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Socioeconomic disparities in the complexity of hernias evaluated at Emergency Departments across the United States

Maria F. Nunez [a, b], Gezzer Ortega [a, b, 1], Lucas G. Souza Mota [c], Olubode A. Olufajo [a, b], Derek W. Altema [c], Terrence M. Fullum [c, d], Daniel Tran [c, d, *]

[a] Research Centers in Minority Institutions Program, Howard University College of Medicine, 520 W Street NW, Rm 436, Washington, DC, 20059, USA
[b] Clive O. Callender, MD Howard-Harvard Health Sciences Outcomes Research Center, Howard University, 2041 Georgia Avenue, NW, Suite 4B-35, Washington, DC, 20060, USA
[c] Howard University College of Medicine, 520 W St NW, Washington, DC, 20059, USA
[d] Department of Surgery, Howard University Center for Wellness and Weight Loss Surgery, 2041 Georgia Ave NW, Tower Building 4100B, Washington, DC, 20060, USA

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ABSTRACT

Background: Hernias represent one of the most common surgical conditions with a high-burden on health expenditures. We examined the impact of socioeconomic-status and complexity of presentation among patients in the Emergency Department (ED).
Methods: Retrospective analysis of 2006–2014 data from the Nationwide Emergency Department Sample, identified adult discharges with a diagnosis of inguinal, femoral, and umbilical hernia. Cases were dichotomized: complicated and uncomplicated. Unadjusted and adjusted analyses were used to determine factors that influence ED presentation.
Results: Among 264,484 patients included, 73% presented as uncomplicated hernias and were evaluated at urban hospitals (86%). Uncomplicated presentation was more likely in Medicaid (OR 1.56 95%CI1.50–1.61) and uninsured (OR 1.73 95%CI 1.67–1.78), but less likely for patients within the third and fourth MHI quartile (OR 0.82 95%CI 0.80–0.84 and OR 0.77 95%CI 0.75–0.79), respectively.
Conclusion: Uninsured, publicly-insured, and low-MHI patients were more likely to present to ED with uncomplicated hernias. This finding might reflect a lack of access to primary surgical care for non-urgent surgical diseases.

Introduction

Collectively, inguinal, femoral, and umbilical hernias represent the most common group of major elective procedures performed by general surgeons.[1,2] Understanding, the role of socioeconomic factors on the management of hernias is imperative as it is a common condition.[3] Although it is hard to estimate the full economic burden that hernias impose, with over a million of these procedures completed annually in the United States, at an average cost per case of approximately $4200 to $6200, the repair of abdominal wall hernias accounts for an estimated cost of over $48 billion in yearly health care expenditures.[4,5]

Currently, uncomplicated hernias are typically managed and treated in the outpatient setting.[6] For these patients, they are initially worked up in clinic and are scheduled for surgery based on approval of insurance companies. In other words, access to these services in the outpatient setting is linked to the insurance status of the patients. It is therefore plausible that patients with hernias who do not have access to outpatient services are more likely to present to the ED for evaluation.

Although a disproportionate use of the ED by racial minority groups and uninsured patients has been shown in previous studies,[7,8] there are no large-scale studies that examine the complexity of presentation of hernia patients. Because of the

* Corresponding author. Howard University College of Medicine, 2041 Georgia Avenue, NW Tower Suite 4100B, Washington, DC, 20060, USA.
E-mail addresses: maria.nunez@howard.edu (M.F. Nunez), gortega1@bwh.harvard.edu (G. Ortega), lucas.souzamota@bison.howard.edu (L.G. Souza Mota), olubode.olufajo@howard.edu (O.A. Olufajo), derek.altema@bison.howard.edu (D.W. Altema), tfullum@howard.edu (T.M. Fullum), daniel.tran@howard.edu (D. Tran).
[1] Center for Surgery and Public Health, Department of Surgery, Brigham and Women's Hospital, Harvard T.H Chan School of Public Health, 1620 Tremont Street Suite 4-020, Boston, MA, 02120, USA.

