

# RACIAL AND INSURANCE STATUS DISPARITIES IN PATIENT SAFETY INDICATORS AMONG HOSPITALIZED PATIENTS

Jay J. Shen, PhD<sup>1</sup>; Christopher R. Cochran, PhD<sup>1</sup>; Olena Mazurenko, PhD<sup>2</sup>;  
Charles B. Moseley, PhD<sup>1</sup>; Guogen Shan, PhD<sup>3</sup>; Robin Mukalian, MHA<sup>4</sup>;  
Scott Neishi, MHA<sup>1</sup>

**Objective:** To examine the association between patient race/ethnicity, insurance status, and their interaction with patient safety indicators among hospitalized patients.

**Methods:** Cross-sectional study was conducted. Data were extracted from the 2009 National Inpatient Sample. A total of 3,052,268 patient safety indicator-related discharges were identified. Dependent variables were 11 patient safety indicators (PSI) whereas independent variables included race/ethnicity and insurance status.

**Results:** As compared with White patients, African American patients were more likely to experience pressure ulcer, post-operative hemorrhage or hematoma, and post-operative pulmonary embolism (PE) or deep vein thrombosis (DVE); Asian/Pacific Islander patients were more likely to experience pressure ulcer, post-operative PE or DVT, and two obstetric care PSIs; whereas Hispanic/Latino patients were more likely to experience post-operative physiometabolic derangement and accidental puncture/laceration. As compared with patients with private insurance, Medicaid patients were more likely to experience pressure ulcer, post-operative physiological metabolic derangement, post-operative PE or DVT, post-operative respiratory failure, post-operative wound dehiscence, and death among surgeries. However, both obstetric care PSIs showed that African Americans, Hispanics, and uninsured patients were less likely to incur them in comparison with their respective counterparts. Furthermore, strong interactive effects between African American and Medicaid on PSIs were detected.

**Conclusions:** Although mixed findings in disparities in PSIs were observed in our study, Asian/Pacific Islander patients and Medicaid patients seem to be the most vulnerable. Further, interactive effects between

## INTRODUCTION

Health disparities associated with race and insurance status are widely documented. A 2003 Institute of Medicine report states that racial/ethnic minorities and low-income groups are disproportionately affected by medical care disparities in the United States, even after controlling for income and access to care.<sup>1</sup> This report suggests that, “the sources of these disparities are complex and rooted in historic and contemporary inequalities, and involve many participants at several levels, including health systems, healthcare managers, medical professionals and patients”. Previous research indicates that minority patients are more likely to receive

lower quality of care across a range of conditions and care processes, and have higher morbidity and mortality rates including some patient safety indicators on selected outcomes.<sup>2-13</sup>

Patient safety indicators (PSIs), developed by the Agency for Healthcare Research and Quality (AHRQ), are a set of indicators providing information on potential in-hospital complications and adverse events following surgeries, procedures, and childbirth. The PSIs were developed after a comprehensive literature review, analysis of ICD-9-CM codes, review by a clinician panel, implementation of risk adjustment, and empirical analyses. The PSIs provide the opportunity to assess the incidence of adverse events and in-hospital complications us-

African American and Medicaid indicate that poverty may be a key factor related to disparities in health care. Future research is merited to identify underlying factors that are related to PSIs among Asian/Pacific Islander patients. Strategies are needed to improve PSIs among Medicaid patients, especially during the current Medicaid program expansion due to the implementation of the Affordable Care Act. *Ethn Dis.* 2016; 26(3):443-452; doi:10.18865/ed.26.3.443

**Keywords:** Race; Ethnicity; Medicaid; Uninsured; Patient Safety Indicator; Socioeconomic Status

<sup>1</sup>Department of Health Care Administration and Policy, University of Nevada Las Vegas

<sup>2</sup>Department of Health Policy and Management, Indiana University – Purdue University Indianapolis

