Title
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Journal
Journal of Substance Use, 24(6)

ISSN
1465-9891

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Publication Date
2019-11-02

DOI
10.1080/14659891.2019.1640303

Peer reviewed

Journal of Substance Use

ISSN: 1465-9891 (Print) 1475-9942 (Online) Journal homepage: https://www.tandfonline.com/loi/ijsu20

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To cite this article: Lu Shi, Khoa Truong, Liwei Chen & William Basco (2019): Burden of non-fatal opioid overdose hospitalizations on Medicaid, Journal of Substance Use, DOI: 10.1080/14659891.2019.1640303

To link to this article: https://doi.org/10.1080/14659891.2019.1640303

Published online: 11 Jul 2019.

JOURNAL OF SUBSTANCE USE
https://doi.org/10.1080/14659891.2019.1640303

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Burden of non-fatal opioid overdose hospitalizations on Medicaid

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ABSTRACT

Background: The Medicaid population experienced an elevated risk of opioid overdose death. Higher risks of a health condition or worse health outcomes could mean high costs imposed on public sources of insurance. In this study, we compared the length of stay and total charge of hospitalized opioid overdose patients across insurance types to shed light on the financial burden of opioid epidemic across different types of payers. Method: Our sample includes all opioid overdose hospitalizations in the 2012–2013 South Carolina Patient Encounter database. Length of stay and total hospital charge are the two dependent variables. The key independent variable is the insurance status, categorized as: self-pay, commercial insurance, Medicare, Medicaid, and other payers (other government plan and charitable plans). Multilevel models were applied to account for the clustering effect of each hospital. The patients' age, gender, race/ethnicity, and Charlson Comorbidity Index were used as covariates. Results: A total of 1,262 hospitalizations were included. Medicaid patients stayed longer in hospital (β = 1.815, 95% confidence interval = [0.406–3.224]) and had higher total charge (β = $6,695.2, 95% CI = [215.1–13,175.3) compared with patients with commercial insurance. Conclusion: Medicaid patients' longer hospitalization and higher hospital charge suggest disparity at the hospital treatment stage.

ARTICLE HISTORY
Received 22 February 2019
Revised 3 May 2019
Accepted 1 July 2019

KEYWORDS
Heroin; illicit; methadone; overdose; substance-abuse

Background

Certain parts of the United States (U.S.) and Canada have seen an unprecedented increase in morbidity and mortality associated with use of opioid in recent years (Kolodny et al., 2015; Morin, Eibl, Franklyn, & Marsh, 2017), and the rise in opioid overdose deaths have also been noted in countries such as Australia and the United Kingdom (Dhalla, Persaud, & Juurlink, 2011). In the U.S., counties with higher Medicaid enrolment rates and higher unemployment rates had more opioids prescribed (Guy et al., 2017) and those with Medicaid or without insurance (Becker et al., 2008) were more likely to have opioid use disorder (OUD). While risk factors of OUD incidence have been identified by previous literature (Edlund, Steffick, Hudson, Harris, & Sullivan, 2007; Turk, Swanson, & Gatchel, 2008), few studies have further examined whether the costs of opioid overdose hospitalizations are disproportionally distributed across different payers due to different underlying reasons.

There have been reports about the rise of prescription opioids among the Medicaid population (Desai, Hernandez-Diaz, Bateman, & Huybrechts, 2014) and the Medicaid population experienced an elevated risk of opioid overdose death ("Overdose Deaths Involving Prescription Opioids Among Medicaid Enrollees – Washington, 2004–2007," 2009). Recent evidence suggests that for the same procedure of total hip replacement Medicaid patients faced significantly worse outcomes than those with private insurance, a phenomenon that could reflect broader disparities in the health-care system (Xu et al., 2017). Higher risks of a health condition or worse health outcomes could mean high costs imposed on public sources of insurance. In this study, we compared the length of stay and total charge of hospitalized opioid overdose patients across insurance types to shed light on the financial burden of opioid epidemic across different types of payers.