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limited resources available in the ED setting, patients who present to the ED with uncomplicated disease which could have been evaluated in the outpatient setting, exert a burden on the health-care system as they potentially utilize part of the resources that are allocated to individuals with emergent conditions. This inappropriate ED use for various non-emergent medical conditions is a subject that has attracted the attention of policy makers and providers during the recent health care reform debate in the United States, with proposals on reducing ED overuse as a possible cost-saving measure.[8,9]

Therefore, we sought to examine the relationship between demographics, insurance status, socioeconomic status and complexity of presentation among patients with inguinal, umbilical and femoral hernias in a national sample of emergency department patients.

Material and methods

A retrospective analysis of adult patient discharges for inguinal, umbilical and femoral hernias was conducted among a national sample using one data source. Patients did not provide written consent for this study owing to the retrospective nature of the administrative de-identified database analysis.

Data source

Data was obtained from the 2006–2014 Nationwide Emergency Department Sample (NEDS). The NEDS is the largest national administrative, all-payer emergency department (ED) database in the United States. It contains clinical and resource use information that is made available to researchers through the Healthcare Cost and Utilization Project (HCUP) of the Agency for Healthcare Research and Quality (AHRQ). This database produces nationally representative estimates about emergency department (ED) visits across the country, regardless of whether they result in inpatient admission.[10]

Patient identification/selection

For our analysis, we extracted information on all adult patients discharges over the age of 18 years with a primary diagnosis (defined as the condition established to be chiefly responsible for occasioning the ED presentation) of inguinal, femoral, and umbilical hernia, according with the codes of the International Classification of Disease, 9th Revision, Clinical Manifestation (ICD-9-CM), Appendix A.

Type of presentation

Patients were dichotomized based on the complexity of presentation into complicated and uncomplicated among each *type of hernia* (inguinal, umbilical, and femoral). As stated in the ICD-9 classification, complicated hernias are those cases that presented with gangrene and/or obstruction.[11]

Demographic and socioeconomic factors

For each case, we extracted and analyzed demographic and socioeconomic characteristics including: age, sex, insurance status and median household income. The NEDS database does not include information about race/ethnicity. Age was reported in years at the presentation; gender/sex categorized as male or female. Median household income was classified by NEDS predetermined quartile: 0-25th percentile (first quartile), 26th-50th percentile (second quartile), 51st-75th percentile (third quartile), or 76th-100th percentile (fourth quartile) according with the residential zip code for each patient. Ranges vary slightly each year in line with fluctuations in reported income. We use as reference point, the values for the year 2010. Quartile cutoff points were defined in 2010 dollars to be $1 - 40,999 (first), $41,000 - 50,999 (second), $51,000 - 66,999 (third), and $67,000 or greater (fourth). Health insurance status was categorized according with the expected primary payer in: public (Medicare or Medicaid), private and uninsured patients. Hospital location was categorized as urban or rural according with the NEDS simplified adaptation of the 2003 version of the Urban Influence Codes (UIC). The urban-rural designation of the hospital is based on the county of the hospital, as identified by the American Hospital Association.

Disposition and interventions

Patients that were admitted to the hospital for inpatient stay were identified. We also extracted details of the inpatient procedures that were performed and determined patients who had operative interventions for the diagnosis that they were admitted for. Specific ICD-9-CM procedure codes that were used are listed in Appendix B.

Statistical analysis

We evaluated the demographic, socioeconomic and hospital characteristics of the patients and determined differences in characteristics between patients who presented with uncomplicated hernias and those presenting with complicated hernias. Chi-square tests were used for categorical variables and t-tests for continuous data. The weighted total number of hernias and hernia types was calculated annually to represent adjusted trends of the variables of interest.

Multivariate logistic regression models were fit for each hernia group including: age, sex, median household income, insurance status, to identify independent factors associated with the complexity of ED presentation among patients with hernia.

All statistical analyses were performed using STATA/SE version 14 (Stata Corporation, College Station, TX, USA), with statistical significance set at p values < 0.05.

Results

A total of 264,484 patients were included in the study. The mean age was 52 years (Standard Deviation; SD 20) and the majority was male (78%). Most patients had public insurance; Medicare (30%), Medicaid (15%). Private insurance accounted for 26% of the patients while 29% of them were uninsured. With respect to median household income (MHI), more than the half of the population (60%) were in the two lowest income quartiles. The majority were seen at an urban hospital (86%). Table 1 shows in detail the overall patient characteristics.