<sup>3</sup>School of Community Health Sciences, University of Nevada Las Vegas

<sup>4</sup>Valley Health System, Las Vegas

Address correspondence to Jay J. Shen, PhD; Department of Health Care Administration and Policy; University of Nevada Las Vegas; 4505 Maryland Parkway, Box 453023; Las Vegas, NV 89154-3023; 702.895.5830; jay.shen@unlv.edu

ing administrative data found in the typical discharge record and include indicators for complications occurring in hospital that may represent patient safety events (AHRQ - Patient Safety Indicators Overview [http://qualityindicators.ahrq.gov/Modules/psi\\_resources.aspx](http://qualityindicators.ahrq.gov/Modules/psi_resources.aspx).)<sup>14</sup>

Research on the examination of patient safety in relation to potential disparities in care among patients across different racial/ethnic and health insurance groups has been limited and has yielded mixed find-

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ings.<sup>15-19</sup> Miller and colleagues reported that African American children were less likely to have adverse outcomes than White children on nine combined PSIs but they were much more likely to have higher rates of birth trauma than White children. Romano and colleagues found that African American adults had higher rates of adverse events than White patients on nine of 19 PSIs and had similar or lower rates on 10 indica-

tors. Coffey and colleagues found that higher adverse event rates for non-Hispanic Blacks when compared with non-Hispanic Whites remained higher even after accounting for income.<sup>16-18</sup> However, after results were adjusted for income, Asian/Pacific Islanders and Hispanics elevated event rates when compared with non-Hispanic Whites disappeared.

Health insurance has been shown to be yet another factor that is associated with disparities in health care. Roughly 16% of the US population lacks health insurance and Hispanics/Latinos have the highest uninsured rate of 33% making them particularly vulnerable to potential disparities in health care. 40% of uninsured African Americans are under the federal poverty line to be eligible for Medicaid expansion under the Affordable Care Act.<sup>20</sup> Evidence indicates that the uninsured or those with Medicaid for health insurance are associated with lower likelihood of receiving needed care and higher likelihood of poor outcomes.<sup>15,21,22</sup>

Furthermore, effects of interactions of race and health insurance status on outcomes have also been less studied. Belgrave, Wykle, and Choi argue that multiple unfavorable socioeconomic factors (eg, minority and uninsured) may aggravate the negative effects on individual health than that of the additive effects of the single factors.<sup>23</sup> Shen and colleagues reported that African American patients with Medicaid or being uninsured experienced exacerbating adverse outcomes compared with White patients with private insurance coverage.<sup>21</sup>

The purpose of our study, therefore, was to examine the associa-

tion between patient race/ethnicity, insurance status, and their interactions with the PSIs by using nationally representative sample of hospital discharges. Our hypotheses were:

H1: Minority patients were more likely to incur adverse PSIs than their White counterparts;

H2: Patients with Medicaid or uninsured were more likely to incur adverse PSIs than patients covered by private insurance;

H3: Race and health insurance have interactive effects on adverse PSIs.

## METHODS

### Study Design and Data

This was a cross-sectional study, and the unit of analysis was the hospital discharge. The data were mainly from the 2009 National Inpatient Sample (NIS), maintained by AHRQ. The NIS contains 20% of all community hospital discharges in the United States. In addition, the American Hospital Association (AHA) annual survey data were used to control for hospital characteristics. A total of 3,052,268 discharges that were related to the PSIs were identified by the AHRQ Patient Safety Indicator (PSI) Software, Version 4.4.<sup>24</sup>

### Measures

Our dependent variables were the PSIs, developed by AHRQ.<sup>14</sup> After running the AHRQ PSI software on the 2009 NIS data, we identified 17 PSIs. We removed six indicators whose frequencies were less than 0.1% because we believed that meaningful differences in those indicators across racial/ethnic and insurance

