Assessing the impact of state “opt-out” policy on access to and costs of surgeries and other procedures requiring anesthesia services

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Abstract

In 2001, the U.S. government released a rule that allowed states to “opt-out” of the federal requirement that a physician supervise the administration of anesthesia by a nurse anesthetist. To date, 17 states have opted out. The majority of the opt-out states cited increased access to anesthesia care as the primary rationale for their decision. In this study, we assess the impact of state opt-out policy on access to and costs of surgeries and other procedures requiring anesthesia services. Our null hypothesis is that opt-out rule adoption had little or no effect on surgery access or costs. We estimate an inpatient model of surgeries and costs and an outpatient model of surgeries. Each model uses data from multiple years of U.S. inpatient hospital discharges and outpatient surgeries. For inpatient cost models, the coefficient of the opt-out variable was consistently positive and also statistically significant in most model specifications. In terms of access to inpatient surgical care, the opt-out rules did not increase or decrease access in opt-out states. The results for the outpatient access models are less consistent, with some model specifications indicating a reduction in access associated with opt-out status, while other model specifications suggesting no discernable change in access. Given the sensitivity of model findings to changes in model specification, the results do not provide support for the belief that opt-out policy improves access to outpatient surgical care, and may even reduce access to outpatient surgical care (among freestanding facilities).

Background

In 2001, the U.S. federal government released a rule that allowed states to “opt-out” of the federal requirement that a physician supervise the administration of anesthesia by a nurse anesthetist. The “November 13” rule was effective upon publication in the November 13, 2001 Federal Register. [1] For a state to opt-out of the federal supervision requirement, the state’s governor must send a letter of attestation to the Centers for Medicare and Medicaid Services [1]. The letter must attest that: 1) the state’s governor has consulted with the state's boards of medicine and nursing about issues related to access to and the quality of anesthesia services in the state; 2) it is in the best interests of the state’s citizens to opt-out of the current federal physician supervision requirement; and 3) the opt-out is consistent with state law.

To date, as shown in Appendix Table 6, 17 states have opted out. [2] The majority of the opt-out states cited increased access to anesthesia care as the primary rationale for their decision. [2] Collectively, in 2015 these states had about 73 million residents, or about 23% of the total resident population of the United States. [3] The majority of the opt-out states were sparsely populated states (e.g., Iowa, North Dakota, and Montana), with the notable exception of California, which nonetheless includes large rural areas interior to the heavily populated Pacific coast.

Following the implementation of the November 13 rule, the U.S. Agency for Healthcare Research and Quality (AHRQ) was charged with assessing whether anesthesia outcomes differed between opt-out states and other states.
The study analyzed Medicare data for 1999 through 2005, and found no evidence that opting out of the oversight requirement resulted in increased inpatient deaths or complications. [4] Similarly, a recent Cochrane review concluded there was insufficient evidence to conclude whether quality of anesthesia care differed across nurse and physician anesthesiologists [5]. However, among the stated goals of the opt-out rule was to improve access to anesthesia care and control growth in its costs. [6] At the time of the rule, there was a potential shortage of anesthesiologists, at least in some regions and states. [7] The presumption was that allowing nurse anesthetist to practice without physician supervision would alleviate these shortages and thus enhance access to anesthesia care. The lower professional service costs for nurse anesthetist practicing without physician supervision also was presumed to lower anesthesia care costs.

Despite the importance of the presumed cost and access benefits of the opt-out rule, to date few studies have attempted to quantify changes in access and costs attributable to the opt-out rules. Sun et al. [8] utilize data from the National Inpatient Sample (NIS) to assess whether opt-out was associated with an increase in the percentage of patients receiving a therapeutic procedure among patients admitted for appendicitis, bowel obstruction, cholecystolithiasis, or hip fracture. In a similar vein, using claims data for Medicare fee-for-service enrollees, Sun et al. [9] examine differences in average anesthesia utilization rates three years before and after opt-out for opt-out states grouped by year of opt-out, compared to differences in average anesthesia utilization rates over the same time period in non-opt-out states. Both studies conclude the adoption of the opt-out rule had no significant impact on access to anesthesia care.

In this study, we extend the literature on the impact of state opt-out policy by adding an assessment of its impact on costs of surgeries, and by assessing its impact on a wider variety of procedures requiring anesthesia services than in prior studies. Our hypothesis is that opt-out states exhibited changes in access to surgery and changes in surgery costs similar to non-opt-out states; that is, that the opt-out laws had little or no effect on surgery access or costs. We estimate models of inpatient surgery costs and surgery volume, as well as a model for volume of outpatient surgeries. Each model uses data from multiple years of U.S. inpatient hospital discharges and outpatient surgeries. Our results indicate that the opt-out policy is associated with higher inpatient surgery costs, with little or no impact on access for either inpatient or outpatient surgery.

**Methods**

We used two data sources that were appropriate for the study objectives. There has been continuous growth in outpatient surgery both in years before and years after passage of the opt-out law. [9] Thus, we believe that it is important to examine access and cost associated with inpatient and outpatient surgery. We used the Nationwide Inpatient Sample (NIS) for analysis of changes in inpatient surgery volume. The NIS is part of the Healthcare Cost and Utilization Project (HCUP), and is the largest publicly available all-payer inpatient health care database in the United States, yielding national estimates of hospital inpatient stays (https://www.hcup-us.ahrq.gov/nisoverview.jsp#data). Unweighted, the NIS contains data from more than 7 million hospital stays each year. Weighted, it estimates (or represents) more than 36 million hospitalizations nationally (around 20%). With more than 20 years of data, the NIS is ideal for longitudinal analyses.

