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Original Contribution

A National Dataset Analysis of older adults in emergency department observation units

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ABSTRACT

Background: Emergency Department (ED) Observation Units (Obs Units) are prevalent in the US, but little is known regarding older adults in observation. Our objective was to describe the Obs Units nationally and observation patients with specific attention to differences in care with increasing age.
Design: This is an analysis of 2010–2013 data from the National Hospital Ambulatory Medical Care Survey (NHAMCS), a national observational cohort study including ED patients. Weighted means are presented for continuous data and weighted percent for categorical data. Multivariable logistic regression was used to identify variables associated with placement in and admission from observation.
Results: The number of adult ED visits varied from 100 million to 107 million per year and 2.3% of patients were placed in observation. Adults ≥65 years old made up a disproportionate number of Obs Unit patients, 30.6%, compared to only 19.7% of total ED visits (odds ratio 1.5 (95% CI 1.5–1.6), adjusting for sex, race, month, day of week, payer source, and hospital region). The overall admission rate from observation was 35.6%, ranging from 31.3% for ages 18–64 years to 47.5% for adults ≥85 years old ($p < 0.001$). General symptoms (e.g., nausea, dizziness) and hypertensive disease were the most common diagnoses overall. Older adults varied from younger adults in that they were frequently observed for diseases of the urinary system (ICD-9 590-599) and metabolic disorders (ICD-9 270-279).
Conclusions: Older adults are more likely to be cared for in Obs Units. Older adults are treated for different medical conditions than younger adults.

1. Introduction

An inpatient hospital stay is not a benign event for older adults (adults ≥65 years old), as many will experience complications such as a subsequent decline in functional status, delirium, and high mortality [1-3]. Limiting hospitalizations and reducing older adult's length of stay in the hospital is therefore important. Emergency care providers must be judicious with hospital resources and patient needs and attempt to avoid admissions if medically possible [4,5]. One mechanism to achieve this goal is the use of ED Observation Units (Obs Units).

Obs Units are areas of the ED dedicated to the care of patients that require further interventions or monitoring but do not meet the Centers for Medicare and Medicaid criteria for an inpatient stay (two midnights of care needed) [6]. Obs Units are more efficient in obtaining testing and disposition than inpatient units, which decreases costs and length of stay for similar syndromes [7-9]. For older patients, observation can provide additional time for the ED provider to further evaluate the patient's home status, cognitive abilities, fall risk, and discharge safety. In addition to the standard use of observation care to obtain more testing for cardiac syndromes or transient ischemic attacks (TIAs), Obs Units are a suitable setting for focused geriatric care such as assessment by a geriatric nurse practitioner, physical therapist, or multidisciplinary geriatric team [10-12]. Multidisciplinary geriatric assessment in an Obs Unit can not only reduce admissions but also screen for unmet healthcare needs [10]. For example, a frail patient who comes into the ED at 3 am can be placed in observation for physical therapy and geriatric consultation in the morning. In this way, observation stay can provide the time necessary to make safe discharges and transitions of care from the ED to home, changing the ED visit from a "sentinel event" to an opportunity to provide person-centered, holistic care [13,14]. This is especially important for older adults presenting after a fall, as 36–50% of these patients will have an ED revisit within 6 months [15,16].

Abbreviations: ED, Emergency Department; Obs Units, Observation Units; NHAMCS, National Hospital Ambulatory Medical Care Survey; TIA, Transient Ischemic Attack.

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Despite these possible benefits, there is minimal data on the care of older patients in observation. Prior studies of older adults in Obs Units are encouraging, but have focused on single sites [9,11,17-19]. It is unknown on a national scale what types of care older adults receive in observation and whether significant numbers of older adults are cared for in these units. The National Hospital Ambulatory Medical Care Survey (NHAMCS), collected by the Centers for Disease Control National Center for Health Statistics, includes information on Obs Units and observation visits. Data from 2009 to 2010 revealed that older age is a predictor for admission from observation with an admission rate of 49.1% for older adults [20]. However this analysis did not look at the diagnoses of these patients or the length of stay in the hospital after admission, which is one marker of whether the admission was warranted.

Therefore, we reviewed the latest NHAMCS data, 2010–2013, with specific attention to the association between age and observation status. Secondary outcomes include the reason for observation, rates of hospital admission from observation, total length of stay in observation and admission length of stay.