Inguinal hernias

Among those patients that presented with inguinal hernias (182,068), most were male (90%) and had a mean age of 53 years (SD 20). Uninsured patients were the majority (32%), followed by Medicare (31%). Most patients were in the first MHI quartile (34%) (Table 1).The most common type of presentation was uncomplicated hernias 77% (140,235), with subjects mean age of 49.4 years (SD 19) compared with 65.5 years (SD 19) in the complicated group ($p < 0.001$). The majority were male, 93% in the uncomplicated group versus 80% in the complicated group ($p < 0.001$).

In terms of insurance, there were proportionally more patients

Table 1
Characteristics of Patients presenting to the Emergency Department with Inguinal, Umbilical and Femoral.

	Overall		Inguinal		Umbilical		Femoral	
	N = 264,484		N = 182,068		N = 73,082		N = 9334	
Mean age (years, SD)	52.2	(20)	53.2	(20)	47.6	(16)	70.5	(17)
	n	%	n	%	n	%	n	%
Gender								
Male	206,259	78.0	163,670	89.9	40,042	54.8	2547	27.3
Female	58,225	22.0	18,398	10.1	33,040	45.2	6787	72.7
Insurance Type								
Private	68,785	26.0	42,088	23.1	24,908	34.1	1789	19.2
Medicare	78,974	29.9	57,134	31.4	15,637	21.4	6203	66.5
Medicaid	40,863	15.4	24,652	13.5	15,657	21.4	554	5.9
Uninsured	75,862	28.7	58,194	32.0	16,880	23.1	788	8.4
Median Household Income								
1 - 40,999	87,097	32.9	61,351	33.7	23,529	32.2	2217	23.8
41,000 - 50,999	72,725	27.5	49,947	27.4	20,328	27.8	2450	26.2
51,000 - 66,999	58,752	22.2	39,964	22.0	16,498	22.6	2290	24.5
67,000 and above	45,910	17.4	30,806	16.9	12,727	17.4	2377	25.5
Hospital location								
Rural	28,695	14.0	19,826	14.0	7869	14.0	1000	13.9
Urban	175,992	86.0	121,413	86.0	48,384	86.0	6195	86.1
Presentation								
Uncomplicated	191,768	72.5	140,235	77.0	49,859	68.2	1674	18.0
Complicated	72,716	27.5	41,833	23.0	23,223	31.8	7660	82.0

uninsured in the uncomplicated group compared to the complicated (37% vs 16%, respectively ($p < 0.001$) (Table 2). Regarding MHI, more patients presenting with inguinal hernias were in the lower income quartiles than the higher income quartiles. However, patients presenting uncomplicated hernias had 63% of patients in the lower two quartiles compared to 54% in the complicated group ($p < 0.001$). The ED at urban hospitals received most of these patients in both groups, 86% of uncomplicated hernias vs 87% of complicated cases ($p < 0.001$).

Umbilical hernia

Overall most patients that presented with umbilical hernias (73,082), were male (55%) and had a mean age of 47.6 years (SD 16). In this group of patients, the majority had Private insurance (34%) and were in the first MHI quartile (32%) (Table 1).

According to the complexity of presentation 68% were uncomplicated hernias, with a mean age of 44 years (SD 15) compared with 55 years (SD 16) in complicated hernias ($p < 0.001$). The sex distribution was similar in both groups. Regarding the insurance status, there was a higher proportion in the complicated group when compared with the uncomplicated group (32% vs 3%) of patients with private insurance, however the proportion of uninsured was higher in the uncomplicated group compared with their counterparts 27% vs 15%, respectively ($p < 0.001$).

Overall, most of the population was in the two lowest MHI quartiles, with similar distribution as the inguinal hernia patients. Eighty six percent of both groups, uncomplicated and complicated cases, where reported in urban hospitals ($p = 0.314$).

Femoral hernia

Patients that presented with femoral hernias (9,334) were the minority. In this group there were 73% female and the mean age was 70 years (SD 17). Sixty six percent had Medicare and half of the population was in the two first quartiles 24% and 26%, respectively (Table 1).

The type of presentation in this set of patients was inverted compared with the previous types of hernias, 18% were in the uncomplicated group. The mean age of uncomplicated hernia cases were 54 years (SD 20) compared with 74 years (SD 14) in the complicated ($p < 0.001$). There were 51% female in the uncomplicated group compared with 77% in the complicated group ($p < 0.001$). Medicare was the predominant type of insurance in both groups, 32% vs 74%, however, there was a greater proportion of uninsured patients in the uncomplicated compared with the complicated group 26% vs 5%, respectively ($p < 0.001$).