However, the database has undergone changes over time, including the sampling and weighting strategy used. Beginning in 2012, sampling strategy for NIS was redesigned from formerly a random sample of hospitals and retaining all discharges from those sampled hospitals to a random sample of discharges from all hospitals participating in HCUP. To remove inconsistency due to change of sampling strategy, we did not include NIS data for hospitalizations after 2011. Thus, our NIS sample covers a 14-year time frame from 1998 to 2011 which allows for several years before and after the opt-out decisions by states. The unit of observation is “facility-year.”

For outpatient surgery, we used the State Ambulatory Surgery and Services Databases (SASD). The SASD is also part of the HCUP system (https://www.hcup-us.ahrq.gov/sasdovertview.jsp). The SASD include encounter-level data for ambulatory surgeries and “may also include various types of outpatient services such as observation stays, lithotripsy, radiation therapy, imaging, chemotherapy, and labor and delivery.” The specific types of ambulatory surgery and outpatient services included in the SASD vary by state and data year. SASD include data from hospital-owned ambulatory surgery facilities and nonhospital-owned facilities.

For the outpatient analysis, we included three opt-out states (California, Colorado, and Kentucky) and three non-opt-out states (Florida, Maryland, and New Jersey). These states were selected based on two criteria: [1] the state-level SASD contain all of the data we will need to estimate the models (e.g., procedure codes); and [2] the state SASD data contain the sufficient pre- and post-opt-out years. The unit of observation for the outpatient analysis is also the “facility-year.”

Our outcomes include measures of access and cost. The access measures were the number of all inpatient and outpatient surgeries. The cost measure was average...
cost per surgical inpatient stay, calculated by using hospital cost-to-charge ratios to deflate total charges per stay reported in the NIS. Nominal cost estimates were converted to constant 2011 dollars using the “Hospital and related services” component of the Consumer Price Index (http://www.bls.gov/cpi/). No cost-to-charge ratio estimates are available for the outpatient facilities in the SASD, and as a result, no average cost estimates are available for outpatient procedures.

A quasi-experimental study design was used to study the change in outcomes (access and costs) in “treatment” facilities (those located in opt-out states) before and after opt-out policy implementation, compared to facilities located in non-opt-out states over the same time period. The statistical analysis was based on panel data facility-level fixed-effect model which examined how the change of opt-out status affected changes in outcomes while removing facility-level time-invariant unmeasured confounders. We used robust standard error estimation adjusting for state level clustering. The null hypothesis is that opt-out states exhibited changes in access to surgery and changes in surgery costs similar to non-opt-out states; that is, that the opt-out laws had little or no effect on surgery access or costs.

The base statistical model of access is written as:

$$D_{it} = \alpha + \beta_1 OPT_{it} + \beta_n X_{it} + \beta_n T_1 + U_i + \epsilon_{it}$$

The unit of observation in the NIS is the discharge, and in the SASD is the procedure. In this equation, the dependent variable $D_{it}$ refers to access (total number of surgeries) or cost (mean cost per surgery) for facility $i$ in year $t$. The key right-hand side variable of interest is a dummy variable $OPT_{it}$ indicating whether the facility is located in an opt-out state (OPT equal to 1 if the facility was located in an opt-out state and 0 otherwise) in year $t$ (For example, CA adopted opt-out in 2009; thus $OPT_{it} = 0$ before 2009 and $OPT_{it} = 1$ since 2009 for CA). For a control state like FL, $OPT_{it} = 0$ during all the observed years [see Appendix Table 6]). $X_{it}$ represents a vector of covariates likely to affect access or cost.

In the inpatient models, $X_{it}$ includes facility characteristics (bed size\(^2\) of hospital; [1] small, [2] medium, [3] large; control/ownership of hospital: [0] government or private, collapsed category, [1] government, nonfederal, public, [2] private, non-profit, voluntary, [3] private, invest-own, [4] private, collapsed category; rural or urban hospital; and teaching or non-teaching hospital).\(^3\)

The inpatient models also adjust for lagged (year t-1) facility-level patient summary measures, including the total number of hospitalizations, patient case mix (i.e. percentage of cases were female, mean length of stay, percentage of surgical cases, the mean of the Centers for Medicare & Medicaid Services Hierarchical Condition Category (CMS-HCC) risk score [9], age distribution [<18, 18 to 44, 45 to 64, 65 to 74, and 75 or older]), admission type [elective, emergency, or other], percentage of routine discharge hospitalizations, health insurance type [Medicare, Medicaid, private insurance, or others], and race [white, black, Hispanic, or others]). CMS-HCC risk adjustment was developed by CMS to produce a health-based measure of future medical need which has shown to be a significant predictor of medical costs and has a better predictive accuracy on mortality than the Charlson and Elixhauser methods [10]. A Herfindahl-Hirschman Index (HHI), with the market definition based on area patient flows,\(^4\) was used to adjust for area hospital market concentration. County-level variables potentially affecting access or cost also were included (i.e. total number of residents in the county, percentage of the population in poverty, percentage of the population who are Medicare beneficiaries, percentage of people between age 16 and 64, the unemployment rate, per capita income, and the number of anesthesiologists [MD/DO] per 10,000 residents).\(^5\) The remaining variables are dummy variables for time (T). $U_i$ is facility-level time-invariant unmeasured variable. The error term is indicated as $\epsilon_{it}$.

