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ORIGINAL SCIENTIFIC REPORT

Association of Medicaid Expansion Policy with Outcomes in Homeless Patients Requiring Emergency General Surgery

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Abstract

Background Medicaid expansion has reduced obstacles faced in receiving care. Emergency general surgery (EGS) is a clinical event where delays in appropriate care impact outcomes. Therefore, we assessed the association between non-Medicaid expansion policy and multiple outcomes in homeless patients requiring EGS.

Methods We used 2014 State Inpatient Database to identify homeless individuals admitted with a primary EGS diagnosis who underwent an EGS procedure. States were divided into those that did and did not implement Medicaid expansion. Multivariable quantile regression was used to examine associations between non-Medicaid expansion states and (1) length of stay and (2) total index hospital charges within the homeless population. Multivariable logistic regression was used to assess the associations between non-Medicaid expansion and (1) mortality, (2) surgical complications, (3) discharge against medical advice, and (4) home healthcare.

Results A total of 6930 homeless patients were identified. Of these, 435 (6.2%) were in non-expansion states. Non-Medicaid expansion was associated with higher charges (coef: $46,264, 95% CI 40,388–52,139). There were non-significant differences in mortality (OR 1.4, 95% CI 0.79–2.62; $p = 0.2$) or surgical complications (OR 1.16, 95% CI 0.7–1.8; $p = 0.4$). However, homeless individuals living in non-expansion states did have higher odds of being discharged against medical advice (OR 2.1, 95% CI 1.08–4.05; $p = 0.02$), and lower odds of receiving home healthcare (OR 0.6, 95% CI 0.4–0.8; $p = 0.01$).

Conclusion Homeless patients living in Medicaid expansion states had lower odds of being discharged against medical advice, higher likelihood of receiving home healthcare and overall lower total index hospital charges.

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Background

EGS accounts for approximately 11% of all surgical admissions, but 50% of all surgical mortality [1]. Patients undergoing EGS are eight times more likely to die post-operatively compared to patients undergoing the same procedure electively [2]. Although several factors, including patient, clinical and hospital level characteristics, explain the association between EGS and likelihood of mortality, socioeconomic status has emerged as a key driver of poor outcomes following EGS– previous work [3] has shown an inverse relationship between patient socioeconomic status and mortality after complex surgical interventions.

Homeless patients are particularly vulnerable as they are of the lowest socioeconomic status and often experience poor health outcomes [4, 5]. Furthermore, homeless individuals are more often uninsured, a known risk factor for more complex disease presentation across a variety of EGS diagnoses [6]. Indeed, homelessness is associated with decreased outpatient encounters [7] and increased emergency department utilization [8] because of urgent conditions requiring prompt medical interventions. In addition, it is well known that patients own perceived inability to pay for care, which is a common problem among homeless individuals, correlates with many patients choosing to delay or forgo necessary medical care [9], resulting in worse surgical outcomes. These findings point to the need for national health policies for equitable access to care to close the gap in homeless patient outcomes.

The Affordable Care Act (ACA) Medicaid coverage expansion was associated with an increase in healthcare coverage for low-income populations and subsequently higher rates of post-discharge services, factors associated with improved outcomes [10–12]. With the expansion of Medicaid in 2014 under the ACA, over 20 million previously uninsured patients were enrolled into health insurance plans. Only 32 states, however, chose to participate, with the remaining states opting out.

In this context, we sought to evaluate the impact of states opting out of ACA Medicaid expansion on EGS outcomes among homeless individuals. We hypothesize that by placing additional obstacles in the flow of care of homeless patients requiring EGS operations, non-expansion states have worse outcomes for their homeless patients.

Methods

Data source and population

For this retrospective cohort study, we used data from the 2014 State Inpatient Databases (SID) from the Healthcare Cost and Utilization Project (HCUP), sponsored by the Agency for Healthcare Research and Quality (AHRQ). The HCUP databases capture statewide inpatient clinical and resource-use information from hospitals from forty-eight partners (47 states and the District of Columbia) in the United States. We identified homeless individuals with an EGS diagnosis, as defined by the American Association for the Surgery of Trauma (AAST), who underwent a surgical procedure. The diagnosis codes associated with each diagnosis are described elsewhere by the AAST [1].