Regarding MHI, the uncomplicated group 33% were in the first quartile vs 22% in the complicated group, 29% vs 26% in the second, 21% vs 25% in the third and 16% vs 27% in the fourth, respectively ($p < 0.001$). Urban hospitals received 82% uncomplicated hernias vs. 87% complicated respectively ($p < 0.001$).

Independent factors associated with complexity of hernia on presentation to the ED

After adjusting for other variables in the multivariate regression model, we saw a higher likelihood of presenting with an uncomplicated hernias for patients with Medicare (OR 1.13 95% CI 1.10–1.16), Medicaid (OR 1.56 95% CI 1.50–1.61) and uninsured (OR 1.73 95% CI 1.67–1.78). And for every incremental income quartile, there was a lower likelihood to present with uncomplicated hernias; second (OR 0.89 95% CI 0.86–0.91), third (OR 0.82 95%CI 0.80–0.84) and fourth MHI quartile (OR 0.77 95%CI 0.75–0.79), compared to the first quartile respectively.

The regression model for each type of hernia showed a higher likelihood of presenting with an uncomplicated inguinal hernia in patients with Medicaid (OR 1.42 95% CI 1.35–1.50), and without insurance (OR 1.50 95%CI 1.44–1.56) compared to patients with private insurance (Table 3). Alike, the progressive income quartile increase determined a lower likelihood to present with uncomplicated inguinal hernia; second (OR 0.93 95% CI 0.90–0.96), third (OR 0.87 95%CI 0.84–0.90) and fourth MHI quartile (OR 0.83 95%CI 0.79–0.86), compared to the first quartile respectively.

There was a higher likelihood of presenting as uncomplicated umbilical hernia for patients with Medicaid (OR 1.49 95%CI 1.41–1.57) and without insurance (OR 1.73 95%CI 1.64–1.82) compared to those with private insurance. Similar to what was seen in the analysis of inguinal hernias, higher income quartiles were associated with fewer presentations to the ED with uncomplicated hernias (the second (OR 0.85 95%CI 0.81–0.89), third (OR 0.77 95% CI 0.73–0.81) and fourth MHI quartile (OR 0.73 95%CI 0.69–0.77), compared to the first quartile respectively).

Finally, the likelihood of presenting as uncomplicated femoral

Table 2
Characteristics of Patients with Inguinal, Umbilical and Femoral Hernia based on Complexity of presentation to the ED.

	Inguinal					Umbilical					Femoral				
	Uncomplicated		Complicated			Uncomplicated		Complicated			Uncomplicated		Complicated		
Mean age (years, SD)	49.5	(19)	65.5	(19)	<0.001	44.3	(15)	54.8	(16)	<0.001	54.1	(20)	74.0	(14)	<0.001
	n	%	n	%	p value	n	%	n	%	p value	n	%	n	%	p value
Gender					<0.001					<0.001					<0.001
Male	130,060	92.7	33,610	80.3		27,099	54.4	12,943	55.7		826	49.3	1721	22.5	
Female	10,175	7.3	8223	19.7		22,760	45.6	10,280	44.3		848	50.7	5939	77.5	
Insurance Type					<0.001					<0.001					<0.001
Private	33,293	23.7	8795	21.0		16,061	32.2	8847	38.1		448	26.8	1341	17.5	
Medicare	34,244	24.4	22,890	54.7		8163	16.4	7474	32.2		548	32.7	5655	73.8	
Medicaid	21,178	15.1	3474	8.30		12,182	24.4	3475	15.0		251	15.0	303	4.0	
Uninsured	51,520	36.8	6674	16.0		13,453	27.0	3427	14.7		427	25.5	361	4.7	
Median Household Income					<0.001					<0.001					<0.001
1 - 40,999	49,575	35.4	11,776	28.1		17,190	34.5	6339	27.3		546	32.6	1671	21.8	
41,000 - 50,999	38,996	27.8	10,951	26.2		14,022	28.1	6306	27.2		500	29.9	1950	25.5	
51,000 - 66,999	30,039	21.4	9925	23.7		10,815	21.7	5683	24.5		343	20.5	1947	25.4	
67,000 and above	21,625	15.4	9181	22.0		7832	15.7	4895	21.0		285	17.0	2092	27.3	
Hospital location					<0.001					0.314					<0.001
Rural	15,726	14.4	4100	12.7		5390	14.1	2479	13.8		233	18.2	767	13.0	
Urban	93,298	85.6	28,115	87.3		32,865	85.9	15,519	86.2		1045	81.8	5150	87.0	
Disposition					<0.001					<0.001					<0.001
Admitted to Hospital	5729	4.1	29,979	71.7		2347	4.7	15,745	67.8		173	10.3	6837	89.3	
Interventions					<0.001					<0.001					<0.001
Surgery	3545	61.9	26,479	88.3		1202	51.2	13,458	85.5		138	79.8	6620	96.8	