Many of the variables available in the NIS included in the inpatient models were not available in the SASD. In the multiple regression models focusing on outpatient surgery, we used all model covariates available in the SASD. The data do not allow identification of the county location of freestanding outpatient facilities. Thus, the outpatient models focusing on the sample of all outpatient facilities account for lagged (year t-1) factors (patient flow, risk score, disposition status, and payment source variables), and a dummy variable for freestanding outpatient facilities (vs. hospital outpatient surgery departments). We addressed the differences (and changes) in access in rural versus urban areas by including an interaction terms of urban/rural indicator and opt-out indicator in the multiple regression models. Alternative models examine dependent variables measured in natural units and log transformations.

We conducted extensive sensitivity analysis to check the robustness of our findings. First, for the NIS, we examined using alternative definitions of access: 1) Removing cases age less than 18 out of total surgical discharges; 2) Removing all transplant Diagnosis-Related Groups (DRGs) and any craniotomy DRGs; and 3) limiting discharges to only hip and knee surgery procedures (DRG 209, 471, 503, 544, 471, or 545) and mean cost per discharge based on the definition. Because many pediatric procedures are performed in children's hospitals where anesthesiologists provide solo care or are part
of care team, and given that children are a unique population (with parents making health care decisions), the impact opt-out may be different from the impact on the adult population. Likewise, transplants and craniotomy represent very complex cases where, given current practice patterns, a low percentage of nurse anesthetists would be able to practice without physician supervision for those procedures. Hips and knees were examined separately because they represent a group of very common and fast growing procedures which are often performed in community hospitals.

Second, we examined robustness of our finding by varying covariates included in the models. In the SASD, we estimate separate models by freestanding status, a model focusing on the volume of specific outpatient procedures likely to require general anesthesia, and a model excluding the lagged patient flow variables. To examine whether early opt out have a different impact on outcomes compared to late opt out states, we conducted a set of sensitivity analyses in NIS sample. We repeated the analysis among early opt out states [states with opt out between 2001 and 2005 (i.e., IA, MN, NE, NH, NM, AK, KS, ND, OR, WA, MT, SD, WI) compared with non-opt out states during the period, and late opt out states (states with opt out between 2009 and 2011 (i.e., CA and CO) compared with non-opt out states during the period; in the whole NIS sample, we also ran another model by including opt-out variable (equal 1 after the opt out states opt out) and late opt-out indicator (equal to 1 for CA and CO during the whole study period, 1998 to 2011; equal to zero for other states)]. The coefficients of interaction terms show the differentiated impact of opt-out for late opt-out states comparing to early opt-out states.

Results
The final analytic files included 13,573 facility-year observations in the NIS sample and 9,994 facility-year observations in the SASD sample. Descriptive data for the main outcomes associated with the inpatient file (NIS) and outpatient file(SASD) are shown in Appendix Tables 7 and 8. The results for the inpatient cost models are shown in Table 1. When cost per discharge was the dependent variable, the estimated coefficient of the opt-out variable was positive and statistically significant ($p < 0.01$). The point estimate indicates that the cost per discharge was $1,815 higher in opt-out states relative to non-opt-out states. Similarly, in the log cost models, the estimated coefficient of the opt-out variable was positive and statistically significant. The point estimate indicates that the cost per discharge was about 8.7% higher in opt-out states relative to non-opt-out states.$^6$

For the inpatient access models (Table 2), the opt-out variable coefficient was positive but not statistically significant in the model with the number of hospital discharges as the dependent variable. The magnitude of the point estimate implies an increase in surgical discharges that is small in magnitude – about 40 annually, or about 1.8% (based on the sample mean). Similarly, in the model that used the log of discharges as the dependent variable, the estimated coefficient of the opt-out variable is positive but not statistically significant.

The results for the outpatient access models are shown in Table 3. In the model where the number of surgical procedures is the dependent variable, the estimated coefficient of the opt-out variable was positive but not statistically significant. When the dependent variable is defined as the log of procedures, the estimated coefficient of the opt-out was also positive but not statistically significant.

To assess the robustness of our inpatient model findings, we estimated a number of models with different definitions of “surgical” discharges or different sets of covariates included in the model, as reported in Table 4. Neither early nor late opt-out states had a statistically significant impact on volumes. However, hospitals in late opt-out states (i.e. CA and CO) had a higher cost increase after state opt-out compared to hospitals in early opt-out states. When pediatric surgical discharges were removed from the facility-level total number of annual surgical discharges, the estimates of the opt-out variable coefficient remained positive but not statistically significant, in both the linear and log models. Similarly, when discharges for transplants and any craniotomy DRGs were removed from the total, or when only hip and knee procedure discharges were included, the estimates of the opt-out variable coefficient remained positive but not statistically significant in all models. In addition, dropping groups of covariates from the model specification did not materially alter the results, with one exception. In models that excluded all hospital characteristics, lagged patient flow variables, and county level variables, the estimated opt-out coefficients were negative, and statistically significant ($p < 0.05$) when the dependent variable was the number of surgical discharges.