Data related to homeless status was available for nine states (AZ, CO, FL, GA, MA, MD, NY, WA, and WI). States within this group were divided into those that did (AZ, CO, MA, MD, NY and WA,) and did not (FL, GA, WI) implement Medicaid expansion. From this cohort, we analyzed those homeless individuals who had an EGS diagnosis and underwent a surgical procedure.

Because this was a retrospective study that used de-identified data from the SID database it was deemed exempt from full review by the institutional review board of Partners Healthcare.

Study variables and outcome

The SID collects clinical and non-clinical information on all patients including diagnosis and procedures codes, admission and discharge status, patient demographic characteristics, insurance status, expected payment source, total index hospital charges and length of stay.

For this study, the outcomes of interest were in-hospital mortality, surgical complications, discharges against medical advice, home healthcare, length of stay and total index hospital charges.

Statistical analysis

Data were first compared between states that did implement Medicaid and states that did not, using descriptive statistics. Results were summarized using frequencies and percentages for dichotomous and categorical variables. Continuous variables were summarized using the median and interquartile range to account for their non-normal distribution. Statistical comparisons were made using the Wilcoxon rank-sum test for continuous variables, and chi-square tests or Fisher's exact tests in cell counts less than five for categorical variables.

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Subsequently, multivariable regression analysis was used to study the relationship between non-Medicaid expansion policy and the outcomes of interest within the homeless population. Multivariable logistic regression (MLR) was used to examine the association between non-Medicaid expansion policy and (1) mortality, (2) surgical complications, (3) discharge against medical advice, and (4) home healthcare. Multivariable quantile regression models at the 50th, 75th, and 90th quantiles were used to examine the association between non-Medicaid expansion and (1) LOS and (2) total index hospital charge. Quantile regression is a statistical technique to model quantiles (percentiles) when the outcome distribution is skewed [13], as is the case of the length of stay and total index hospital charge. In these cases, modeling only the mean through linear regression may miss essential elements of the association of interest [13]. Unlike linear regression, quantile regression provides a complete picture of the effect of an independent variable on the outcome variable as it allows to fit regression curves to other parts of the distribution of the response variable [14]; thus, it is useful to examine whether associations are different for low, medium and high percentiles of the outcome variable.

All models were adjusted by age, gender, race/ethnicity, insurance status, Charlson Comorbidity Index and procedure type (tracheostomy, appendectomy, lysis of peritoneal adhesions and burn debridement). The model examining the association between non-Medicaid expansion policy and the likelihood of receiving home healthcare was additionally adjusted by surgical complications. All analyses were performed using Stata Statistical Software version 14.0 (College Station, TX, USA).

Results

A total of 6930 homeless individuals were identified from the nine states that reported data regarding homeless status. Of these, 435 (62.7%) lived in states that did not implement Medicaid expansion. Half of the patients were females (51.7%). The median (IQR) age was 48 (32–61). Patients were predominantly Hispanics (33.9%) and blacks (30.5%); followed by whites (15.9%), Asians (4.8%) and Native Americans (0.5%). Three-quarters of patients were insured through Medicaid (74.4%, $n = 5162$). Medicare covered a 19.2% ($n = 1333$) of patients and 2.5% ($n = 173$) were uninsured.

Table 1 provides an overview of participants' demographics, insurance status and comorbidities stratified by group. Homeless individuals from states that did not implement Medicaid were significantly older [Age, median (IQR) 53 (4–59) vs. 48 (31–61); $p < 0.001$]. The proportion of blacks, Hispanics and Asians, was significantly higher in states that did implement Medicaid expansion (Table 1). In contrast, the proportion of whites was significantly greater in non-expansion states [271/435 (62.3%) vs. 830/6495 (12.8%); $p < 0.001$]. While a majority of homeless individuals were insured through Medicaid in expansion states, this number was significantly lower in states that did not implement Medicaid expansion [5030/6495 (77.4%) vs. 132/435 (30.3%); $p < 0.001$]. Homeless individuals in non-expansion states were more likely to be uninsured [165/435 (37.9%) vs. 14/6495 (0.5%), $p < 0.001$) or have a private insurance [31/435 (7.1%) vs. 142/6495 (2.1%); $p < 0.001$]. Moreover, the proportion of self-pay patients was significantly higher in these states [120/435 (27.6%) vs. 13/6495 (0.2%); $p < 0.001$].