Table 3
Likelihood of uncomplicated hernia presentation at the ED[a].

	OR	95% CI	p-value
Inguinal hernia			
Insurance Type			
Private Insurance		(Reference)	
Medicare	0.99	0.96–1.04	0.935
Medicaid	1.42	1.35–1.50	<0.001
Uninsured	1.50	1.44–1.56	<0.001
Median Household Income			
1 - 40,999		(Reference)	
41,000 - 50,999	0.93	0.90–0.96	<0.001
51,000 - 66,999	0.87	0.84–0.90	<0.001
67,000 and above	0.83	0.79–0.86	<0.001
Umbilical hernia			
Insurance Type			
Private Insurance		(Reference)	
Medicare	1.28	1.20–1.35	<0.001
Medicaid	1.49	1.41–1.57	<0.001
Uninsured	1.73	1.64–1.82	<0.001
Median Household Income			
1 - 40,999		(Reference)	
41,000 - 50,999	0.85	0.81–0.89	<0.001
51,000 - 66,999	0.77	0.73–0.81	<0.001
67,000 and above	0.73	0.69–0.77	<0.001
Femoral hernia			
Insurance Type			
Private Insurance		(Reference)	
Medicare	1.02	0.82–1.27	0.854
Medicaid	1.82	1.42–2.34	<0.001
Uninsured	1.96	1.57–2.46	<0.001
Median Household Income			
1 - 40,999		(Reference)	
41,000 - 50,999	0.86	0.72–1.03	0.119
51,000 - 66,999	0.74	0.60–0.90	<0.001
67,000 and above	0.64	0.51–0.79	<0.001

[a] Adjusted variables: age, sex, median household income, insurance status, hospital location.

hernia was higher for patients with Medicaid (OR 1.82 95%CI 1.42–2.34), and without insurance (OR 1.96 95%CI 1.57–2.46) compared to those with private insurance. And less likely if they were in the third (OR 0.74 95%CI 0.60–0.90) and fourth MHI quartile (OR 0.64 95%CI 0.51–0.79), respectively.

Fig. 1. Shows the changes in the tendency of the type of insurance in patients presenting to the ED with an inguinal, umbilical and femoral hernias, it demonstrated a proportional increase in Medicaid status from 2010 to 2014 and a significant drop in uninsured status also observed in 2014. These trends are showed in each type of the uncomplicated hernias in Fig. 2.

Discussion

Hernia is a common condition and its management represent a large component of healthcare expenditures.[1,3] The relationship between socioeconomic status, insurance coverage and the complexity of disease presentation to the Emergency Department (ED) among patients with hernias has not been well studied. To our knowledge this is the first large scale study to describe how these factors impact the use of the ED by patients with a primary diagnosis of inguinal, umbilical or femoral hernias in the United States. Our study showed that patients with Medicaid, uninsured and in the lowest MHI quartile were more likely to present to the ED seeking attention for an uncomplicated hernia, a non-emergent surgical condition.