In the alternative cost models, when all pediatric surgical discharges were removed, or all discharges for transplants and any craniotomy DRGs were removed, the coefficient of the opt-out variable was consistently positive and statistically significant. When only hip and knee procedure discharges were included, the estimated opt-out coefficient was positive but not statistically significant. Similarly, when groups of covariates were dropped from the model specification, the coefficient of the opt-out variable remained consistently positive and statistically significant. Point estimates suggest costs per discharge were about
### Table 1 Inpatient Cost Models, Linear and Log Linear

|                         | Mean costs per surgical case | Log Mean costs per surgical case |
|-------------------------|------------------------------|----------------------------------|
|                         | b    | t    | b     | t    |
| Opt out                 | 1815.33*** | 3.76 | 0.08* | 2.43 |
| Rural hospital          | −584.32 | −0.51 | 0.01  | 0.19 |
| Hospital bed size       |      |      |       |      |
| Small (reference)       |      |      |       |      |
| Medium                  | 85.99 | 0.13 | −0.03 | −0.68 |
| Large                   | −1037.20 | −1.45 | −0.10 | −1.83 |
| Control/ownership of hospital |      |      |       |      |
| Government or private, collapsed category (reference) |      |      |       |      |
| Government, nonfederal, public, | 1403.23 | 0.99 | −0.04 | −0.93 |
| Private, non-profit, voluntary | 1448.21 | 0.99 | −0.15** | −2.85 |
| Private, invest-own     | 1770.03 | 1.11 | −0.01 | −0.19 |
| Private, collapsed category | 3400.20 | 1.96 | 0.01  | 0.17 |
| Teaching hospital       | 1648.59 | 1.22 | −0.04 | −1.30 |
| Hospital HHI based on patient flow | 11802.96 | 1.73 | −0.26 | −0.56 |
| Lagged (year t-1) facility-level patient summary measures |      |      |       |      |
| Total number of hospitalizations | −0.05 | −0.54 | −0.00 | −0.44 |
| Percentage of cases were female | −2308.72 | −0.24 | −0.71 | −0.93 |
| Mean length of stay     | 426.60 | 1.21 | 0.03  | 1.11 |
| Percentage of surgical cases | 14348.88 | 1.75 | 0.54  | 1.33 |
| Mean (CMS-HCC) risk score | −438.02 | −0.16 | −0.27 | −1.16 |
| Age distribution (%)    |      |      |       |      |
| <18                     | 7003.33 | 0.63 | 0.96  | 0.86 |
| 18_44 (reference)       |      |      |       |      |
| 45_64                   | 11426.77 | 0.91 | 0.18  | 0.20 |
| 65_74                   | 9031.06 | 0.47 | 1.42  | 1.13 |
| 75 or older             | 8585.06 | 0.56 | 0.91  | 0.86 |
| Admission type (%)      |      |      |       |      |
| Elective (reference)    |      |      |       |      |
| Emergency               | −993.71 | −0.50 | −0.08 | −0.52 |
| Other                   | 1733.18 | 0.84 | 0.20  | 1.85 |
| Percentage of routine discharge hospitalizations | −4511.40 | −0.85 | −0.47 | −1.35 |
| Health insurance type (%)|      |      |       |      |
| Private insurance (reference) |      |      |       |      |
| Medicare                | −2590.06 | −0.56 | −0.15 | −0.42 |
| Medicaid                | −289.20  | −0.06 | −0.02 | −0.09 |
| Others                  | 559.90  | 0.21 | 0.07  | 0.35 |
| Race (%)                |      |      |       |      |
| White (reference)       |      |      |       |      |
| Black                   | 5323.13 | 0.76 | −0.11 | −0.24 |
| Hispanic                | −7994.42 | −1.27 | −0.38 | −1.04 |
| Other                   | −2340.99 | −1.35 | −0.19 | −1.63 |
$1,760 to $1,980 higher (in the linear models), or about 6.6 to 8.8% higher (in log models), for facilities in opt-out states compared to non-opt-out states.

Several alternative specifications of the outpatient access model were estimated, as summarized in Table 5. In model specifications focusing on freestanding facilities, the estimated coefficient of the opt-out variable is negative and statistically significant, in both the linear and log models. This implies that the opt-out policy reduced the volume of procedures at freestanding outpatient facilities by about 310 procedures, or about 23%. In the model limited to non-freestanding facilities, the estimated coefficient of the opt-out variable was positive but not statistically significant. When the analysis focused on selected procedures likely to require general anesthesia, the estimated coefficient of the opt-out variable was negative but not statistically significant. Finally, in model specifications dropping groups of covariates, the opt-out coefficient estimates remain positive but not statistically significant.

**Discussion**

The primary intent of the opt-out laws was to increase access to anesthesia services by increasing the scope of practice of NAs and reducing the barriers to use of NAs. In turn, the hypothesis is that the reduction in barriers will increase access to surgical care. In our study, we do not find evidence to support this belief. In addition to the regression results presented in Tables 1, 2, and 3, we estimated a large number of variations of these base models (Tables 4 and 5).

Overall, the results consistently show no improvement in access to inpatient surgical care associated with the opt-out indicator. In other words, opt out was not associated with increase (or decrease) in access; the opt-out rules had no measurable effect on access. Interestingly, states choosing to opt out were associated with subsequent higher costs per inpatient —about $1,800 higher per surgery, or about 8.7%.

On the surface, the inpatient cost result seems counterintuitive, as opt-out provisions in theory allow lower-priced nurse anesthetists to perform the same services