**Table 1. Patient Safety Indicator coding and definitions**

PSI	Coding	Definition
PSI 03	1 - Yes, 0 - No	In-hospital pressure ulcer
PSI 04	1 - Yes, 0 - No	Death among surgeries
PSI 09	1 - Yes, 0 - No	Post-operative hemorrhage or hematoma
PSI 10	1 - Yes, 0 - No	Post-operative physiological metabolic derangement
PSI 11	1 - Yes, 0 - No	Post-operative respiratory failure-2 EHR variables included in the model
PSI 12	1 - Yes, 0 - No	Post-operative PE of DVT
PSI 13	1 - Yes, 0 - No	Post-operative physiologic metabolic derangement
PSI 14	1 - Yes, 0 - No	Post-operative wound dehiscence
PSI 15	1 - Yes, 0 - No	Accidental puncture/laceration
PSI 18	1 - Yes, 0 - No	In-hospital OB trauma-vaginal with instrument
PSI 19	1 - Yes, 0 - No	OB trauma-vaginal without instrument

groups might not be detected by very low frequencies. Those six indicators were: death in low-mortality diagnosis related groups (DRGs); retained surgical item or unretrieved device fragment; iatrogenic pneumothorax; central venous catheter-related blood stream infection; postoperative hip fracture; and transfusion reaction. The remaining 11 indicators in our study our listed in Table 1. Detailed descriptions of the 11 indicators can be found elsewhere.<sup>14</sup>

Our independent variables were formed based on socioeconomic status, such as race/ethnicity and health insurance status. Dummy variables were created to represent African American, Hispanic/Latino, and Asian/Pacific Islander, respectively, while White served as the reference group. We did not present results of other races due to small sample size (eg, Native American) or unclearness of specific racial/ethnic group. Three dummy variables were created to represent Medicare, Medicaid, and uninsured, while private insurance served as the reference. Since Medicare mainly covers people aged >65 years, we did not report results related to Medicare patients and

only compared patients covered by Medicaid or private insurance, or patients without health insurance who were within comparable age ranges.

### Data Analysis

To model the relationship between race and health insurance status with the 11 dichotomous PSI dependent variables, we used generalized logistic models to take into account potential within hospital effect among patients in the same hospital (ie, patients were not randomly sampled within hospital). The patient's age, sex, and 29 comorbidities that were developed by AHRQ were adjusted in the multivariable analysis.<sup>25</sup>

In addition to the risk adjustment, we also controlled for hospital-level variables, such as bed size, ownership type, teaching affiliation, system membership, network participation, the number of staffed beds per full time equivalent registered nurses, percentage Medicare patients, percentage Medicaid patients, capitation-based reimbursement, market competitiveness, rural or urban hospital, and hospital region.<sup>26,27</sup>

Given that there were more than

40 independent variables to be modeled, we used the preliminary regression analysis for detecting multicollinearity among independent variables in the multivariable models.<sup>28</sup> For example, teaching hospital status was not included in the multivariable model because it was highly correlated to bed size; percentage of Medicare patients was not included due to its high correlation with percentage of Medicaid patients. In regard to interactions between race and insurance status, we included an interaction term if both main effects (ie, one for race, the other for insurance status) were toward the same direction (i.e., both with a positive sign or a negative sign) and statistically significant in the multivariable model, but only retained the interaction term if it was statistically significant. For example, if both Medicaid and African American (AA) were positive and significant, we formed an interaction term, Medicaid\*AA, in the multivariable. If the interaction term was significant, its results would be shown; if the interaction term was not significant, the original results of the main effects without the interaction remained.

## RESULTS

Table 2 shows unadjusted descriptive results of all patients. About one quarter of the patients were minorities, 12% were covered by Medicaid and 6.1% were uninsured. The average hospital stay was 5.1 days.

