

## STATISTICAL BRIEF #121

September 2011

### Readmissions for Chronic Obstructive Pulmonary Disease, 2008

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#### Introduction

High rates of hospital readmissions and unexplained variation in those rates may indicate problems in transitions of care and outpatient management following discharge. While some readmissions may be unavoidable, reducing hospital readmissions has been an objective of the Affordable Care Act and accountable care organizations. Improving the quality of care including care transitions at the time of hospital discharge may result in fewer hospital readmissions and associated costs. Examining characteristics that explain variability in readmission rates can help to identify opportunities for targeted interventions for patients with common high risk conditions such as chronic obstructive pulmonary disease (COPD).<sup>1,2,3</sup>

Based on data from 2003–2004, 22.6 percent of fee-for-service Medicare beneficiaries admitted to the hospital for COPD were readmitted within 30 days.<sup>4</sup> This Statistical Brief presents data on hospital readmissions within 30 days following an initial hospital stay for COPD among patients 40 years old and older in 15 states in 2008.<sup>5</sup> The 15 states are geographically dispersed and account for 42 percent of the total U.S. resident population.

For this Statistical Brief, the initial—or index—admission occurred between January and November of 2008. The 30-day readmission rate is defined as any repeat admission within 30 days after being discharged alive from an index hospital stay

<sup>1</sup> Westert G. P., Lague R. J., Keskimaki I., Leyland A., Murphy M. An international study of hospital readmissions and related utilization in Europe and the USA. *Health Policy* 2002; 61(3):269-278.

<sup>2</sup> Garcia-Aymerich J., Ferrero E., Felez M. A., Izquierdo J., Marrades R. M., Anto J. M. Risk factors of readmission to hospital for a COPD exacerbation: a prospective study. *Thorax* 2003; 58:100-105.

<sup>3</sup> Chen Y., Li Q., Johansen H. Age and sex variations in hospital readmissions for COPD associated with overall and cardiac comorbidity. *International Journal of Tuberculosis and Lung Disease* 2009; 13(3):394-399.

<sup>4</sup> Jencks S. F., Williams M.V., Coleman E. A. Rehospitalizations among patients in the Medicare Fee-for-Service program. *NEJM* 2009; 360:1418-1428.

<sup>5</sup> The 15 states are Arkansas, California, Florida, Hawaii, Louisiana, Massachusetts, Missouri, Nebraska, New Hampshire, New York, South Carolina, Tennessee, Utah, Virginia, and Washington. These states were selected based on availability of synthetic patient-level identifiers that enabled tracking of patients across time.

#### Highlights

- Across a selection of 15 states in 2008, there were 190,700 index admissions with a principal diagnosis of COPD among patients 40 years old and older. The 30-day readmission rate for a principal diagnosis of COPD was 7.1 percent and the rate of 30-day readmissions for any diagnosis of COPD was 17.3 percent.
- If all readmissions were counted regardless of diagnosis, one out of five index admissions for COPD (20.5 percent) were followed by a readmission within 30 days.
- Readmissions were more likely for some groups of patients than others. Among COPD patients residing in the lowest income areas, the readmission rate was 22 percent higher than among patients from the highest income areas (7.8 percent compared to 6.4 percent).
- Readmission rates were 30 percent higher among black patients (8.0 percent) than among the groups with the lowest readmission rate—Hispanic patients and Asian and Pacific Islander patients (6.1 percent were readmitted for both groups).
- Costs were consistently higher for readmissions than for initial stays. On average, costs for a 30-day readmission with COPD as principal diagnosis (\$8,400) were 18 percent higher than for the index stay (\$7,100). Costs were more than 50 percent higher for the readmission with COPD as any diagnosis (\$10,900) or for all-cause readmissions (\$11,100).

divided by the total number of index admissions between January and November 2008.<sup>6</sup> An individual patient can have multiple index admissions during this observation period. More details on how readmissions were calculated are available under “Definitions”.