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**Table 1** Inpatient Cost Models, Linear and Log Linear (Continued)

| County-level variable                                          | 2002.year | 2003.year | 2004.year | 2005.year | 2006.year | 2007.year | 2008.year | 2009.year | 2010.year | 2011.year | Constant | N  | R-squared (within) |
|---------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----|------------------|
| Total number of residents in the county                       | 0.00      | 0.77      | 0.00      | 0.68      |           |           |           |           |           |           | −2772.51 | 1339    | 0.7226           |
| Percentage of people in poverty                               | 42.77     | 0.38      | 0.01      | 0.75      |           |           |           |           |           |           | 1167.60**| 3.62    | 9.19             |
| Percentage of people are Medicare beneficiaries               | −12526.56| −0.50     | −2.32     | −1.27     |           |           |           |           |           |           | 1993.96***| 4.18    | 11.54            |
| Percentage of people between age 16 to 64                     | −7064.95  | −0.77     | −0.31     | −0.65     |           |           |           |           |           |           | 2942.80***| 5.06    | 9.88             |
| Unemployment rate                                              | 1553.06   | 0.12      | −0.73     | −0.93     |           |           |           |           |           |           | 4007.31***| 5.60    | 9.93             |
| Per capita income                                              | 0.10      | 1.06      | 0.00      | 1.63      |           |           |           |           |           |           | −784.20  | −1.39   | −1.41            |
| Number of anesthesiologists [MD/DO] per 10,000 residents      |           |           |           |           |           | −2832.00***| −5.76     | −0.69***  | 9.80      |           | 6344.68***| 5.84    | 10.12            |
| Year dummy variables                                           |           |           |           |           |           |           |           |           |           |           | 7524.34***| 6.37    | 10.61            |
| 2001.year (reference)                                          |           |           |           |           |           |           |           |           |           |           | 9554.10***| 6.17    | 9.39             |
| 2002.year                                                     | 466.64    | 1.66      | 0.14***   | 6.16      |           |           |           |           |           |           | 10332.97***| 5.79    | 9.21             |
| 2003.year                                                     | 1176.08**| 3.62      | 0.26***   | 9.19      |           |           |           |           |           |           | 7524.34***| 6.37    | 10.61            |
| 2004.year                                                     | 1993.96***| 4.18      | 0.36***   | 11.54     |           |           |           |           |           |           | 9554.10***| 6.17    | 9.39             |
| 2005.year                                                     | 2942.80***| 5.06      | 0.48***   | 9.88      |           |           |           |           |           |           | 10332.97***| 5.79    | 9.21             |
| 2006.year                                                     | 4007.31***| 5.60      | 0.57***   | 9.93      |           |           |           |           |           |           | 7524.34***| 6.37    | 10.61            |
| 2007.year                                                     | 5322.00***| 5.76      | 0.69***   | 9.80      |           |           |           |           |           |           | 9554.10***| 6.17    | 9.39             |
| 2008.year                                                     | 6344.68***| 5.84      | 0.79***   | 10.12     |           |           |           |           |           |           | 10332.97***| 5.79    | 9.21             |
| 2009.year                                                     | 7524.34***| 6.37      | 0.92***   | 10.61     |           |           |           |           |           |           | 7524.34***| 6.37    | 10.61            |
| 2010.year                                                     | 9554.10***| 6.17      | 1.06***   | 9.39      |           |           |           |           |           |           | 9554.10***| 6.17    | 9.39             |
| 2011.year                                                     | 10332.97***| 5.79    | 1.13***   | 9.21      |           |           |           |           |           |           | 10332.97***| 5.79    | 9.21             |
| Constant                                                      | −2772.51  | −0.16     | 9.06***   | 6.87      |           |           |           |           |           |           | 1339    | 1339     | 0.7946           |

Notes: [1] t-statistics in parentheses; *p < 0.05; **p < 0.01; ***p < 0.001; [2] Some hospital-year do not have cost-to-charge ratios; therefore, cost measure was not available; [3] interaction term between opt-out and rural hospital status was not statistically significant; therefore, main models do not include interaction terms; [4] Costs were in 2011 dollar adjusted by hospital and related services CPI.
|                          | Total number of surgical discharges | Log Total number of surgical discharges |
|--------------------------|-------------------------------------|----------------------------------------|
|                          | $b$       | $t$       | $b$       | $t$       |
| **Opt out**              | 39.78     | 0.62      | 0.05      | 1.08      |
| **Rural hospital**       | −78.00    | −0.87     | 0.05      | 0.35      |
| **Hospital bed size**    |          |           |           |           |
| Small (reference)        |          |           |           |           |
| Medium                   | 20.62     | 0.77      | −0.01     | −0.49     |
| Large                    | 226.72    | 1.39      | 0.06      | 1.24      |
| **Control/ownership of hospital** |          |           |           |           |
| Government or private, collapsed category (reference) |          |           |           |           |
| Government, nonfederal, public, | −151.78   | −0.86     | 0.20      | 0.53      |
| Private, non-profit, voluntary | 112.93    | 0.69      | −0.03     | −0.09     |
| Private, invest-own      | 104.25    | 1.05      | 0.27      | 0.87      |
| Private, collapsed category | 15.87    | 0.10      | 0.01      | 0.05      |
| **Teaching hospital**    | 75.87     | 1.12      | 0.05      | 0.39      |
| Hospital HHI based on patient flow | 254.90    | 0.61      | 0.85*     | 2.15      |
| **Lagged (year t-1) facility-level patient summary measures** |          |           |           |           |
| Total number of hospitalizations | 0.16***   | 12.43     | 0.00***   | 9.02      |
| Percentage of cases were female | −409.79   | −0.69     | −0.23     | −0.21     |
| Mean length of stay      | 3.98      | 0.37      | 0.00      | 0.01      |
| Percentage of surgical cases | 2580.39*** | 5.43     | 3.99***   | 4.46      |
| Mean (CMS-HCC) risk score | −51.14    | −0.34     | −0.55     | −1.55     |
| Age distribution (%)     |          |           |           |           |
| <18                      | 293.78    | 0.49      | 2.70      | 1.83      |
| 18_44 (reference)        |          |           |           |           |
| 45_64                    | −185.31   | −0.24     | 2.07      | 1.49      |
| 65_74                    | 597.26    | 1.22      | 2.28      | 1.81      |
| 75 or older              | 483.46    | 0.92      | 0.34      | 0.31      |
| **Admission type (%)**   |          |           |           |           |
| Elective (reference)     |          |           |           |           |
| Emergency                | −46.15    | −0.40     | 0.21      | 1.04      |
| Other                    | 124.02    | 1.27      | 0.08      | 0.49      |
| Percentage of routine discharge hospitalizations | −330.91   | −1.27     | −0.23     | −0.58     |
| **Health insurance type (%)** |          |           |           |           |
| Private insurance (reference) |          |           |           |           |
| Medicare                 | −106.02   | −0.28     | 0.23      | 0.54      |
| Medicaid                 | 163.72    | 0.61      | 0.50      | 1.23      |
| Others                   | −29.26    | −0.14     | 0.15      | 0.57      |
| **Race (%)**             |          |           |           |           |
| White (reference)        |          |           |           |           |
| Black                    | −2054.46* | −2.62     | −0.21     | −0.32     |
| Hispanic                 | 154.64    | 0.42      | 0.23      | 0.40      |
| Other                    | −168.06*  | −2.14     | −0.07     | −0.79     |
as physician anesthesiologists. However, as some recent research has shown, nurse anesthetists take longer to perform the same services. [11] As a result, despite the lower payment per unit for nurse anesthetists, the greater number of units provided may translate into higher anesthesia costs overall. Moreover, recent research suggests that surgery procedures with nurse anesthesia providers working without physician supervision have worse surgery outcomes in terms of complications requiring additional treatment. [6–8] Clearly, surgical procedures with these complications are likely to entail higher overall costs than procedures without complications. [9] Thus, the observed higher costs in opt-out states could be a result of the combined effects of these two issues.