Methods

Our analytical dataset for opioid overdose hospitalizations was constructed from the 2012–2013 South Carolina Patient Encounter database – the "universe" of all hospitalizations at non-federal health-care providers in the state of South Carolina (Feng, Nietert, & Adams, 2009). This database can be used for multiple purposes including identifying risk factors of hospital outcomes among the state's inpatients of a defined disease (L. Shi, Zhang, Chen, & Truong, 2016). Using the inpatient component of this database, hospitalizations with ICD 9 codes 965.00, 965.01, 965.02, and 965.09 (Y. Shi, 2017) in their primary diagnoses at admission were identified to construct our analytical sample.

Two outcome variables were examined in this study: length of stay (number of days of the hospitalization) and total charge (dollars). Because of the nature of these two outcome variables, we had to further limit our analytical sample. Those with discharge status as "expired" or "hospice" were excluded because death or "discharged to hospice" event truncated the hospitalization, confounding the association between insurance status and the two outcome variables.

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The key independent variable is the insurance status, categorized as: self-pay, commercial insurance, Medicare, Medicaid, and other payers (including indigent/charitable organization and other government payers). "Other payers" is a category that includes state and local governments' health plans and charitable funds hospitals could have to pay for certain hospitalizations. The payer in this category of "other payer" is therefore public or nonprofit.

Multilevel models were applied to account for the grouping structure of data – patients are nested within hospitals. The patients' age, gender, race/ethnicity, and Charlson Comorbidity Index (CCI)(Charlson, Szatrowski, Peterson, & Gold, 1994; Stagg, 2017) – computed from the secondary diagnoses of the hospitalization were used as the control variables at the individual level. Race/ethnicity was recoded as 1 for non-Hispanic Whites and 0 for other racial/ethnic groups as there were small counts of minority races in our sample.

STATA 14.0's function "mixed" was used to contain both fixed effects and random-intercept effects for our multilevel linear regressions (Rabe-Hesketh, Skrondal, & Pickles, 2002; StataCorp, 2013), with hospital ID set as the cluster variable.

Results

A total of 1,262 hospitalizations clustered within 55 hospitals were included in our multilevel analyses. Table 1 presents the descriptive statistics of variables used in our multilevel analyses by insurance statuses. ANOVA analyses show that total hospital charge was significantly different across insurance statuses (p = .001). Statistically significant differences across insurance statuses were also observed for length of stay (p = .002), CCI (p < .001), and age (p < .001). Medicaid patients had notably the highest average length of stay while total hospital charge was highest among the "other payer" group.

Table 2 presents the results of our multilevel analyses. Both multilevel models are significantly different from single-level models based upon the likelihood ratio tests, signaling that the cluster effect at the hospital level is significant. Among the nonfatal opioid overdose hospitalizations, Medicaid-covered patients had longer stay in the hospital (β = 1.815, 95% confidence interval = [0.406–3.224]) and larger amounts of total charge (β = $6,695.2, 95% confidence interval = [215.1–-13,175.3) compared with patients who had commercial insurance, after controlling for age, gender, race/ethnicity, and CCI. These results mean that on average opioid overdose inpatients with Medicaid as the primary payer stayed 1.815 days longer in the hospital and incurred an excess of $6,692.2 in total hospital charge as compared with opioid overdose inpatients with commercial insurance (the reference group in our statistical model). Meanwhile, opioid overdose inpatients with Medicare or those self-pay patients had no statistically significant difference from those inpatients with commercial insurance in terms of length of stay and total hospital charge.

Patients with "other payers" (other government plans, charitable/indigent care) had an excess of $7,814.6 (95% confidence interval = [448.4–15,180.9) as compared with those with commercial insurance. Length of stay for those patients of "other payers" is not statistically significant as compared to private insurance, though the coefficient had the positive sign (consistent with the pattern of total hospital charge).