Table 3 lists number of patients and the respective percentage for each of the 11 PSI incidents. PSI15 had the highest denominator, because virtually all patients had a risk of incurring the accidental puncture/laceration whereas PSI18 had the lowest denominator of 35,075. PSI18 and PSI04 had the highest percentages (13.98% and 12.58%, respectively) whereas PSI10 was the least frequent (0.14%). Furthermore, most PSIs showed statistical significance in bivariate analyses across race and health insurance status.

Tables 4, 5 and 6 display results of relationships between race and 11 PSIs as well as between insurance status and 11 PSIs, respectively. While White and Hispanic patients had comparable odds of incurring pressure ulcer (PSI 03), both African American patients and Asian/Pacific Islander patients were more likely to incur pressure ulcer (OR 1.61; 95%CI 1.48, 1.76 for African Americans and OR 1.69; CI 1.35, 2.12 for Asians/Pacific Islanders) than their White counterparts were. As compared with patients with private insurance, patients covered by Medicaid were more likely to incur pressure ulcer (OR 1.59; CI 1.36, 1.86) while the uninsured patients had a comparable odds of incurring pressure ulcer. Moreover, some interaction effects between African American and

**Table 2. Patients sociodemographic and hospitalization characteristics**

Variable	%, (n = 3,052,268)
Sociodemographics	
Age, year (SD)	61.9 (18.7)
Sex, %	
Male	46.1
Female	53.9
Race, %	
White	74.0
African American	13.2
Hispanic	10.1
Asian	2.6
Insurance status, %	
Medicare	53.5
Medicaid	12.0
Private insurance	28.4
Uninsured	6.1
Hospitalization characteristics	
Length of stay, day (SD)	5.1 (7.1)
Total charge, \$ (SD)	38,924 (60,257)
Died in hospital, %	2.6
SD, standard deviation	

Medicaid were detected. Among African American patients, there was no difference in incurring PSI 03 between patients with Medicaid and patients with private insurance; but among White patients, patients with the Medicaid coverage were more likely to incur PSI 03 (OR 1.59; CI 1.36, 1.86) than their privately insured counterparts, which indicates that insurance status shows stronger effects among White patients. On the other hand, among patients with Medicaid, there were no racial disparities; but among patients with private insurance, African Americans were more likely to incur pressure ulcer than their White counterparts (OR 1.61; CI 1.48, 1.76). These results indicate that racial disparities are weakened among poor populations such as those covered by Medicaid.

Fewer disparities in the next four PSI were observed. There were no disparities found in PSI 04 (death

among surgeries except in that patients covered by Medicaid having a .25 higher OR than privately insured patients (OR 1.25; CI 1.06, 1.47). Both African Americans and Asians were more likely to incur PSI 09 than their White counterparts (OR 1.23; CI 1.06, 1.42 and OR, 1.30; CI 1.01, 1.67) for African Americans and Asians, respectively). Patients covered by Medicaid were more likely to incur PSI 10 (post-operative metabolic derangement) than their privately insured counterparts (OR 1.68; CI 1.06, 2.84); and Medicaid patients were more likely to incur PSI 11 than their privately insured counterparts (OR 1.24; CI 1.00, 1.53) (Tables 4,5,6).

In regard to PSI 12 (post-operative PE of DVT), both African Americans and Asians and had higher odds than their White counterparts (OR, 1.45; CI 1.35, 1.57) for African Americans and OR 1.22; CI 1.03, 1.35 for Asians; and both Medicaid patients