In all cases COPD was the principal diagnosis during the index stay, but three alternative definitions of readmissions were examined—COPD was the principal diagnosis on the readmission, COPD was any diagnosis, and COPD did not appear as a diagnosis on the subsequent stay. Differences in 30-day readmission rates by patient age, sex, income, and race are presented, along with information on costs of index admissions and readmissions.<sup>7</sup>

All numbers noted in the text and included in the tables are actual values, not estimates, as the data include a census of discharges, not a sample of discharges. In other words, we count the actual number of patients hospitalized for COPD in the 15 states and their actual readmissions. Because we are describing a population rather than a sample that represents an underlying population, there is no sampling error associated with the calculated values presented and significance testing is not necessary.<sup>8</sup>

## Findings

In the 15 states examined here, there were 190,700 index admissions with COPD as the principal diagnosis among patient 40 years and older (table 1). Among these patients, 7.1 percent of index admissions were followed by at least one readmission within 30 days for a principal diagnosis of COPD. When COPD was listed as any diagnosis (principal or secondary) during a subsequent hospital stay, 30-day readmission rates were 17.3 percent. When all-cause 30-day readmissions were considered (including those with no COPD diagnosis on the subsequent admission), 20.5 percent of COPD index admissions were followed by a readmission within 30 days.

**Table 1. 30-day readmissions among COPD patients 40 years and older, 15 states, 2008**

|  | Index admissions*<br>(COPD is the principal diagnosis) | 30-day readmissions             |                       |                                     |
|--|--|---------------------------------|-----------------------|-------------------------------------|
|  |  | COPD is the principal diagnosis | COPD is any diagnosis | All-cause readmissions <sup>†</sup> |
| Number of admissions                                     | 190,700  | 13,600                          | 33,000                | 39,100                              |
| Percentage of index admissions followed by a readmission | --   | 7.1%                            | 17.3%                 | 20.5%                               |
| Mean adjusted cost per stay                              | \$7,100  | \$8,400                         | \$10,900              | \$11,100                            |

\*Index admissions are the starting point for analyzing repeat hospital visits. They include inpatient admissions where the patient has not been admitted for the same diagnosis in the previous 30 days.

<sup>†</sup>All readmissions include those with no COPD diagnoses in the readmission record.

**Note:** Hospital costs are adjusted by the statewide mean area wage index weighted by bed size.

**Source:** Agency for Healthcare Research and Quality, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, State Inpatient Databases, 15 states, 2008: Arkansas, California, Florida, Hawaii, Louisiana, Massachusetts, Missouri, Nebraska, New Hampshire, New York, South Carolina, Tennessee, Utah, Virginia, and Washington

<sup>6</sup> No more than one readmission is counted within the 30-day period

<sup>7</sup> Patient race is reported for the 12 state databases that included data on race/ethnicity: Arkansas, California, Florida, Hawaii, Massachusetts, Missouri, New Hampshire, New York, South Carolina, Tennessee, Utah, and Virginia.

<sup>8</sup> Houchens, R. Inferences with HCUP State Databases Final Report. HCUP Methods Series Report # 2010-05. Online October 12, 2010. U.S. Agency for Healthcare Research and Quality. Available: [http://www.hcup-us.ahrq.gov/reports/methods/2010\\_05.pdf](http://www.hcup-us.ahrq.gov/reports/methods/2010_05.pdf). Accessed on May 25, 2011.

As shown in table 1, costs for readmissions were higher than costs for COPD index admissions.<sup>9</sup> Index admissions cost an average of \$7,100 compared to \$8,400 for readmissions with COPD as the principal diagnosis, \$10,900 readmissions when COPD was listed as any diagnosis, and \$11,100 for all-cause readmissions. Compared with the index stay, readmissions for COPD as the principal diagnosis cost 18 percent more; while costs for other types of readmissions cost over 50 percent more than the index hospital stay.

*30-day readmission rates by patient characteristics in 15 states, 2008*

Table 2 provides 30-day readmission rates by patient characteristics. For readmissions in which COPD was the principal diagnosis, readmission rates were 15 percent higher among adults 40–64 years old (7.8 percent of index admissions were followed by at least one readmission within 30 days) than among the elderly (6.8 percent of index admissions were followed by at least one readmission). Thirty-day readmission rates were 13 percent higher among males (7.6 percent) compared to females (6.7 percent).