The natural progression of an untreated hernia in the population in large is unclear. Few patients with un-repaired hernia have long term follow up. Hair et al. evaluated the association of hernia symptoms and the time from hernia presentation.[12] Pain and discomfort at the hernia site on presentation was reported in 66% of

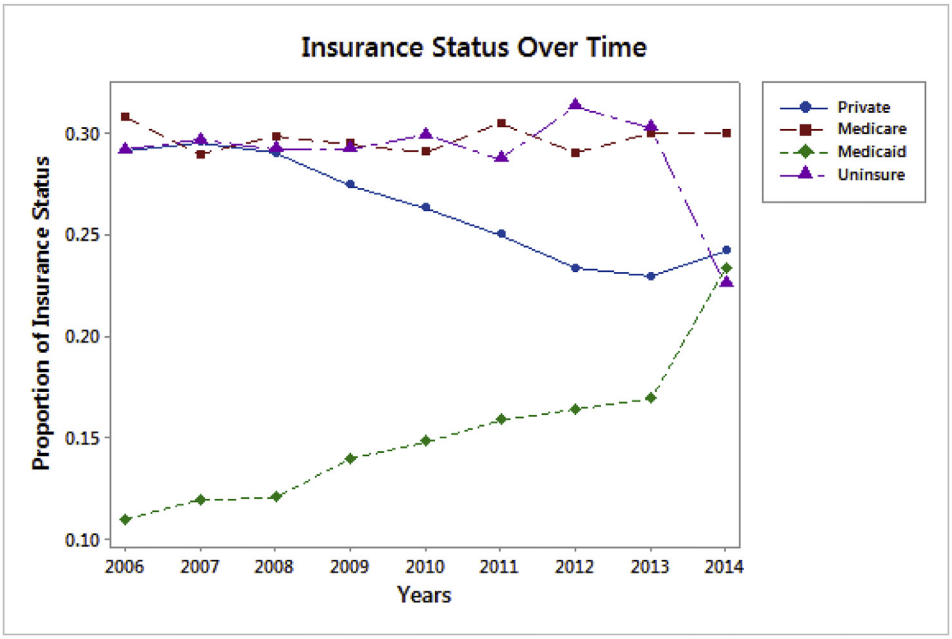

Fig. 1. Trends in type of insurance of hernia patients evaluated at Emergency Department.

patients. The cumulative probability of pain increases to almost 90% at 10 years, whereas more than one-third of patients were asymptomatic.[12] Uncomplicated hernias, which generally do not cause significant symptoms, can be managed non-operatively.[6,13] The conservative management of this condition has been extensively discussed and is beyond the scope of this study.[6,13,14] However, these patients must be monitored over time for progression of symptoms, especially those indicating incarceration or strangulation, which require immediate medical attention.[14–16]

Overall most patients in our study had an uncomplicated presentation, 77% and 69% in the inguinal and umbilical group respectively. As expected the least common among the three types of hernias, the femoral group, conversely showed that more than three-quarters of these patients presented to the ED with a complicated hernia. Patients with inguinal hernias were predominantly male in their fifth decade of life. However, there was a significant difference within the mean age of presentation according with the complexity of presentation, younger patients were identified in the uncomplicated group when comparing to the complicated group. Patients with umbilical hernias were also predominantly male without significant difference in both groups (uncomplicated and complicated). Ages differences in both groups were less marked. The majority of patients in the uncomplicated group of both inguinal and umbilical hernias were from the lowest MHI, and either has Medicaid or were uninsured. Older female patients were the majority in the femoral hernia group, of which most were complicated. Due to the age, the most common type of insurance was Medicare; however, there was fivefold higher number of uninsured patients in the uncomplicated compared to the complicated group.

The results of this study indicating more ED visits for uncomplicated hernias, regardless of the type of hernia, by the uninsured and lower income patients might reflect poor access to primary care and that the EDs could be inappropriately utilized for initial care as well as follow up. During the past decades, EDs in the United States have experienced dramatically increasing volumes.[17,18] Consequently, EDs have experienced more crowding with longer waiting times, which affects care quality and patient satisfaction.[18,19] The American Hospital Association has documented that increasing patient volumes threaten EDs abilities to provide appropriate care.[20] In this regard, it has been also recognized a disproportionate use of the ED for various non-emergent medical conditions, particularly by minority groups and self-pay patients.[7,8] The crowding problem is particularly severe in urban and teaching hospitals[21] which correlates with our findings, that 86% of the studied population were managed at urban hospitals. Therefore, strategies to reduce the unnecessary consultations that could otherwise have been managed in the outpatient setting are warranted.