Discussion

Our data analyses confirm the important role Medicaid plays in reimbursing for opioid poisoning hospitalizations: 43% of the opioid overdose hospitalizations in our sample had Medicaid as the primary payer, a percentage by far larger than the percentage of Medicaid enrollees in the South Carolina population (25%) (The Center for Medicaid and CHIP Services, 2016). This reflects the excess burden of the opioid epidemic on Medicaid financing as well as illustrates the potential role Medicaid has in controlling the opioid epidemic (Sharp et al., 2018). Similar interpretation can be drawn for the "other payers," which consisted of a large proportion of public funding as explained earlier.

Health disparity occurs at different stages of the natural history of an OUD: the geographic disparity is salient for the OUD incidence and opioid overdose risk (Dunn et al., 2016; Keyes, Cerdá, Brady, Havens, & Galea, 2014) whereas the racial and gender disparities are significant at the treatment

Table 1. Descriptive statistics of the sample with nonfatal opioid overdose hospitalizations in South Carolina 2012–2013.

Payer status / variables	Commercial insurance	Self-pay	Medicare	Medicaid	Other payers[1]	Bivariate associations with payer status
Continuous variables (mean and standard deviation)						*p value from ANOVA tests*
Age (years)	43.67 (15.95)	36.07 (11.99)	61.12 (12.85)	41.91 (14.98)	42.22 (15.11)	<0.001
Charlson Comorbidity Index	0.62 (1.36)	0.25 (0.75)	1.30 (1.54)	0.85 (1.33)	0.54 (1.04)	<0.001
Length of stay (days)	3.40 (3.88)	3.48 (4.49)	4.31 (4.23)	5.32 (14.18)	4.50 (5.37)	0.002
Total hospital charge ($)	24,505.97 (23,888.72)	25,213.48 (25,581.98)	33,184.40 (31,528.02)	31,829.69 (40,605.66)	33,343.57 (38,140.90)	0.001
Categorical variables (frequency/column percent)						*p-value from Chi-square tests*
Female	93 57.41%	102 40.16%	323 59.81%	126 66.32%	60 51.72%	<0.001
Non-Hispanic White	150 92.59%	228 89.76%	470 87.04%	163 85.79%	99 85.34%	0.193
Sample size	162	254	540	190	116	*Total* 1,262

Note:
1. "Other payers" include state government insurance plan for public employees and hospital funds for indigent patients.

Table 2. Multilevel Linear Regressions of outcomes by payer status, nonfatal opioid overdose hospitalizations in South Carolina 2012–2013.

	Length of stay (days)	Total hospital charge ($)
	Regression coefficient [95% Confidence Interval]	*Regression coefficient [95% Confidence Interval]*
Non-Hispanic Whites[1]	0.296 [−0.864,1.456]	−1,286.2 [−6,666.9,4,094.6]
Age	0.0172 [−0.011,0.0448]	129.8* [2.574,257.0]
Payer (commercial insurance as the reference group)		
Self-pay	0.358 [−0.982,1.698]	1789.0 [−4,371.9,7,949.9]
Medicare	0.484 [−0.789,1.757]	4,514.3 [−1,331.6,10,360.2]
Medicaid	1.815* [0.406,3.224]	6,695.2* [215.1,13175.3]
Other payers	1.035 [−0.565,2.636]	7,814.6* [448.4,15,180.9]
Female	−0.233 [−0.987,0.522]	−1311.5 [−4,780.0,2,156.9]
Charlson Comorbidity index	0.120 [−0.183,0.423]	1,051.7 [−339.3,2,442.7]
N	1,262	1,262

Notes:
1. Non-Whites and Hispanics are set as the reference group.
2. 95% confidence intervals in brackets
3. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
4. Natural log of standard deviations of the hospital-level random effects are significant for both models: Length of stay (1.893, 95% Confidence Interval: [1.854, 1.932]), total charge: (10.32, 95% Confidence Interval: [10.28, 10.36]).
5. Natural log of standard deviation of the individual-level errors is significant for the model about total charge (8.863, 95% Confidence Interval: [8.516, 9.210]) but not for the model about the length of stay (−0.110, 95% Confidence Interval: [−0.595, 0.376]).