The results for the outpatient access models are less consistent, with some model specifications indicating a reduction in access associated with opt-out status, while other model specifications suggesting no discernable change in access. It is possible that the limited number of states included in the analysis contributed to this inconsistency. Given the sensitivity of model findings to changes in model specification, the results do not provide support for the belief that opt-out policy improves access to outpatient surgical care, and may even reduce access to outpatient surgical care (among freestanding facilities).

There are some important limitations to this study. First, this is an observational study where states chose to opt out; opt-out was a random event. There are potential unmeasured confounders associated with opt-out and outcomes. The analytic approach we used eliminates the impact of any unobservables across states that are time-invariant, but does not account for the potential impact of time-varying unobservables. It is possible that the association between opt-out status and higher surgical costs results from differences between opt-out and non-opt-out states not accounted for in our analysis. Second, some opt-out states declared opt-out status toward the end of

Table 2 Inpatient Access Models, Linear and Log Linear (Continued)

| County-level variable                                      | Coef. (Linear) | Coef. (Log Linear) |
|-----------------------------------------------------------|----------------|--------------------|
| Total number of residents in the county                    | −0.00          | −0.17              |
| Percentage of people in poverty                           | −2.75          | −0.31              |
| Percentage of people are Medicare beneficiaries            | −258.94        | −0.24              |
| Percentage of people between age 16 to 64                 | −285.91        | −0.70              |
| Unemployment rate                                         | −81.65         | −0.07              |
| Per capita income                                         | 0.01           | 1.14               |
| Number of anesthesiologists [MD/DO] per 10,000 residents  | 231.51         | 2.04               |

Year dummy variables

| Year dummy variables                                      | Coef. (Linear) | Coef. (Log Linear) |
|-----------------------------------------------------------|----------------|--------------------|
| 1999.year (reference)                                     | 0.00           | .                  |
| 2000.year                                                 | 78.70*         | 2.58               |
| 2001.year                                                 | 90.38*         | 2.27               |
| 2002.year                                                 | 70.76          | 1.02               |
| 2003.year                                                 | 81.98          | 1.21               |
| 2004.year                                                 | 141.51         | 1.88               |
| 2005.year                                                 | 122.69         | 1.53               |
| 2006.year                                                 | −2.13          | −0.03              |
| 2007.year                                                 | 44.26          | 0.49               |
| 2008.year                                                 | 59.28          | 0.45               |
| 2009.year                                                 | −4.30          | −0.03              |
| 2010.year                                                 | −55.14         | −0.29              |
| 2011.year                                                 | −183.95        | −0.97              |
| Constant                                                  | 295.62         | 0.55               |

Notes: [1] t-statistics in parentheses; *p < 0.05; **p < 0.01; ***p < 0.001; [2] Some hospital-year do not have cost-to-charge ratios; therefore, cost measure was not available; [3] interaction term between opt-out and rural hospital status was not statistically significant; therefore, main models do not include interaction terms.
the timeline of available data, thereby providing a small number of years post opt-out years for the facility fixed-effects panel models. However, accounting for early vs. late opt-out status indicated later opt-out status was associated with greater increase in cost that the cost increase in early opt-out states, relative to non-opt-out states, but did not alter the finding of no significant improvement in access associated with opt-out. In addition, NIS randomly selected a 20% random sample of national hospitals during out study period. Some hospitals were not included in our sample or contribute fewer years of observation times