Differences in the rates of EGS procedures and healthcare services utilization are presented in Table 2. A significantly higher proportion of patients in the expansion states required appendectomy and lysis of peritoneal adhesions. In contrast, tracheostomy and debridement of wounds/burns were performed at significantly lower rates in these states. Patients in non-expansion states were more likely to be discharged against medical advice [non-expansion: 25 (5.7%) vs. expansion: 96 (1.4%); $p < 0.001$] and less likely to receive post-discharge home healthcare [non-expansion: 32 (7.3%) vs. expansion: 770 (11.8%); $p = 0.005$]. Non-expansion states had higher mortality [non-expansion: 25 (5.7%) vs. expansion: 198 (3%); $p < 0.001$] and surgical complications [non-expansion: 45 (10.3%) vs. expansion: 496 (7.6%); $p = 0.004$]. Finally, length of hospital stay and total index hospital charges were significantly higher in non-expansion states.

After adjusting for confounders, multivariable regression analysis showed no significant differences in mortality and surgical complications. However, patients living in non-expansion states had higher risk-adjusted odds of being discharged against medical advice and lower risk-adjusted odds of receiving post-discharge home healthcare (Table 3).

Risk-adjusted quantile models showed that non-expansion states were associated with significantly higher total hospital charges, and this effect was observed in the quantiles 50th, 75th, and 90th (Table 4). There were no differences in hospital length of stay between expansion and non-expansion states in the multivariable model.

Discussion

To our knowledge, this is the first study examining the relationship between Medicaid expansion policy and emergency general surgery outcomes among the homeless population. Although there were no differences in mortality,

Table 1 Homeless individuals general characteristics

	Overall (n = 6930)	Medicaid expansion (n = 6495)	Non-medicaid expansion (n = 435)	p value
Age, median (IQR)	48 (32–61)	48 (31–61)	53 (44–59)	<0.001
Females [n (%)]	3588 (51.8%)	3500 (53.9%)	88 (20.2%)	<0.001
Race				<0.001
White [n (%)]	1101 (15.9%)	830 (12.8%)	271 (62.3%)	
Black [n (%)]	2118 (30.5%)	2040 (31.4%)	78 (17.9%)	
Hispanic [n (%)]	2349 (33.9%)	2290 (35.2%)	59 (13.5%)	
Asian/native American/other [n (%)]	1362 (19.6%)	336 (5.1%)	27 (6.2%)	
Insurance				<0.001
Medicaid [n (%)]	5162 (74.4%)	5030 (77.4%)	132 (30.3%)	
Uninsured [n (%)]	179 (2.5%)	14 (0.2%)	165 (37.9%)	
Private [n (%)]	173 (2.5%)	142 (2.1%)	31 (7.1%)	
Medicare [n (%)]	1333 (19.2%)	1271 (19.5%)	62 (14.2%)	
Other [n (%)]	83 (1.2%)	38 (0.5%)	45 (10.3%)	
Self-paying patient [n (%)]	133 (1.9%)	13 (0.2%)	120 (27.6%)	<0.001
Comorbidities				
Cerebrovascular disease [n (%)]	181 (2.6%)	162 (2.5%)	19 (4.3%)	0.01
AMI [n (%)]	162 (2.3%)	136 (2.1%)	26 (5.9%)	<0.001
Congestive heart failure [n (%)]	381 (5.5%)	352 (5.4%)	29 (6.7%)	0.2
COPD [n (%)]	975 (14.1%)	906 (13.9%)	69 (15.8%)	0.2
Mild liver disease [n (%)]	124 (1.7%)	106 (1.6%)	20 (4.6%)	<0.001
Moderate-severe liver disease [n (%)]	57 (0.8%)	39 (0.6%)	18 (4.1%)	<0.001
Diabetes [n (%)]	1156 (16.7%)	1098 (16.9%)	58 (13.3%)	0.053
Peripheral vascular disease [n (%)]	306 (4.4%)	287 (4.4%)	19 (4.3%)	0.9
Cancer [n (%)]	451 (6.5%)	430 (6.6%)	21 (4.8%)	0.1

AMI acute myocardial infarction, *COPD* chronic obstructive pulmonary disease

surgical complications, and length of hospital stay; we show that EGS homeless patients living in Medicaid expansion states had lower odds of being discharged against medical advice, higher odds of accessing post-discharge care and overall lower total index hospital charges.