Several recent health policy changes have aimed to decrease the inappropriate ED use. Insurance status has been discussed as a key factor that could explain ED crowding.[22,23] Although, uninsured patients had a higher likelihood of ED presentation with uncomplicated hernias, patients with Medicaid also formed a disproportionate proportion of those presenting with uncomplicated hernias. It has been described that publicly insured and uninsured patients tend to use less primary health care services, including elective procedures and preventive services likely because of high out of pocket costs.[24] The Patient Protection and Affordable Care Act (ACA) was passed in 2010 and had the main goal of improving access to health care by creating private health insurance markets and an expansion of the Medicaid program.[25] We demonstrated a proportional increase in Medicaid status from 2010 to 2014 and a significant drop in uninsured status also observed in 2014, which coincides with the endorsement of Medicaid expansion in most states. Our data is consistent with other reports which have shown the ACA has reduced the number of uninsured subjects from 49 to 29 million since its passage in 2010.[25–27] Unfortunately, a significant number of the population, an estimated of 15 million of Americans according with the Congressional Budget Office, will remain without health insurance for the foreseeable future. Thus, it is necessary to evaluate the ways in which coverage expansion policies may mitigate the effects of insufficient access to timely and appropriate care among this population.

It is believed that the ACA will allow previously uninsured individuals access to primary care which will reduce their unnecessary use of the ED.[23,28] On the other hand, gaining insurance may simply increase the use of all types of care including the ED.[23] Some

Fig. 2. Trends of health insurance status by type of uncomplicated hernias of patients evaluated at Emergency Department.

studies suggested that the effect on ED visits depends on the patients' type of coverage.[27,28] It is also postulated that patients who gain insurance through Medicaid, as opposed to marketplace coverage, might increase use of the ED because there is little cost sharing associated with ED use.[23,24] On the contrary, patients who gain marketplace coverage are expected to use the ED less than

before because many plans have large deductibles and cost-sharing requirements.[29] It is therefore plausible that the increase in health coverage will provide the much-needed primary care service which will ultimately decrease the unnecessary ED visits.

This study comes with all the attendant limitations attributed to administrative database use, including inaccuracies in coding and reporting inconsistencies. Nevertheless, inaccuracies are not necessarily problematic since they were not likely to be biased or distributed unevenly between cohorts. Race was not a reported variable in this database, which limits our ability to account for the role of race in some of the disparities shown in the study. In addition, our definition of complexity of presentation was solely based on ICD-9 diagnosis codes and do not have nuances of their presentation including the physical examination. However, ICD-9 codes are the best proxy we have for their clinical state and have been shown to be relatively accurate for clinical research in previous studies.[30]

While socioeconomic disparities in health care are widely documented for some medical conditions, less research has been conducted to fully understand similar disparities in surgical care. In the present study, we attempted to address the issue of differences in socioeconomic and insurance status according to the complexity of presentation among patients with inguinal, umbilical and femoral hernias using multivariate analyses. Characterizing the degree to which lack of insurance and low median household income impact the complexity of disease among patients presenting to the ED allows us to demonstrate the existence of socioeconomic disparity. Our findings have important implications for emergency providers and policy makers to re-evaluate factors associated with inappropriate ED use. The utilization of the ED as the main source of care must be addressed because it is more expensive, less effective, and may lead to poorer outcomes. The lack of insurance or access to primary care providers could paradoxically increase overall health care costs. Therefore, achieving equity in care is imperative to improving the health of the population and the success of the health care system.

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Appendix A

ICD-9 codes for inguinal, umbilical and femoral hernia diagnosis.