2. Methods

2.1. Study design

This is a secondary analysis of existing NHAMCS data, which was collected by the Center for Disease Control, National Center for Health Statistics (CDC). As this is a publically available dataset, this study was exempt from Institutional Review. The NHAMCS is an annual, national probability sample of visits made to non-federal, general, and short-stay hospitals across the United States. Descriptions of this dataset have been previously published [21]. Data from the latest available years (2010–2014) were accessed and analyzed. The data from 2014 had differently assigned variables for observation which made it unable to be analyzed with the prior 4 years, therefore we limited this analysis to the years 2010–2013.

2.2. Study setting and population

NHAMCS uses standardized data collection and probability estimations detailed in prior literature [22]. ED visits were defined as undergoing ED observation if they had an ED observation disposition (variables "OBSHOS" if admitted from observation and "OBSDIS" if discharged). These variables were included in all study years. The estimate of prevalence of ED observation units was made using the question "Does your ED have a physically separate observation or clinical decision unit?" Only years 2010 and 2011 were included as they were the only years with both the questions and ED weights available at time of analysis.

2.3. Data analysis

SAS 9.4 (SAS Institute Inc., Cary, NC) was used for data management and all data analyses were conducted using STATA 14 (StataCorp, College Station, TX). All analyses used survey procedures with weights and strata as provided in the NHAMCS data sets, and included all records in the data files to obtain the correct sample variance estimates. Estimates considered unreliable by standard NHAMCS criteria (relative standard error of 30% of more or based on <30 records) are not reported. Weighted means are presented for continuous data and weighted percent for categorical data to produce national estimates. Our data were compared to the Emergency Department Summary tables from the CDC for the respective year as a double check for our computations of patients placed in observation.

Diagnosis International Classification of Diseases 9 (ICD-9) codes were classified based on the first 3 numerals without decimals (see Supplemental Table 1). All other variables presented are as defined in the NHAMCS documentation or above. As ED weights have not yet been released for calendar years 2012 and 2013, only visit-level data are presented. Differences among subgroups were compared using a two-tailed *t*-test ($p < 0.05$). Logistic regression analysis was done to determine the significance of the association between age and hospital admission rates and age and hospital length of stay. The model controlled for sex, race/ethnicity, and hospital characteristics (region, metropolitan status and ownership).

3. Results

Over 2010–2013, the number of adult ED visits varied from 100 million to 107 million per year and 2.3% of patients were placed in observation. There were 10,225,371 weighted adult Obs Unit visits, or approximately 2.56 million per year (Table 1). Patients were mostly female (55.6%) and Caucasian (65.1%). Most patients were community dwelling, although the rate of residence in an extended care facility increased to 23.2% for patients ≥85 years old. In 2010 and 2011, 20.9% (95% confidence interval: 16.5–26.2%) of EDs had Obs Units. The number of EDs with Obs Units was not included for years 2012 and 2013.

Over the 4 year period, approximately 3.13 million (95% CI 2.6 million–3.6 million) older adults were cared for in Obs Units; this represents 782,000 per year. Older adults were also assigned to observation at a consistently higher percentage than younger adults (Table 1). Older adults made up 30.6% of Obs Unit patients, despite comprising only 19.7% of ED patients during this timeframe (odds ratio 1.5 (95% CI 1.5–1.6) for placement in observation for age ≥65 years, adjusting for patient sex and race, visit month and day of week, payer source, and hospital region of country). Additionally, adults in the 65–74 years age group had the longest average stay in observation, 26.0 h, compared to 18.0 h for adults 18–64 years old.

Disposition from observation status also varied with age (Fig. 1). This trend persisted even when controlling for sex, race, and hospital characteristics (region, metropolitan status and ownership) ($p < 0.001$). Overall admission rate for those 65 years and older was 44.2%, compared to 31.3% for patients 18–64 years old. Assuming these patients would have required admission if an Obs Unit was unavailable, these units prevented an average 436,000 admissions of older adults per year.

The most common diagnostic codes were for symptoms (Table 2). The ICD-9 category of General Symptoms (ICD780-789) includes syncope, dizziness, fever, tachycardia, and vomiting. Hypertensive disorders and ischemic heart disease were also common diagnoses. Older adults varied from younger adults in that they were also placed in Observation for diseases of the urinary system (ICD-9 590-599) and metabolic disorders (ICD-9 270-279). See Supplemental Tables 1 and 2 for further breakdown of the ICD codes used and the rates of placement for different ICD codes.