**Table 2. 30-day readmission rates by patient characteristics among COPD patients 40 years old and older, 15 states, 2008**

|   | Percentage of index admissions followed by a readmission |                       |                         |
|---|--|-----------------------|-------------------------|
|   | COPD is the principal diagnosis                          | COPD is any diagnosis | All-cause readmissions* |
| Total   | 7.1%   | 17.3%                 | 20.5%                   |
| Age   |  |                       |                         |
| 40–64   | 7.8%   | 16.2%                 | 19.8%                   |
| 65+   | 6.8%   | 17.9%                 | 20.8%                   |
| Sex   |  |                       |                         |
| Male  | 7.6%   | 18.6%                 | 21.6%                   |
| Female  | 6.7%   | 16.3%                 | 19.6%                   |
| Median household income for the patient's ZIP Code of residence |  |                       |                         |
| 1 <sup>st</sup> quartile (lowest income)                        | 7.8%   | 17.9%                 | 21.5%                   |
| 2 <sup>nd</sup> quartile  | 7.1%   | 17.1%                 | 20.2%                   |
| 3 <sup>rd</sup> quartile  | 6.6%   | 16.8%                 | 19.6%                   |
| 4 <sup>th</sup> quartile (highest income)                       | 6.4%   | 17.1%                 | 20.2%                   |
| Race/ethnicity <sup>†</sup>                                     |  |                       |                         |
| White   | 7.2%   | 17.8%                 | 20.5%                   |
| Black   | 8.0%   | 17.6%                 | 23.1%                   |
| Hispanic  | 6.1%   | 15.1%                 | 20.4%                   |
| Asian and Pacific Islander                                      | 6.1%   | 15.2%                 | 19.1%                   |

\* All readmissions include those with no COPD diagnoses in the readmission record.

† Includes data from 12 states that provide information on patient's race: Arkansas, California, Florida, Hawaii, Massachusetts, Missouri, New Hampshire, New York, South Carolina, Tennessee, Utah, and Virginia.

**Source:** Agency for Healthcare Research and Quality, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, State Inpatient Databases, 15 states, 2008: Arkansas, California, Florida, Hawaii, Louisiana, Massachusetts, Missouri, Nebraska, New Hampshire, New York, South Carolina, Tennessee, Utah, Virginia, and Washington

<sup>9</sup> Hospital costs are adjusted by the statewide mean area wage index weighted by bed size.

Among COPD patients residing in the lowest income areas, 7.8 percent of index admissions were followed by a readmission principally for COPD—about 22 percent higher than among patients from the highest income areas (6.4 percent readmitted).

For black patients, 8.0 percent of index admissions were followed by a readmission within 30-days principally for COPD—30 percent higher than among the groups with the lowest readmission rate, Hispanic patients and Asian and Pacific Islander patients (6.1 percent were readmitted for both groups).

Comparable patterns were seen for the alternative definitions of readmissions—for COPD as any diagnosis and for all-cause readmissions, except for age. In contrast to readmissions with COPD as the principal diagnosis where younger patients had 15 percent higher readmission rates, elderly patients had 10 percent higher readmission rates when COPD was any diagnosis and only 5 percent higher readmission rates for all-cause readmissions.

Under the alternative definitions of readmissions, males had 10–14 percent higher readmission rates than females, comparable to the differences seen for readmissions with COPD as the principal diagnosis.

Differences by median household income were much smaller—5–6 percent higher readmission rates for patients from the lowest income ZIP Codes, compared to 22 percent higher for readmissions with COPD as the principal diagnosis.

Differences by race were also less pronounced—13–20 percent higher readmission rates for blacks compared to Hispanics and Asian/Pacific Islanders, compared to 30 percent higher for readmissions with COPD as the principal diagnosis.

#### *30-day readmission costs by patient characteristics in 15 states, 2008*

Statewide area wage indexes were used to adjust costs to account for local differences in costs. This is especially important for comparisons by race/ethnicity because several high cost states contributed larger proportions of Hispanics and Asian/Pacific Islanders.

Costs were consistently higher for readmissions than for index stays (table 3). As described earlier, compared to the index stay, costs were 18 percent higher for readmissions with COPD as the principal diagnosis and more than 50 percent higher for other types of readmissions.

Costs were slightly lower for patients 40–64 years old than for patients 65 and older across all types of readmissions. The magnitude of difference between the cost of index admissions and readmissions was similar across all readmission types.

There were also small differences in the costs for readmissions by patient sex. Costs were slightly higher for male patients across all types of readmissions.

For both index admissions and readmissions, costs were consistently higher in higher income communities.