These findings are consistent with existing research which found that expanding Medicaid eligibility is associated with improved financial security and better health services outcomes among different patient populations [10, 12]. Moreover, our findings have important policy implications as they suggest that not expanding Medicaid appears to result in the persistence of poor modifiable outcomes and increased hospital charges for an often-overlooked segment of the EGS population least equipped to handle them.

A primary function of insurance coverage is financial protection from destitution [15]. In this regard, EGS homeless patients living in non-Medicaid expansion states had significantly higher charges compared to those living in expansion states. Furthermore, the proportion of self-paying patients was significantly higher in states that did not implement Medicaid. Although we didn't account for individual out-of-pocket expenses, our results are in line with those of previous literature showing the benefits of coverage on patients' financial security [10, 16]. For example, in the Oregon experiment Baicker et al. [12] studied the impact of Medicaid expansion through randomized evaluation and found that coverage almost eliminated out-of-pocket medical expenses exceeding 30% of income.

Homeless individuals from expansion states had a higher likelihood of accessing post-discharge home-care services. This supports previous research which links coverage with higher rates of access to post-discharge care [10]. For example, Akande et al. [17] found that the first year of implementation of Medicaid expansion was associated with increased access to post-discharge rehabilitation among trauma patients in 11 selected US states. Similarly, Scott and colleagues [18] evaluated the impact of the Medicaid expansions in trauma outcomes at the nationwide level and found a significant increase in the rate of discharge to a facility and an increase in discharge with home services, both associated with the expansion policy. Providing coverage through the expansion policy could help homeless individuals accessing the care needed, which

Table 2 EGS procedures and Health Services Utilization

	Overall (n = 6930)	Medicaid expansion (n = 6495)	Non-medicaid expansion (n = 435)	p value
EGS procedures				
Tracheostomy [n (%)]	474 (6.8%)	433 (6.6%)	41 (9.4%)	0.02
Gastrostomy [n (%)]	236 (3.4%)	216 (3.3%)	20 (4.6%)	0.1
Cholecystectomy [n (%)]	835 (12.1%)	793 (12.2%)	42 (9.6%)	0.1
Laparoscopic Cholecystectomy [n (%)]	737 (10.6%)	698 (10.7%)	39 (8.9%)	0.2
Small/large bowel resection [n (%)]	352 (5%)	329 (5%)	23 (5.2%)	0.8
Appendectomy [n (%)]	888 (12.8%)	871 (13.4%)	17 (3.9%)	<0.001
Lap appendectomy [n (%)]	663 (9.5%)	648 (9.9%)	15 (3.4%)	<0.001
Lysis of peritoneal adhesions [n (%)]	874 (12.6%)	856 (13.1%)	18 (4.1%)	<0.001
Debridement of wounds, infections or burns [n (%)]	663 (9.5%)	586 (9%)	77 (17.7%)	<0.001
Type of discharge				
AMA discharge [n (%)]	121 (1.7%)	96 (1.4%)	25 (5.7%)	<0.001
Short term facility [n (%)]	82 (1.1%)	68 (1%)	14 (3.2%)	<0.001
SNF/ICF [n (%)]	922 (13.3%)	853 (13.1%)	69 (15.8%)	0.1
Home healthcare [n (%)]	802 (11.5%)	770 (11.8%)	32 (7.3%)	0.005
Surgical complications [n (%)]	541 (7.8%)	496 (7.6%)	45 (10.3%)	0.04
Mortality [n (%)]	223 (3.2%)	198 (3%)	25 (5.7%)	0.002
LOS, median (IQR)	5 days (2–13)	5 days (2–13)	9 days (4–18)	<0.001
Total Index Hospital Charges, median (IQR)	$38,796 (20,535–90,108)	$36,486 (19,598–82,744)	$94,143 (52,649–212,726)	<0.001

EGS emergency general surgery, *AMA* against medical advice, *SNF* skilled nursing facility, *ICF* intermediate care facility, *LOS* length of stay

Table 3 Association between non-Medicaid expansion policy and outcomes

	Simple logistic regression		Multivariable logistic regression	
	OR (95% CI)	p value	OR (95% CI)	p value
AMA discharge	4.05 (2.57–6.36)	<0.001	2.01 (1.05–3.86)	0.03
Home Healthcare	0.5 (0.4–0.8)	<0.001	0.6 (0.4–0.8)	0.01
Mortality	1.93 (1.25–2.94)	0.003	1.4 (0.79–2.62)	0.2
Surgical complications	1.39 (1.01–1.92)	0.04	1.16 (0.75–1.8)	0.4