4. Discussion

Obs Units care for over 2.56 million adult visits per year, and a higher than expected amount (30.6%) are older adults. Similar to past analyses, we found that age is an independent risk factor for a longer length of stay in observation and for hospital admission from the Obs Unit [17,18,20]. While the admission rate from observation is higher for older adults, Obs Unit care is still effective at avoiding full admission for over half of older adults, with an estimated 436,000 avoided admissions per year.

Since older adults comprise almost a third of the patients in these units, Obs Unit staff may want to consider how to optimize their care. Prior studies suggest that staffing Obs Units with geriatric-trained personnel or offering multidisciplinary assessments avoids full hospital admissions, perhaps by identifying and managing issues such as delirium [11,12,23]. This is recommended by the Geriatric ED Guidelines [24]. For example, geriatric specific protocols can be used to address underlying needs such as risk for falls, polypharmacy, and cognitive deficits. Physical therapists can provide great insight into fall risk and ways to improve ambulation safety [10,25]. Protocols that focus on safe

Table 1
Demographics of adult patients placed in observation in calendar years 2010–2013. Data are weighted. Observation length of stay and admission rates are significantly higher for any of the older age groups as compared to 18–64 year olds ($p < 0.001$).

	All ED Patients n = 527,362,430	All Observation Unit Patients				
		All[a] n = 10,225,371 (1.9%)	18–64 years n = 6,217,770 (1.9%)	65–74 years n = 1,204,642 (3.5%)	75–84 years n = 1,215,588 (4.1%)	≥85 years n = 706,105 (4.1%)
Female	55.4%	55.6%	55.7%	52.5%	60.3%	64.3%
Race						
White	62.2%	65.1%	62.6%	65.1%	73.9%	78.3%
Black/African American	19.8%	23.0%	27.0%	20.3%	10.5%	13.1%
Asian	1.5%	1.4%	1.0%	1.6%	2.7%	1.2%
Native Hawaiian/Pacific Islander	0.3%	0.4%	0.4%	0.7%	0.2%	0.0%
American Indian/Alaska Native	0.7%	0.5%	0.3%	2.4%	0.2%	0.0%
More than one race reported	0.4%	0.2%	0.1%	0.2%	0.1%	0.2%
Unknown/missing	14.9%	9.5%	8.7%	9.6%	12.4%	7.2%
Residence						
Private residence	92.7%	89.1%	91.7%	91.0%	80.0%	68.8%
Extended care facility	1.9%	4.1%	1.2%	3.8%	11.2%	23.2%
Homeless	0.6%	0.7%	1.0%	0.0%	0.0%	0.0%
Other	1.2%	1.6%	1.5%	2.4%	2.9%	1.0%
Unknown/missing	3.7%	4.5%	4.6%	2.8%	6.0%	6.9%
Observation length of stay (hours)	–	20.0	18.0	26.0	22.2	24.1
Admission rate from Observation	–	35.6%	31.3%	38.2%	48.3%	47.5%

[a] 881,266 visits with missing age.

transitions of care to home often use case management or home health needs assessments prior to discharge [26-28].

In addition to protocols, Obs Units can be made more geriatric friendly with additional equipment or physical layout changes. Providing assist devices such as reading glasses, hearing amplifiers, walkers, canes, and high rise toilet seats can assist with comfort, communication, and mobility. This can also reduce delirium as hearing and visual impairments are risk factors for delirium [29]. In this way, the Obs Unit can become an area of high quality geriatric care.

This study also found a higher admission rate from observation than the oft-quoted goal of 20% [30,31]. The overall admission rate was 35.6% which is slightly decreased from the 2009–2010 rate of 40.4% but almost double the 18% rate in the 2007 data. [20,32] This increased admission rate from the 2000s to the 2010s is interesting as the total percentage of patients assigned to observation has not changed significantly (2.1% in 2007, 1.87% in 2008, and 1.95% to 2.50% in years 2010–2013) [32,33]. Looking at the reasons for observation placement, this increased admission rate may be due to the diversity and complexity of patients. The most common diagnostic category in this dataset was not chest pain, but General Symptoms, (ICD780-789), which includes syncope, fever, tachycardia, and vomiting among others. These symptoms can be indicative of a broad range of underlying illnesses. This is not surprising as Obs Units are typically caring for patients without a clear diagnosis or who require further testing to make a diagnosis. Since older adults may present with atypical symptoms and increased diagnostic uncertainty, observation can be helpful to elucidate the cause. Or it may be that ED providers are reluctant to give a specific diagnosis and prefer these broader diagnoses describing symptoms rather than causes.