stage (Hadland et al., 2017). Our findings that patients with Medicaid stayed longer in hospital and had higher charge suggests there could be disparity at the treatment stage during the hospitalization. It could be that these patients had delayed treatment, resulting in more complication to treat. While we already know that Medicaid enrollees might be at elevated risk for receiving opioid prescriptions as compared with the non-Medicaid population (Ailes et al., 2015), there has been little information about the severity difference between Medicaid patients and other patients at the time of an opioid overdose hospitalization. The fact that the 43% of the opioid overdose hospitalizations were Medicaid patients and the Medicaid OUD patients faced substantially higher charge and longer stay in the hospital warrants attention from federal and state stakeholders of Medicaid, either from an overdose prevention perspective or from a perspective of cost control. While all payers might have an incentive to minimize opioid overdose among their beneficiaries, Medicaid administrators could find it particularly efficient to prevent opioid overdose among its enrollees, since the cost of their hospitalizations is notably higher than those with commercial insurance. In other words, a more "proactive approach" in overdose prevention could potentially save costs.

The relatively low reimbursement rate of Medicaid as compared with commercial insurance could create incentives among health-care providers to discriminate against Medicaid patients (Meyer, 2001) and this kind of possible discrimination could in the long run result in worse outcomes and longer duration of hospitalization among Medicaid patients (Smoyer Tomic, Wilson, Smith, & Agodoa, 2013). In a 2013 study of inpatients with systematic heart failure where researchers identified longer length of stay and higher mortality rate among Medicaid patients than those with private insurance, the latter were found to be more likely to receive inpatient procedures (Smoyer Tomic et al., 2013). This possible mechanism could have resulted in the worse CCI and longer hospitalization among Medicaid patients as we see in this study.

It has been well documented that Medicaid patients were more limited by their access to rehabilitation facilities than those with commercial insurance: (i) fewer providers accept Medicaid patients; and (ii) for those Medicaid patients getting service, they waited significantly longer that those with private insurance (Rogers, Penvose, Curry, DeGiacomo, & Li, 2018). This longer delay before admission to rehabilitation might have also contributed to higher severity among Medicaid patients with OUD and subsequently led to longer stay at the hospital and higher total expenditure. While our current study cannot examine these hypothetical mechanisms, Medicaid decision makers and public health stakeholders might find it optimal to close these gaps in OUD treatment, especially if follow-up studies clarify the causal pathways behind the higher hospitalization costs and longer stays of Medicaid opioid overdose patients.

South Carolina faces elevated risk for OUD in that its 4.89 million residents in 2015 filled nearly 4.5 million opioid prescriptions, a rate greater than 1.5 times the national average (Arnold, Arshonsky, Bloch, Holzman, & Sade, 2019). Our analytical sample included only the inpatient data, therefore presenting only a portion of the health-care expenditure attributable to OUD. In 2015, South Carolina had 105.8 opioid-related emergency department visits per 100,000 population, representing a 50.3% increase since 2009 (Weiss et al., 2017). Further studies can look at the distribution of reimbursement for ED visits across types of payers.

Our dataset is limited in that it does not include specific clinical information such as laboratory results for the admitted OUD patients and thus we do not know the specific severity of overdose in each insurance category, which could be a confounder in the association between payer status and hospitalization outcomes. We tried to compensate that by computing a CCI from the secondary diagnoses of the hospital discharge data. However, the index alone might not capture all the possible severity differences between Medicaid patients and commercial insurance patients. Another limitation is our data are limited to two years 2012 and 2013, which does not capture the latest changes of the opioid epidemic in the state of South Carolina (e.g., changes in the type of opioid substance used by the patients, which might influence the mortality, morbidity and the expenditure outcomes). Finally, there are significant state-level differences in Medicaid coverage for treatment of substance use disorder including OUD treatment (Grogan et al., 2016) and each state's legislative environment for private insurance plans' coverage for OUD could also vary. Therefore, findings from one state cannot be easily generalized to other states. For follow-up studies, we look forward to addressing these limits by using more

updated national data sources with longitudinal structure and richer information about the patient's OUD history.

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