**Table 3. PSI Denominator and percentage of incidents by race and insurance status**

PSI	Race/ Ethnicity				Health Insurance			Total		
	White	African American	Hispanic	Asian	Medicaid	Private Insurance	Uninsured			
PSI03 (n = 1,327,925)	.52	.91	.63	.53	b	.43	.25	.15	b	.59
PSI04 (n = 45,641)	12.59	11.90	12.29	14.75		10.89	9.37	12.18		12.58
PSI09 (n = 1,310,567)	.27	.36	.28	.36	a	.33	.26	.24	a	.28
PSI10 (n = 614,701)	.14	.16	.16	.17		.14	.07	.11	a	.14
PSI11 (n = 498,531)	.92	.96	.89	.97		1.02	.52	.78	a	.92
PSI12 (n = 1,311,866)	1.02	1.90	1.01	1.00	a	1.28	.78	.77	b	1.11
PSI13 (n = 126,247)	1.59	1.79	1.73	1.43		1.60	1.20	1.39		1.63
PSI14 (n = 214,668)	.21	.13	.13	.18	a	.22	.12	.16	a	.19
PSI15 (n = 4,480,214)	.28	.22	.25	.36		.20	.40	.17	b	.27
PSI18 (n = 35,075)	14.58	9.25	11.60	19.23	b	10.79	16.42	14.51	b	13.98
PSI19 (n = 414,931)	2.42	1.20	1.70	4.02	b	1.56	2.81	1.92	b	2.16

Data are expressed as percentage.

a.  $P < .05$ .

b.  $P < .01$  for bivariate analyses.

and uninsured patients had higher odds than their counterparts covered by private insurance (OR, 1.20; CI 1.08, 1.33 for Medicaid patients and OR 1.18; CI 1.03, 1.35 for uninsured patients). Again, interaction effects between African American and Medicaid were significant. Among African Americans, no disparities in insurance status existed, but among Whites, Medicaid patients were more likely to incur PSI 12 (OR, 1.20; CI 1.08, 1.33); among Medicaid patients, no racial disparities were observed, but among privately insurance patients, African Americans were more likely to incur post-operative PE of DVT (OR, 1.45; 1.35, 1.57) (Tables 4,5,6).

Hispanic patients were more likely to incur PSI 13 (post-operative physiometabolic derangement) than their White counterparts (OR 1.37; CI 1.03, 1.83); and Medicaid patients were more likely to incur PSI 14 (post-operative wound dehiscence) than their counterparts covered by private insurance (OR 1.71; CI 1.09, 2.70) (Table 4).

Both main effect and interactive effects in disparities were observed in PSI 15 (accidental puncture / laceration) in a more complicated fashion (Table 6). As compared with White patients, Hispanic patients were more likely to incur accidental puncture/laceration (OR, 1.30; CI 1.08, 1.57) whereas Asian patients were less likely to (OR, .72; CI .54, .97). Compared with patients with private insurance, Medicaid patients were less likely to incur accidental puncture/laceration (OR .73; CI .59, .90) but uninsured patients were more likely (OR 2.05; CI 1.53, 2.76). The significance of the main effect of African Americans disappeared but its interactions with Medicaid remained significant. Among Whites, Medicaid patients were less likely to incur the incident (OR .73; CI .59, .90), and among African Americans, Medicaid patients were even much less likely to (OR .33; CI .18, .59). Among Medicaid patients, African Americans were less likely to incur the incident (OR .39; CI .22, .70) but among

patients with private insurance, no racial disparities were detected.

Two PSIs related to maternal outcomes showed opposite disparities to those related to other PSIs shown above (Tables 4, 5, 6). For PSI 18 (in-hospital OB trauma-vaginal with instrument), African Americans, compared with White patients, were less likely but Asians were more likely to incur the incident (OR .68; CI .57, .81 and 1.40; 1.21, 1.63 for African Americans and Asians, respectively); as compared with their privately insured counterparts, Medicaid patients were less likely to incur the incident (OR .69; CI .62, .77). As for PSI 19 (OB trauma-vaginal without instrument), as compared with White patients, both African Americans and Hispanics were less likely to incur the incident (OR, .54; CI .48, .61 and .81; .75, .89 for African Americans and Hispanics, respectively) but Asians were more likely to incur the incident (OR 1.82; CI 1.64, 2.03); as compared with their privately insured counterparts, both