There were large differences in the costs of 30-day readmissions among COPD patients by race and ethnicity. For all three types of readmissions, the lowest cost readmissions were for white patients and the highest cost readmissions were for Asian and Pacific Islander patients. Readmissions among Asian and Pacific Islander patients cost between 32 and 38 percent more than readmissions among white patients. Much smaller differences were seen between the other subgroups.

**Table 3. Mean readmission adjusted hospital costs\* by patient characteristics among COPD patients 40 years and older, 15 states, 2008**

|  | Index admissions**<br>(COPD is the principal diagnosis) | 30-day readmissions             |                       |                         |
|--|---|---------------------------------|-----------------------|-------------------------|
|  |   | COPD is the principal diagnosis | COPD is any diagnosis | All-cause readmissions† |
| Total  | \$7,100   | \$8,400                         | \$10,900              | \$11,100                |
| Age  |   |                                 |                       |                         |
| 40–64  | 6,900   | \$8,100                         | \$10,700              | \$10,800                |
| 65+  | \$7,200   | \$8,500                         | \$11,000              | \$11,200                |
| Sex  |   |                                 |                       |                         |
| Male   | \$7,100   | \$8,400                         | \$11,200              | \$11,300                |
| Female   | \$7,100   | \$8,300                         | \$10,700              | \$10,900                |
| Median household income for the patient's ZIP Code of residence‡ |   |                                 |                       |                         |
| 1 <sup>st</sup> quartile (lowest income)                         | \$6,800   | \$8,200                         | \$10,600              | \$10,700                |
| 2 <sup>nd</sup> quartile   | \$6,900   | \$8,000                         | \$10,500              | \$10,700                |
| 3 <sup>rd</sup> quartile   | \$7,100   | \$8,500                         | \$11,100              | \$11,200                |
| 4 <sup>th</sup> quartile (highest income)                        | \$7,700   | \$9,300                         | \$12,100              | \$12,300                |
| Race§  |   |                                 |                       |                         |
| White  | \$6,900   | \$8,200                         | \$10,700              | \$10,800                |
| Black  | \$7,400   | \$8,400                         | \$11,400              | \$11,400                |
| Hispanic   | \$7,300   | \$9,000                         | \$12,500              | \$12,100                |
| Asian and Pacific Islander                                       | \$8,100   | \$11,300                        | \$14,200              | \$14,300                |

\* Hospital costs are adjusted by the statewide mean area wage index weighted by bed size to control for differences in costs by state.

\*\* Index admissions are the starting point for analyzing repeat hospital visits. They include inpatient admissions where the patient has not been admitted for the same diagnosis in the previous 30 days.

† All readmissions include those with no COPD diagnoses in the readmission record.

‡ Median household income for the patient's ZIP Code of residence

§ Includes data from 12 states that provide information on patient's race: Arkansas, California, Florida, Hawaii, Massachusetts, Missouri, New Hampshire, New York, South Carolina, Tennessee, Utah, and Virginia.

**Source:** Agency for Healthcare Research and Quality, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, State Inpatient Databases, 15 states, 2008: Arkansas, California, Florida, Hawaii, Louisiana, Massachusetts, Missouri, Nebraska, New Hampshire, New York, South Carolina, Tennessee, Utah, Virginia, and Washington

## Data Source

The estimates in this Statistical Brief are based upon data from the HCUP 2008 State Inpatient Databases for 15 states: Arkansas, California, Florida, Hawaii, Louisiana, Massachusetts, Missouri, Nebraska, New Hampshire, New York, South Carolina, Tennessee, Utah, Virginia, and Washington. These states were selected based on availability of synthetic patient-level identifiers that enabled tracking of patients across time.

## Definitions

### *Readmission*

The 30-day readmission rate is defined as any repeat admission within 30 days after being discharged alive from an index hospital stay (where COPD is the principal diagnosis) divided by the total number of index admissions between January and November 2008. In other words, once a patient is discharged from the hospital with a principal diagnosis of COPD, they are followed for 30 days in the data. If any readmission occurs during this time period, the patient is counted as having a readmission. No more than one readmission is counted within the 30-day period since the outcome measure assessed here is “percentage of patients who are readmitted”.