AMA against medical advice

Table 4 Multivariable quantile regression analysis: association between non-Medicaid expansion policy and (1) length of stay and, (2) charges

	Q 50, RAQ (95% CI)	Q 75, RAQ (95% CI)	Q 90, RAQ (95% CI)
LOS	0.86 days (− 0.061 to 1.7)	1.6 days (0.005–3.3)	2.9 days (− 1.4 to 7.4)
Charges*	$46,264 (40,388–52,139)	$94,113 (82,085–106,141)	$171,288 (145,835–196,742)

*All p values were significant at the 0.05 level

LOS length of stay

in turn may help these vulnerable patients in achieving optimal post-discharge long-term outcomes.

Although it might sound incongruous to indicate that homeless individuals had increased risk-adjusted odds of receiving post-discharge home healthcare, this somewhat paradoxical result may be because homeless patients could have received post-discharge care at respite care centers [19–21]. Unlike traditional overnight shelters, which require

homeless people to vacate the premises each morning and live on the street during the day, respite homeless programs provide 24-h accommodation to homeless patients discharged from a medical treatment facility which in turn offers a room to increase compliance with post-hospital rehabilitation. Indeed, respite care after hospital discharge has been associated with a lower likelihood of readmissions and subsequent hospitalizations [20, 21].

We observed that homeless individuals who were living in non-expansion states had higher risk-adjusted odds of being discharged against medical advice. Discharge against medical advice is the patient choice to decline further care and leave the hospital before the treating physician recommends discharge [22, 23]. This phenomenon disproportionately affects vulnerable populations and has been associated with worse health outcomes. For example, in a matched-cohort study of 203 homeless individuals and 203 low-income controls, Saab et al. [24] found that homeless patients who were discharged against medical advice were twice as likely to be readmitted to the hospital compared to those who were not. Furthermore, these kinds of discharges have been shown to stigmatize patients, reduce the quality of care and undermine access to health services [22, 25, 26]. Therefore, reducing the likelihood of discharge against medical advice by increasing coverage through Medicaid expansion could result in improved patient care and associated better health outcomes among the vulnerable homeless population.

Consistent with previous literature which shows that most of the benefits of coverage are related to improvements in health-related quality of life and financial protection, but not to mortality reductions [10, 12, 16]; we found no significant differences in the risk-adjusted odds of mortality between states that implemented Medicaid compared to states that did not. A possible explanation for this might be that EGS is less plausibly affected by access to medical care. Patients with emergency surgery diagnoses often have access to the healthcare system through the Emergency Department which in turn becomes their gateway for inpatient admission and live-saving urgent critical interventions. Indeed, a recent study [11] found that Medicaid expansion was associated with a 6-percent reduction in all-cause mortality, with the most robust reductions from “healthcare-amenable” conditions such as non-communicable diseases and infections, which are more plausibly affected by access to medical care [10, 11].

Limitations

This study and the results should be interpreted within the context of the study design and the dataset used. Primarily, results could be biased due to the use of an administrative database like HCUP-SID because of lack of data granularity to allow for risk adjustment. As a claims database, it does not contain granular clinical information such as lab values, findings on physical exams, and some findings on peri-operative assessment which may contribute to health outcomes in many patients. Second, this database does not have information on outpatient care received prior to the surgery which may have an impact on surgical outcomes. Third, such datasets may have over or under-reporting of procedure codes which may have impacted the inclusion and exclusion criteria of our study population. The limitations of this dataset are that it is limited to a certain number of states in the US which may mean that we may have missed out on trends from other states and that it is only available till the year 2014 which may mean that we were not able to capture more recent trends.

Despite our limitations, our study adds to the body of literature showing the benefits of insurance coverage and shows that expanding Medicaid may provide access to healthcare services and financial security to a vulnerable population that is least equipped to handle health expenditures.

Conclusion

Homeless patients living in Medicaid expansion states had lower odds of being discharged against medical advice, higher likelihood of receiving home healthcare and overall lower total index hospital charges.

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Compliance with ethical standards

Informed consent Because this was a retrospective study that used de-identified data from the SID database it was deemed exempt from full review by the institutional review board of Partners Healthcare.

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