| Table 3 Outpatient Access Linear and Log Models | Total number of surgical procedures (w/o county variables) | Log of total number of surgical procedures (w/o county variables) |
|-----------------------------------------------|-----------------------------------------------|
| Opt out | b | t | b | t |
| Lagged (year t-1) facility-level patient summary measures | | | |
| Percentage of female | 10380.26 | 1.28 | 0.11 | 0.69 |
| Mean (CMS-HCC) risk score | 9003.39 | 2.17 | 0.24 | 1.45 |
| Age distribution (%) | | | |
| <18 | 5126.30 | 0.48 | 0.04 | 0.06 |
| 18_44 (reference) | | | |
| 45_64 | 8195.99 | 0.84 | 0.52 | 1.18 |
| 65_74 | -29766.70 | -0.86 | -0.46 | -1.31 |
| 75 or older | -13872.42 | -1.10 | 0.76 | 1.26 |
| Percentage of routine discharge hospitalizations | 2073.23 | 0.52 | -0.08 | -0.67 |
| Health insurance type (%) | | | |
| Private insurance | | | |
| Medicare | -1380.08 | -0.68 | -0.25 | -1.79 |
| Medicaid | -10119.71 | -0.93 | -0.27 | -1.04 |
| Others | -10856.39 | -1.07 | -0.46** | -5.48 |
| Freestanding | -1043.54 | -1.04 | -0.08 | -1.56 |
| Year dummy variables | | | |
| 1999.year (reference) | | | |
| 2000.year | -16.36 | -0.05 | 0.05*** | 11.74 |
| 2001.year | -923.90 | -1.34 | 0.02* | 3.63 |
| 2002.year | -876.51 | -1.00 | 0.09*** | 9.77 |
| 2003.year | 7386.10** | 4.19 | 0.61*** | 21.00 |
| 2004.year | 9061.60*** | 16.62 | 0.76*** | 36.50 |
| 2005.year | 10213.33*** | 20.49 | 0.79*** | 41.31 |
| 2006.year | 11373.59*** | 22.15 | 0.84*** | 43.80 |
| 2007.year | 32466.04*** | 59.07 | 1.58*** | 78.96 |
| 2008.year | 63228.57*** | 202.11 | 2.26*** | 73.62 |
| 2009.year | 62817.03*** | 271.86 | 2.18*** | 207.52 |
| 2010.year | 62829.63*** | 143.72 | 2.15*** | 162.03 |
| 2011.year | 62947.40*** | 89.87 | 2.12*** | 91.22 |
| 2012.year | 63165.88*** | 57.08 | 2.14*** | 74.13 |
| 2013.year | 64712.58*** | 27.96 | 2.21*** | 17.61 |
| Constant | -57093.83*** | -15.05 | 5.98*** | 18.56 |
| N | 7856 | | 7856 |
| Squared (within) | 0.3581 | | 0.4638 |

Note: *p < 0.05; **p < 0.01; ***p < 0.001
Table 4: Sensitivity analyses on NIS sample (Coefficients of opt-out variable)

|                         | Total number of surgical discharges | Log Total number of surgical discharges | Mean costs per surgical case | Log Mean costs per surgical case |
|-------------------------|------------------------------------|----------------------------------------|-------------------------------|----------------------------------|
| Main model              | 39.78                              | 0.0529                                 | 1815.3***                    | 0.0840*                         |
|                         | (0.62)                             | (1.08)                                 | (3.76)                       | (2.43)                           |
| Subgroup analysis       |                                    |                                        |                              |                                  |
| Early opt-out vs control| 103.9                              | 0.0741                                 | 644.5                        | 0.0183                           |
|                         | (1.50)                             | (1.50)                                 | (1.42)                       | (0.50)                           |
| Late opt-out vs control | −185.4                             | 0.0234                                 | 2461.0***                    | 0.120*                           |
|                         | (−1.14)                            | (0.29)                                 | (4.42)                       | (2.38)                           |
| opt-out variable * late opt-out | −279.9                            | −0.00687                               | 2202.9***                    | 0.130*                           |
|                         | (−1.87)                            | (−1.16)                                | (3.09)                       | (2.38)                           |
| Alternative definitions of surgical case |                          |                                        |                              |                                  |
| Removing cases age <18 out of total surgical discharges | 39.91                              | 0.0410                                 | 1833.5**                     | 0.0784*                         |
|                         | (0.61)                             | (0.98)                                 | (3.41)                       | (2.26)                           |
| Removing all transplant DRGs and any craniotomy DRGs | 38.84                              | 0.0535                                 | 1757.2***                    | 0.0831**                         |
|                         | (0.61)                             | (1.09)                                 | (3.75)                       | (2.39)                           |
| Include only hip and knee surgery procedures | 24.12                              | 0.00109                                | 494.1                        | 0.0292                           |
|                         | (1.55)                             | (0.03)                                 | (0.63)                       | (1.27)                           |
| Using partial covariates |                                    |                                        |                              |                                  |
| Exclude hospital characteristics | 33.71                              | 0.0477                                 | 1839.3***                    | 0.0702*                         |
|                         | (0.56)                             | (1.08)                                 | (4.08)                       | (2.72)                           |
| Exclude hospital characteristics and county variables | 6.887                              | 0.0364                                 | 1903.8**                     | 0.0637*                         |
|                         | (0.12)                             | (0.70)                                 | (3.06)                       | (2.10)                           |
| Exclude hospital variables, county variables and t-1 year variables | −1104*                            | −0.0561                                | 1977.9**                     | 0.0709***                        |
|                         | (−2.03)                            | (−1.18)                                | (2.91)                       | (4.71)                           |

Notes: Costs were in 2011 dollar adjusted by hospital and related services CPI; *p < 0.05; **p < 0.01; ***p < 0.001

*Early opt out = 1 for those hospitals in states opt out between 2001 and 2005 (i.e. IA, MN, NE, NH, NM, AK, KS, ND, OR, WA, MT, SD, WI)