Following the 30-day period, if a patient experiences another hospital stay with COPD as the principal diagnosis, it is counted as a second index admission, the 30-day follow-up period begins again, and another readmission can be counted in the 30-day window. Thus a single patient can be counted multiple times during the course of the January to November observation period. This method follows the approach described by Jencks et al. (2009).<sup>10</sup>

Discharges for patients who died during an index admission or whose index admission occurred in December of 2008 were also disqualified because they could not be followed for 30 days. If a patient was transferred to a different hospital on the same day or was transferred within the same hospital, the two events were combined as a single stay and the second event was not counted as a readmission. In other words, transfers were not considered a readmission. Multiple discharges that represented the transfer of a patient from one hospital to another, or from one unit of a hospital to another, were combined so that the second part of each “episode of care” was not counted as a readmission. If for the same person, one discharge ended on the same day as a second discharge started, the two discharge records were combined into a single “transfer” record. The combined transfer record retained the diagnoses from the second discharge and combined the length of stay and total hospital charges from the two discharges. The percentage of discharges that were considered transfers in each state ranged from 1.7 percent to 6.1 percent with an average of 2.9 percent.

### *Diagnoses*

The principal diagnosis is that condition established after study to be chiefly responsible for the patient’s admission to the hospital. Secondary diagnoses are concomitant conditions that coexist at the time of admission or that develop during the stay. All-listed diagnoses include the principal diagnosis plus these additional secondary conditions.

### *Types of hospitals included in HCUP*

HCUP is based on data from community hospitals, defined as short-term, non-Federal, general and other hospitals, excluding hospital units of other institutions (e.g., prisons). HCUP data include OB-GYN, ENT, orthopedic, cancer, pediatric, public, and academic medical hospitals. Excluded are long-term care, rehabilitation, psychiatric, and alcoholism and chemical dependency hospitals. Please note, a discharge of this nature will be included in the SID if it occurred in a community hospital.

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<sup>10</sup> Jencks S. F., Williams M. V., Coleman E. A. Rehospitalizations among patients in the Medicare Fee-for-Service program. *NEJM* 2009; 360:1418-1428.

## Costs

Total hospital costs tend to reflect the actual costs of production, while charges represent what the hospital billed for the case. Total hospital charges were converted to costs using HCUP cost-to-charge ratios based on hospital accounting reports from the Centers for Medicare & Medicaid Services (CMS).<sup>11</sup> For each hospital, a hospital-wide cost-to-charge ratio is used. For the purposes of this Statistical Brief, costs are reported to the nearest hundred. Statewide average area wage indexes weighted by bed size were used to adjust for local differences in costs.

## About HCUP

HCUP is a family of powerful health care databases, software tools, and products for advancing research. Sponsored by the Agency for Healthcare Research and Quality (AHRQ), HCUP includes the largest all-payer encounter-level collection of longitudinal health care data (inpatient, ambulatory surgery, and emergency department) in the United States, beginning in 1988. HCUP is a Federal-State-Industry Partnership that brings together the data collection efforts of many organizations—such as State data organizations, hospital associations, private data organizations, and the Federal government—to create a national information resource.

HCUP would not be possible without the contributions of the following data collection Partners from across the United States:

**Arizona** Department of Health Services  
**Arkansas** Department of Health  
**California** Office of Statewide Health Planning and Development  
**Colorado** Hospital Association  
**Connecticut** Hospital Association  
**Florida** Agency for Health Care Administration  
**Georgia** Hospital Association  
**Hawaii** Health Information Corporation  
**Illinois** Department of Public Health  
**Indiana** Hospital Association  
**Iowa** Hospital Association  
**Kansas** Hospital Association  
**Kentucky** Cabinet for Health and Family Services  
**Louisiana** Department of Health and Hospitals  
**Maine** Health Data Organization  
**Maryland** Health Services Cost Review Commission  
**Massachusetts** Division of Health Care Finance and Policy  
**Michigan** Health & Hospital Association  
**Minnesota** Hospital Association  
**Missouri** Hospital Industry Data Institute  
**Montana** MHA – An Association of Montana Health Care Providers  
**Nebraska** Hospital Association  
**Nevada** Department of Health and Human Services  
**New Hampshire** Department of Health & Human Services  
**New Jersey** Department of Health and Senior Services  
**New Mexico** Health Policy Commission  
**New York** State Department of Health  
**North Carolina** Department of Health and Human Services  
**Ohio** Hospital Association  
**Oklahoma** State Department of Health  
**Oregon** Association of Hospitals and Health Systems  
**Pennsylvania** Health Care Cost Containment Council  
**Rhode Island** Department of Health