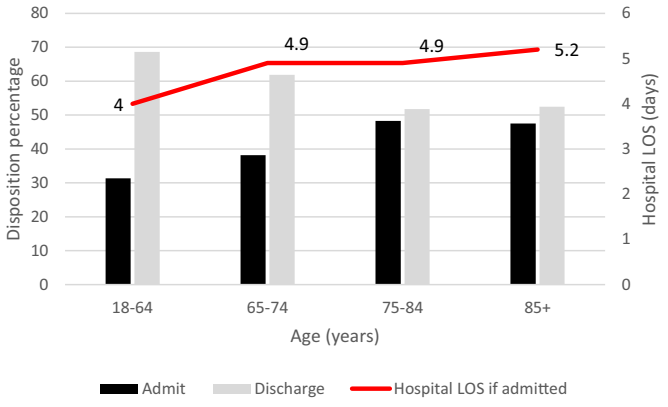

Fig. 1. The bar graphs display the weighted disposition of Obs Unit adult patients by percentage. The red line demonstrates the weighted average hospital length of stay in days among observation patients admitted to the hospital by age, demonstrating that the majority of people admitted from Obs Units have a hospital length of stay of at least 4 days.

Interestingly, the oldest patients (≥85 years old) are observed for different reasons than the younger old (65–84 year olds). Diseases of the urinary system are a diagnostic code in 16% of visits in ≥85 year olds and <6% of 65–84 year olds. The oldest age group is also more frequently placed in observation after fractures (ICD9 codes 805-809). This could relate to needing more assistance with ambulation assessments and home health care after a fracture, or it could be due to the higher risk of fractures with older age. More information on the type of care these patients are receiving (e.g., physical therapy assessments, durable medical equipment provided, case management) would be helpful to understand how Obs Units are providing care to complex older patients.

A newly identified trend from this data analysis is the use of observation status for intoxication (ICD-9 codes 303-305). The use of observation services for intoxicated patients is not well described in the literature. One article mentions an Obs Unit as a feasible place for monitoring of intoxicated patients, but there are no studies of patients in Obs Units for this purpose [34]. This is surprising as this was the 4th most common diagnosis category for younger adults. However, diagnoses are not mutually exclusive, so intoxication could also be a secondary or tertiary diagnosis and not the main reason for observation.

The 2010–2013 data does differ from prior years in the estimated number of Obs Units (21%). The NHAMCS data from 2001 to 2008 demonstrated that 34% of EDs have an Obs Unit [33]. This older estimate is more consistent with data published by the Emergency Department Benchmarking Alliance, a consortium of 1200 EDs, which reported in 2015 that 35% of their EDs serving over 40,000 patient visits a year had Obs Units [35]. This fluctuation in the estimated number of Obs Units may be also due to some of the sampling limitations of the NHAMCS dataset, given that larger EDs are more likely to have an Obs Unit than smaller EDs.

5. Limitations

NHAMCS uses weighted percentages which can be biased by the hospital sampling process [36]. While the NHAMCS study uses a stratification algorithm to sample from a variety of hospitals (e.g., urban,

Table 2
The top 10 weighted diagnoses among adults in Emergency Department observation units, as grouped by ICD-9 codes for the calendar years 2010–2013. Percentage and number of total weighted diagnoses in that age group are listed. Diagnostic codes are not mutually exclusive and therefore total number of diagnoses is greater than the total number of patient visits.