INGUINAL HERNIA:	
COMPLICATED	
550.0	Inguinal hernia, with gangrene
550.00	Inguinal hernia, with gangrene, unilateral or unspecified (not specified as recurrent)
550.01	Inguinal hernia, with gangrene, unilateral or unspecified, recurrent
550.02	Inguinal hernia, with gangrene, bilateral (not specified as recurrent)
550.03	Inguinal hernia, with gangrene, bilateral, recurrent
550.1	Inguinal hernia, with obstruction, without mention of gangrene
550.10	Inguinal hernia, with obstruction, without mention of gangrene, unilateral or unespecified (not specified as recurrent)
550.11	Inguinal hernia, with obstruction, without mention of gangrene, unilateral or unspecified,recurrent
550.12	Inguinal hernia, with obstruction, without mention of gangrene, bilateral (not specified as recurrent)
550.13	Inguinal hernia, with obstruction, without mention of gangrene, bilateral, recurrent
UNCOMPLICATED	
550	Inguinal hernia
550.9	Inguinal hernia, without mention of obstruction or gangrene
550.90	Inguinal hernia, without mention of obstruction or gangrene, unilateral or unspecified (not specified as recurrent)
550.91	Inguinal hernia, without mention of obstruction or gangrene, unilateral or unspecified, recurrent
550.92	Inguinal hernia, without mention of obstruction or gangrene, bilateral (not specified as recurrent)
550.93	Inguinal hernia, without mention of obstruction or gangrene, bilateral, recurrent
FEMORAL HERNIA:	
COMPLICATED	
551.0	Femoral hernia with gangrene
551.00	Unilateral or unspecified (not specified as recurrent)
551.01	Unilateral or unspecified, recurrent
551.02	Bilateral (not specified as recurrent)
551.03	Bilateral, recurrent
552.0	Femoral hernia with obstruction
552.00	Unilateral or unspecified (not specified as recurrent)
552.01	Unilateral or unspecified, recurrent
552.02	Bilateral (not specified as recurrent)
552.03	Bilateral, recurrent
UNCOMPLICATED	
553.0	Femoral hernia without mention of obstruction of gangrene
553.00	Unilateral or unspecified (not specified as recurrent)
553.01	Unilateral or unspecified, recurrent
553.02	Bilateral (not specified as recurrent)
553.03	Bilateral, recurrent
UMBILICAL HERNIA:	
COMPLICATED	
551.1	Umbilical hernia with gangrene
552.1	Umbilical hernia with obstruction
UNCOMPLICATED	
553.1	Umbilical hernia without mention of obstruction or gangrene

Appendix B

53	Repair of hernia
53.0	Other unilateral repair of inguinal hernia
53.00	Unilateral repair of inguinal hernia, not otherwise specified
53.01	Other and open repair of direct inguinal hernia
53.02	Other and open repair of indirect inguinal hernia
53.03	Other and open repair of direct inguinal hernia with graft or prosthesis
53.04	Other and open repair of indirect inguinal hernia with graft or prosthesis
53.05	Repair of inguinal hernia with graft or prosthesis, not otherwise specified
53.1	Other bilateral repair of inguinal hernia
53.10	Bilateral repair of inguinal hernia, not otherwise specified
53.11	Other and open bilateral repair of direct inguinal hernia
53.12	Other and open bilateral repair of indirect inguinal hernia
53.13	Other and open bilateral repair of inguinal hernia, one direct and one indirect
53.14	Other and open bilateral repair of direct inguinal hernia with graft or prosthesis
53.15	Other and open bilateral repair of indirect inguinal hernia with graft or prosthesis
53.16	Other and open bilateral repair of inguinal hernia, one direct and one indirect, with graft or prosthesis
53.17	Bilateral inguinal hernia repair with graft or prosthesis, not otherwise specified
17.1	Laparoscopic unilateral repair of inguinal hernia
17.11	Laparoscopic repair of direct inguinal hernia with graft or prosthesis
17.12	Laparoscopic repair of indirect inguinal hernia with graft or prosthesis
17.13	Laparoscopic repair of inguinal hernia with graft or prosthesis, not otherwise specified
17.2	Laparoscopic bilateral repair of inguinal hernia
17.21	Laparoscopic bilateral repair of direct inguinal hernia with graft or prosthesis
17.22	Laparoscopic bilateral repair of indirect inguinal hernia with graft or prosthesis
17.23	Laparoscopic bilateral repair of inguinal hernia, one direct and one indirect, with graft or prosthesis
17.24	Laparoscopic bilateral repair of inguinal hernia with graft or prosthesis, not otherwise specified
53.4	Repair of umbilical hernia
53.41	Other and open repair of umbilical hernia with graft or prosthesis
53.49	Other open umbilical herniorrhaphy
53.42	Laparoscopic repair of umbilical hernia with graft or prosthesis
53.43	Other laparoscopic umbilical herniorrhaphy
53.2	Unilateral repair of femoral hernia
53.21	Unilateral repair of femoral hernia with graft or prosthesis
53.29	Other unilateral femoral herniorrhaphy
54.11	Exploratory laparotomy

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