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<sup>11</sup> HCUP Cost-to-Charge Ratio Files (CCR). Healthcare Cost and Utilization Project (HCUP). 2001–2008. U.S. Agency for Healthcare Research and Quality, Rockville, MD. [www.hcup-us.ahrq.gov/db/state/costtocharge.jsp](http://www.hcup-us.ahrq.gov/db/state/costtocharge.jsp)

**South Carolina** State Budget & Control Board  
**South Dakota** Association of Healthcare Organizations  
**Tennessee** Hospital Association  
**Texas** Department of State Health Services  
**Utah** Department of Health  
**Vermont** Association of Hospitals and Health Systems  
**Virginia** Health Information  
**Washington** State Department of Health  
**West Virginia** Health Care Authority  
**Wisconsin** Department of Health Services  
**Wyoming** Hospital Association

### About the SID

The HCUP State Inpatient Databases (SID) are hospital inpatient databases from data organizations participating in HCUP. The SID contains the universe of the inpatient discharge abstracts in the participating HCUP states, translated into a uniform format to facilitate multistate comparisons and analyses. Together, the SID encompasses 95 percent of all U.S. community hospital discharges in 2009. The SID can be used to investigate questions unique to one state; to compare data from two or more states; to conduct market area variation analyses; and to identify state-specific trends in inpatient care utilization, access, charges, and outcomes.

### For More Information

For more information about HCUP, visit [www.hcup-us.ahrq.gov](http://www.hcup-us.ahrq.gov).

For additional HCUP statistics, visit HCUPnet, our interactive query system, at [www.hcup.ahrq.gov](http://www.hcup.ahrq.gov).

For information on other hospitalizations in the U.S., download *HCUP Facts and Figures: Statistics on Hospital-Based Care in the United States in 2008*, located at <http://www.hcup-us.ahrq.gov/reports.jsp>.

For more information on the design of the SID, more information on the HCUP Revisit Files, and methods to make inferences based on state databases, please refer to the following publications:

*Introduction to the HCUP State Inpatient Databases*. Online. June 2010. U.S. Agency for Healthcare Research and Quality. [http://hcup-us.ahrq.gov/db/state/siddist/Introduction\\_to\\_SID.pdf](http://hcup-us.ahrq.gov/db/state/siddist/Introduction_to_SID.pdf)

Overview of the HCUP Supplemental Files for Revisit Analyses available at <http://www.hcup-us.ahrq.gov/toolsoftware/revisit/revisit.jsp>.

Houchens, R. Inferences with HCUP State Databases Final Report. HCUP Methods Series Report # 2010-05. Online October 12, 2010. U.S. Agency for Healthcare Research and Quality. Available: [http://www.hcup-us.ahrq.gov/reports/methods/2010\\_05.pdf](http://www.hcup-us.ahrq.gov/reports/methods/2010_05.pdf).

### Suggested Citation

Elixhauser, A. (AHRQ), Au, D. (AHRQ), and Podulka, J. (Thomson Reuters). *Readmissions for Chronic Obstructive Pulmonary Disease, 2008*. HCUP Statistical Brief #121. September 2011. Agency for Healthcare Research and Quality, Rockville, MD. <http://www.hcup-us.ahrq.gov/reports/statbriefs/sb121.pdf>



## Acknowledgments

The authors would like to acknowledge Marguerite Barrett for her assistance on this analysis.

Dr. Au was supported through the Department of Veterans Affairs, VA Puget Sound Health Care System and Health Services Research and Development

Disclaimer: The views expressed represent those of the authors and do not necessarily represent the views of the Department of Veterans Affairs.

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AHRQ welcomes questions and comments from readers of this publication who are interested in obtaining more information about access, cost, use, financing, and quality of health care in the United States. We also invite you to tell us how you are using this Statistical Brief and other HCUP data and tools, and to share suggestions on how HCUP products might be enhanced to further meet your needs. Please e-mail us at [hcup@ahrq.gov](mailto:hcup@ahrq.gov) or send a letter to the address below:

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