falling in the comparison group compared to the risk of the outcome falling in the referent group changes with the variable in question. Results for Each Disorder are compared to non-Mental and Behavioral Health (MBH) visits (referent group).

When evaluating **Manic Disorder** visits relative to non-MBH visits, we did not see any statistically significant differences due to DST (2 weeks before; 2 weeks before and after). Meanwhile, only Spring/Summer 2013 visits were 44% statistically higher (RRR = 1.44) compared to visits during 'off-season' days.

Results for **Depressive Disorders** did not show any statistically significant differences due to DST (2 weeks before; 2 weeks before and after). However, there were statistically significant results due to seasonality. For example, visits were higher during 2013 Spring/Summer (RRR = 1.24) and lower during 2014/15 Fall/Winter (RRR = 0.65) and 2015 Spring/Summer (RRR = 0.59) seasons.

Visits for **Other mental disorders w**ere higher only during 2013 Winter (RRR = 1.25) and 2015 Spring/Summer (RRR = 1.13) seasons. There were no statistically significant seasonal difference for **Dementia, drugs, and schizophrenia**.

We have also conducted additional analyses (not reported). First, we re-coded the ICD9 diagnoses 296.1 (manic disorder recurrent episode), 296.3 (major depressive disorder recurrent episode), and 296.5 (bipolar I disorder, most recent episode (or current) depressed) as '*depressive disorders*', which were previously coded as manic disorders. However, our results did not change. Second, we have combined seasons together (i.e. instead of non-season and 6 year/seasons, we have used non-season, fall/winter, and spring/summer). Results did not show statistically significant variations due to seasonality using the modified seasonality variable. Furthermore, the ratio of MBH visits to non-MBH visits (Table 2, last column) remains relatively stable during the seasons and non-season. We hypothesize that non-medical, perhaps secular, factors are influencing variations in ED visits overall.

4. Discussion

This study used a 3-year population based de-identified dataset to examine changes in ED MBH visits due to seasonal variations and changes in daylight savings time. There is currently a major public health challenge regarding visit of psychiatric patients in the ED due to historically increasing ED visits levels and significant decreases in psychiatric visit capacity of EDs in the United States. Better understanding the contemporaneous association between time-driven events (e.g. seasons and changes in daylight savings time) and variations in ED visits for MBH conditions will provide valuable insight to healthcare administrators and policymakers to further improve healthcare service delivery for the psychiatric patients and improve overall healthcare management. To our knowledge, this study is the first to examine the association between seasonality and daylight savings time and ED visits for MBH conditions.

Our results indicate of the existence of significant variations in the ED MBH visit patterns during certain seasons, however these variations were not consistent. Our data is derived from a hospital in State of Georgia, which is located relatively closer to the equator (latitude of 33) with less dramatic year around changes in day light and seasons. Compared to the northern regions, such as the Scandinavia,[1] where there are more dramatic changes in day lights and seasons, we would have expected much weaker or no effects in Georgia. Therefore, our findings become even more interesting and a future research is needed to further explore contemporaneous associations between time-driven events and MBH ED visits. It will allow for greater understanding of challenges regarding psychiatric patients and opportunities for improvement.

Future research should also explore the economic and financial implications of elevated MBH visits due to seasonality and daylight savings time to inform hospital administrators and healthcare providers of best strategies to meet the medical needs of such patients. Future research should be expanded to include other geographic areas and different types of medical centers. For example, a comparative study of EDs servicing urban and rural patients will provide better policy advice.

There may be other potential drivers of ED visits that were not captured in our dataset. For example, we may hypothesize that hotter temperatures may be conductive of harmful behaviors, such as gun violence, that will result in increased ED visits. Furthermore, increased ED visits may be driven in part by other environmental and behavioral factors, such as previous primary care provider visits/referrals, behavioral health problems for which they saw a psych/social worker, or inadequate housing that may elevate such symptoms. Future research should incorporate these potential determinants to generate a more complete model of MBH ED visits.

Finally, the Affordable Care Act (ACA) came into effect in late 2010, which aimed to increase the number of individuals with health insurance and the access to regular physician services that many lacked due to the absence of health insurance. Therefore, it is warranted to examine the impact of the ACA on MBH visits. We can hypothesize that there should be a downward trend in ED visits for MBH conditions, since increased health insurance coverage should result in a better care for MBH conditions. Because this study utilizes data for 2013–2015, we cannot suggest any pre- and post-differences from this data explicitly. However, results reported in Table 2 indicate of an existence of downward trend for depressive and dementia/drugs/schizophrenia disorders, which may be due to the continuation of the secular trend based on the ACA impact. Furthermore, in another study [26] we have used ED data from 2009 to 2013 to examine trends in ED visits and average financial charges. Results showed that there is a downward trend in post-ACA period in the number of annual ED visits and an upward trend in average per visit financial charge in the post-ACA period. We assume that these trends are due to patients gaining more coverage in post-ACA period, which results in less ED visits, especially for low acuity reasons. As for the average per visit financial charges, we think that due to increased insurance coverage, the ED visits are being dominated by high acuity emergency visits, which require more hospital resources for treatment, and, hence, higher costs.

5. Conclusion

Results show that increased MBH ED visits are registered in certain seasons, however these patterns are not consistent across all years and seasons of this study, providing no conclusive evidence of increased ED visits for MBH conditions during seasons where MBH conditions are elevated. Furthermore, we saw no significant changes in MBH visits due to changes in the daylight savings time.

The year-to-year variation in seasonal effects for ED mood disorder visits may be related to secular trends, such as changing socioeconomic factors and increased access to health insurance in post-ACA period [27]. It is apparent that future research is required to further examine contemporaneous associations between time-driven events and MBH ED visits and economic and financial implications for hospital management at the rural and urban health centers. From a policy and economic perspective, there is a need to explore the implication of ACA on ED visits for MBH conditions and how such waves of increased MBH visits impact staffing decisions, especially by trained behavioral health professionals.

6. Limitations

This study was retrospective and restricted to single facility. This sample was unique to one county in the southeastern United States.

Previous presentation

This study has not been presented before.

[1] [25].

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Disclosures

The authors report no conflict of interests.

Author contributions statement

VH has obtained data from the Augusta University Medical Center. VH and SS conceived the study and designed and conducted data analyses. WM provided subject matter expertise on the development of the study and interpretation of the results. All authors contributed substantially to drafting and finalizing the manuscript. VH takes responsibility for the manuscript as a whole.

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