**Table 4. Relationships between race/ethnicity, insurance status, and quality indicators<sup>a</sup>**

Independent Variable	Odds Ratio	95% CI	P
PSI 03 - In-hospital pressure ulcer			
Race			
White (reference)	1.00		
African American	1.61	[1.48, 1.76]	<.001
Hispanic	.90	[.81, 1.01]	.073
Asian/Pacific Islander	1.69	[1.35, 2.12]	<.001
Insurance			
Private insurance (reference)	1.00		
Medicaid	1.59	[1.36, 1.86]	<.001
Uninsured	1.54	[.57, 1.02]	.001
Interaction between race and insurance			
Among African American			
Medicaid vs private insurance	.93	[.75, 1.16]	.534
Among White			
Medicaid vs private insurance	1.59	[1.36, 1.86]	<.001
Among Medicaid			
African American vs White	.95	[.75, 1.19]	.637
Among privately insured			
African American vs White	1.61	[1.48, 1.76]	<.001
PSI 04 - Death among surgeries			
Insurance			
Private insurance (reference)	1.00		
Medicaid	1.25	[1.06, 1.47]	.007
Uninsured	1.11	[.88, 1.41]	.371
Race			
White (reference)	1.00		
African American	.87	[.75, 1.00]	.052
Hispanic	.93	[.79, 1.08]	.335
Asian/Pacific Islander	.96	[.76, 1.23]	.773
PSI 09 - Post-operative hemorrhage or hematoma			
Insurance			
Private insurance (reference)	1.00		
Medicaid	.97	[.82, 1.15]	.747
Uninsured	.80	[.63, 1.02]	.075
Race			
White (reference)	1.00		
African American	1.23	[1.06, 1.42]	.007
Hispanic	1.01	[.86, 1.20]	.869
Asian/Pacific Islander	1.30	[1.01, 1.67]	.046
PSI 10 - Post-operative physiological metabolic derangement			
Insurance			
Private insurance (reference)	1.00		
Medicaid	1.68	[1.06, 2.64]	.026
Uninsured	1.70	[.84, 3.44]	.140
Race			
White (reference)	1.00		
African American	.95	[.66, 1.35]	.764
Hispanic	1.46	[.95, 2.22]	.081
Asian/Pacific Islander	1.47	[.72, 2.98]	.287

a. Results of the risk-adjustment variables and other control variables are not listed.  
CI, 95% confidence interval

Medicaid and uninsured patients were less likely to incur the incident (OR .60; CI .56, .64 and .64; .54, .76 for Medicaid patients and uninsured patients, respectively) (Table 6).

## DISCUSSION

Our racial/ethnic group findings were consistent with prior studies that used PSIs to examine racial/ethnic disparities.<sup>29</sup> Although we found that, compared with White patients, African American patients and Hispanic/Latino patients have higher occurrence in three and two

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*Given that abundant studies report wider disparities between White and African American and between White and Hispanic than between White and Asian/Pacific Islander, our finding was, to some degree, unexpected and merits further research.*

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PSI events, respectively, it is surprising to observe that Asian/Pacific Islander patients have five PSI events. Given that abundant studies report wider disparities between White and African American and between

White and Hispanic than between White and Asian/Pacific Islander, our finding was, to some degree, unexpected and merits further research.

One potential explanation is that, during the decade of the 2000s, there were rapidly growing increases in the US Asian populations, particularly Asians with limited English proficiency (LEP), and there is evidence that LEP patients are more likely to experience hospital-based adverse errors.<sup>30</sup>

As discussed, the study appears to be one of the first ones to examine the association between the insurance status of adult hospital patients and the occurrence of PSIs. We found that Medicaid patients were more likely than privately insured patients to have experienced PSI events in six of the 11 PSIs that we examined. We also found that uninsured patients were more likely to experience PSI events in only two of the 11 PSIs studied. Thus, it appears that poverty may be more predictive of a hospital patient experiencing a PSI event than purely being insured or uninsured.