	All ≥18 years	18–64 years	65–74 years	75–84 years	≥85 years
1	Symptoms (780–789)	Symptoms (780–789)	Symptoms (780–789)	Symptoms (780–789)	Symptoms (780–789)
	49.1% (n = 5,023,392)	47.5% (n = 2,955,498)	58.3% (n = 702,564)	61.9% (n = 752,297)	51.3% (n = 362,454)
2	Hypertensive disease (401–405)	Hypertensive disease (401–405)	Other forms of heart disease (420–429)	Hypertensive disease (401–405)	Other diseases of urinary system (590–599)
	7.7% (n = 791,806)	7.5% (n = 464,069)	8.9% (n = 107,250)	12.8% (n = 156,118)	16.4% (n = 115,578)
3	Other metabolic and immunity disorders (270–279)	Ischemic heart disease (410–414)	Other metabolic and immunity disorders (270–279)	Other metabolic and immunity disorders (270–279)	Other forms of heart disease (420–429)
	7.5% (n = 767,277)	6.4% (n = 397,381)	8.2% (n = 98,368)	11.0% (n = 133,679)	15.5% (n = 109,624)
4	Ischemic heart disease (410–414)	Psychoactive substance (303–305)	Diseases of other endocrine glands (249–259)	Ischemic heart disease (410–414)	Other metabolic and immunity disorders (270–279)
	6.1% (n = 626,478)	6.2% (n = 386,397)	7.6% (n = 91,984)	10.3% (n = 125,628)	15.0% (n = 105,747)
5	Chronic obstructive pulmonary disease and allied conditions (490–496)	Chronic obstructive pulmonary disease and allied conditions (490–496)	Hypertensive disease (401–405)	Other forms of heart disease (420–429)	Hypertensive disease (401–405)
	6.0% (n = 611,661)	5.9% (n = 368,583)	7.6% (n = 91,411)	9.6% (n = 116,625)	11.4% (n = 80,208)
6	Other diseases of urinary system (590–599)	Other metabolic and immunity disorders (270–279)	Other diseases of urinary system (590–599)	Cerebrovascular disease (430–438)	Ischemic heart disease (410–414)
	5.4% (n = 555,988)	5.7% (n = 355,531)	5.8% (n = 69,502)	5.9% (n = 71,361)	6.2% (n = 43,900)
7	Other forms of heart disease (420–429)	Other diseases of urinary system (590–599)	Ischemic heart disease (410–414)	Pneumonia and influenza (480–488)	Cerebrovascular disease (430–438)
	4.7% (n = 477,993)	4.9% (n = 302,312)	4.8% (n = 58,049)	5.3% (n = 64,156)	5.8% (n = 41,238)
8	Psychoactive substance (303–305)	Other diseases of digestive system (570–579)	Chronic obstructive pulmonary disease and allied conditions (490–496)	Nephritis, nephrotic syndrome and nephrosis (580–589)	Fracture of neck and trunk (805–809)
	4.1% (n = 416,450)	4.2% (n = 263,435)	4.8% (n = 57,811)	5.1% (n = 61,392)	5.2% (n = 36,590)
9	Diseases of other endocrine glands (249–259)	Pain (338)	Persons with potential health hazards from personal/family history (V10-V19)	Chronic obstructive pulmonary disease and allied conditions (490–496)	Chronic obstructive pulmonary disease and allied conditions (490–496)
	3.7% (n = 375,675)	3.9% (n = 242,124)	4.2% (n = 50,444)	4.8% (n = 58,125)	5.1% (n = 36,263)
10	Other diseases of digestive system (570–579)	Diseases of other endocrine glands (249–259)	Nephritis, nephrotic syndrome and nephrosis (580–589)	Other diseases of digestive system (570–579)	Nonspecific abnormal findings (790–796)
	3.5% (n = 362,604)	3.5% (n = 219,538)	3.8% (n = 46,358)	4.4% (n = 53,996)	4.6% (n = 32,142)

rural) there are limitations with generalizing the data to predict national trends. Lack of consistency in coding and use of diagnostic codes is another limitation. For example, a patient who was evaluated for chest pain may be given a variety of diagnostic codes. This contributed to our choice to evaluate diagnoses by ICD-9 grouping rather than by specific diagnoses. Therefore we recommend that the data in Table 2 be used just to identify trends and not to try to estimate the exact number of patients seen for a specific diagnosis such as angina or urinary tract infections. Additionally, changes in the coding variables over time can create swings in the data from year to year. This was the cause of our decision not to include 2014 in this analysis, as the Obs unit variables were coded differently and the data did not align with the prior years.

6. Conclusions

In conclusion, the NHAMCS database suggests that about 2% or 2.56 million adult ED patients per year are cared for in ED Obs Units. Older adults make up a disproportionate number of these patients, and have higher admission rates and observation lengths of stay. Obs Units may be an ideal setting to target quality improvement processes of geriatric care.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ajem.2018.12.009.

Impact statement

We certify that this work is novel clinical research that reports on an area of clinical care that has had little investigation- older adults in observation units. We report the breakdown for rates of use of observation and quality metrics for these units in addition to the difference in reasons for use (diagnostic codes) for younger versus older adults on a national level. This information has never been reported prior and may be helpful for Emergency Medicine physicians and hospital administrators evaluating care in their observation units.

Presentations

This information was presented as an abstract at the 2018 Annual Meeting of the American Geriatrics Society, Orlando, FL.

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Author contributions

LTS, KMH, and JMC designed the study. LTS and KMH performed the statistical analysis. All authors participated in analysis and data interpretation and manuscript preparation.

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