Moreover, we found considerable overlap between insurance status and racial / ethnic status. Interactive effects between African American and Medicaid indicate, again, that poverty may be a key factor being associated with disparities in health care, which also shows the complexity of addressing disparities related to racial/ethnicity and health insurance status. More research is needed to further differentiate the relationship between patient race/ethnicity, insurance status and patient safety.

Nevertheless, the question remains as to why Medicaid patients were more likely to experience PSI

**Table 5. Relationships between race/ethnicity, insurance status, and quality indicators<sup>a</sup>**

Independent Variable	Odds Ratio	95% CI	P
PSI 11 - Post-operative respiratory failure			
Insurance			
Private insurance (reference)	1.00		
Medicaid	1.24	[1.00, 1.53]	.049
Uninsured	.87	[.58, 1.29]	.481
Race			
White (reference)	1.00		
African American	1.00	[.82, 1.21]	.990
Hispanic	1.04	[.80, 1.35]	.768
Asian/Pacific Islander	1.24	[.81, 1.90]	.330
PSI 12 - Post-operative PE of DVT			
Race			
White (reference)	1.00		
African American	1.45	[1.35, 1.57]	<.001
Hispanic	.99	[.90, 1.08]	.791
Asian/Pacific Islander	1.22	[1.04, 1.43]	.013
Insurance			
Private insurance (reference)	1.00		
Medicaid	1.20	[1.08, 1.33]	.001
Uninsured	1.18	[1.03, 1.35]	.019
Interaction between race and insurance			
Among African American			
Medicaid vs private insurance	.97	[.82, 1.14]	.681
Among White			
Medicaid vs private insurance	1.20	[1.08, 1.33]	.001
Among Medicaid			
African American vs White	1.18	[.99, 1.40]	.070
Among privately insured			
African American vs White	1.45	[1.35, 1.57]	<.001
PSI 13 - Post-operative physiometabolic derangement			
Race			
White (reference)	1.00		
African American	1.22	[.96, 1.54]	.099
Hispanic	1.37	[1.03, 1.83]	.033
Asian/Pacific Islander	1.10	[.61, 1.98]	.750
Insurance			
Private insurance (reference)	1.00		
Medicaid	1.08	[.80, 1.44]	.624
Uninsured	.93	[.57, 1.54]	.789
PSI 14 - Post-operative wound dehiscence			
Insurance			
Private insurance (reference)	1.00		
Medicaid	1.71	[1.09, 2.70]	.020
Uninsured	1.18	[.61, 2.29]	.620
Race			
White (reference)	1.00		
African American	.76	[.46, 1.24]	.266
Hispanic	.67	[.38, 1.17]	.160
Asian/Pacific Islander	.95	[.40, 2.23]	.904

a. Results of the risk-adjustment variables and other control variables are not listed. CI, 95% confidence interval

**Table 6. Relationships between race/ethnicity, insurance status, and quality indicators<sup>a</sup>**

Independent Variable	Odds Ratio	95% CI	P
PSI 15 - Accidental puncture/laceration			
Race			
White (reference)	1.00		
African American	.86	[.70, 1.06]	.165
Hispanic	1.30	[1.08, 1.57]	.005
Asian/Pacific Islander	.72	[.54, .97]	.029
Insurance			
Private insurance (reference)	1.00		
Medicaid	.73	[.59, .90]	.004
Uninsured	2.05	[1.53, 2.76]	<.001
Interaction between race and insurance			
Among African American			
Medicaid vs private insurance	.33	[.18, .59]	<.001
Among White			
Medicaid vs private insurance	.73	[.59, .90]	.004
Among Medicaid			
African American vs White	.39	[.22, .70]	.002
Among privately insured			
African American vs White	.86	[.70, 1.06]	.165
PSI 18 - In-hospital OB trauma-vaginal with instrument			
Race			
White (reference)	1.00		
African American	.68	[.57, .81]	<.001
Hispanic	.88	[.76, 1.00]	.057
Asian/Pacific Islander	1.40	[1.21, 1.63]	<.0001
Insurance			
Private insurance (reference)	1.00		
Medicaid	.69	[.62, .77]	<.001
Uninsured	.89	[.67, 1.17]	.400
PSI 19 - OB trauma-vaginal without Instrument			
Race			
White (reference)	1.00		
African American	.54	[.48, .61]	<.001
Hispanic	.81	[.75, .89]	<.001
Asian/Pacific Islander	1.82	[1.64, 2.03]	<.001
Insurance			
Private insurance (reference)	1.00		
Medicaid	.60	[.56, .64]	<.001
Uninsured	.64	[.54, .76]	<.001

a. Results of the risk-adjustment variables and other control variables are not listed. CI, 95% confidence interval

events than privately insured patients. This appears to be a generalized occurrence across all types of hospitals, because we controlled for the influence of hospitals that are more likely to be Medicaid reimbursement dependent hospitals (urban, publi-

cally owned hospitals). Are hospital clinical personnel more likely to treat Medicaid patients in ways that result in a PSI event? This is difficult to assess and, in fact, would presume that clinical staffs are aware of insurance or income differences between patients

and thus consciously treat them differently. A better explanation may be, as with our racial/ethnic results, that Medicaid and uninsured patients may be more likely to be LEP patients. Research has reported that a disproportionate number of recently uninsured and Medicaid patients are LEPs.<sup>31</sup>

Further research is needed to delineate the potential relationship between race/ethnicity, insurance status and LEP. This is an important research area given the rapidly growing Asian and Hispanic immigrant LEP populations in this country, who may be at risk for hospital adverse errors.

Potential limitations were identified of this study: 1) there may be a need for more race-specific comorbidities for PSIs,<sup>32</sup> because, as we noted, we were unable to rule out race-based physiological differences that might be underlying some of the racial PSI differences;<sup>15</sup> 2) there still may be coding errors in the reporting of PSIs – for example, surgically based PSIs appear to more reliable than medically based PSIs;<sup>33</sup> 3) as has already been discussed, we were not able to control for individual differences in LEP status that may be confounding our racial/ethnicity and insurance status findings; and, 4) the representation of the US population of all hospital discharges in our sample might be compromised due to the loss of some discharges in the process of combining NIS, AHA and AHRQ PSI datasets.<sup>15,32,33</sup>

## CONCLUSION

In conclusion, issues surrounding race and insurance status discrepan-

cies in patient safety and care are complicated, which merits further investigation. Since Medicaid is a significant factor in several of the disparity findings and can also be related to race and ethnicity, further research needs to examine whether hospitals that admit a higher proportion of low-income and/or uninsured patients have poorer patient safety outcomes. These conditions may also affect other factors such as hospital staffing rates. Future research is also merited to identify underlying factors that are related to unfavorable patient safety indicators among Asian/Pacific Islander patients. Given the expansion of Medicaid programs across the country due to the Affordable Care Act, we will likely to see an increase in Medicaid patients, many of them may be new to the health care system. Factors including pent up demand for coverage may lead to an increase in sicker patients for the short term and these patients may be prone to being at risk for conditions that may lead to poorer patient outcomes; strategies are needed to improve patient safety indicators for the Medicaid program.

#### CONFLICT OF INTEREST

No conflicts of interest to report.

#### AUTHOR CONTRIBUTIONS

Research concept and design: Shen, Cochran, Mazurenko, Moseley, Shan; Acquisition of data: Shen; Data analysis and interpretation: Shen, Mazurenko, Moseley, Mukalian; Manuscript draft: Shen, Cochran, Mazurenko, Shan, Mukalian, Neishi; Statistical expertise: Shen; Administrative: Shen, Mazurenko, Shan, Neishi; Supervision: Shen, Cochran

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