**Late opt out = 1 for those hospitals in states opt out between 2009 and 2010 (i.e. CA, CO)

***This is the coefficient for the interaction term between opt-out variable and late opt out variable. The model was conducted on whole sample to test whether state opt out in recent year had different impact on outcomes comparing those opt out in early year

Table 5: Sensitivity and subgroup analyses on SASD sample (Coefficients of opt-out variable)

|                         | Total number of surgical procedures | Log of total number of surgical procedures |
|-------------------------|-------------------------------------|-------------------------------------------|
| Main model (sample includes freestanding facilities) | 1149.2                             | 0.0601                                    |
|                         | (1.06)                             | (0.71)                                    |
| Subgroups               |                                    |                                          |                              |                                  |
| Non-freestanding        | 1333.9                             | 0.129                                     |
|                         | (1.08)                             | (1.93)                                    |
| Freestanding            | −310.2***                          | −0.257***                                 |
|                         | (−15.71)                           | (−23.06)                                  |
| Alternative definition of surgical cases |                          |                                          |                              |                                  |
| Subset of selected procedures per facility usually requiring general anesthesia* | −22.84                             | −0.0916                                  |
|                         | (−0.66)                            | (−0.76)                                   |
| Using partial covariates |                                    |                                          |                              |                                  |
| Exclude t-1 year case mix variables | 537.3                              | 0.0496                                    |
|                         | (0.34)                             | (0.48)                                    |

Notes: [1] Hospital characteristics and county variables were not available for freestanding facilities; [2] procedures with CPT code of 19301, 19302, 23410, 23412, 23420, 23430, 23470, 23472, 23473, 23474, 23700, 24300, 24341, 24342, 24363, 24370, 24371, 29827, 29882, 29883, 42821, 42826, 47562, 47563, 47600, 47605, 49505, 49507, 49520, 49521, 49525, 49587, 49650, 49651, 58541, 58542, 58543, 58544, 58545, 58546, 58550, 58552, 58553, 58554, 58570, 58571, 58572, 58573, 58670, 58671; *p < 0.05; **p < 0.01; ***p < 0.001
which might reduce to power for the facility-level fixed-effects model. However, given the large sample, it is unlikely to be threat to our main conclusion. Finally, the opt-out status variable is a “black box” in our analysis – it does not measure to what extent either the number of nurse anesthetists or physician anesthesiologists, or their typical workloads, actually changed as a result of the implementation of the opt-out policy. However, our results suggest that, whatever the impact of opt-out on the actual supply of anesthesia services, the net impact of opt-out policy implementation was little or no impact on access to inpatient or outpatient surgical care, and an increase in the cost of inpatient surgical care.

Conclusions
Our results do not support the hypothesis that opt-out laws improve access to inpatient surgical care or reduce its costs. Across a number of specifications for our inpatient discharges models, we find a consistent pattern of point estimates of increased costs with no discernable impact on access. Findings for our outpatient access models are less consistent, but overall, our results suggest opt-out policies were not associated with improvement in access to outpatient surgery.

Endnotes
1In NIS, the total number of all surgeries was the sum of all hospitalizations with surgical DRG in a facility (excluding records with patients age younger than 1); In SASD, it was the total number of visits in the facility.
2We used the size classification defined by HCUP, for which specific bed-size thresholds for size categories vary across Census regions, and by urban/rural and teaching status (https://www.hcup-us.ahrq.gov/db/vars/hosp_bedsize/nisnote.jsp).
3These facility level variables were almost fixed over the sample time period. Dropping the facility variables from the facility fixed-effects model does not change model results.
4The market area definition recommended by HCUP was used (see HCLIP Hospital Market Structure File: 2009 Central Distributor SID, NIS, and KID User Guide [https://www.hcup-us.ahrq.gov/toolsoftware/hms/HMSSUserGuide2009.pdf].) Years with missing HHI values were imputed using a time trend.
5The source for these data is county-level data from the Area Resource File (ARF).
6Estimated as $\beta^* = \exp\left[\beta - \frac{1}{2} \text{var}(\beta)\right] - 1$. See Kennedy [12].

Appendix

Table 6 Opt out year-month for states included in our NIS and SASD sample

| State      | Opt-out date | Included in our sample |
|------------|--------------|------------------------|
| Alaska     | Oct. 2003    | Yes                    |
| Arizona    | NA           | Yes                    |
| Arkansas   | NA           | Yes                    |
| California | Jun. 2009    | Yes                    |
| Colorado   | Sept. 2010   | Yes                    |
| Connecticut| NA           | Yes                    |
| Florida    | NA           | Yes                    |
| Georgia    | NA           | Yes                    |
| Hawaii     | NA           | Yes                    |
| Illinois   | NA           | Yes                    |
| Indiana    | NA           | Yes                    |
| Iowa       | Dec. 2001    | Yes                    |
| Kansas     | Apr. 2003    | Yes                    |
| Kentucky   | Apr. 2012    | Yes                    |
| Louisiana  | NA           | Yes                    |
| Maine      | NA           | Yes                    |
| Maryland   | NA           | Yes                    |
| Massachusetts | NA         | Yes                    |
| Michigan   | NA           | Yes                    |
| Minnesota  | Apr. 2002    | Yes                    |
| Mississippi| NA           | Yes                    |
| Missouri   | NA           | Yes                    |
| Montana    | Jan. 2004    | Yes                    |
| Nebraska   | Feb. 2002    | Yes                    |
| Nevada     | NA           | Yes                    |
| New Hampshire | Jun. 2002   | Yes                    |
| New Jersey | NA           | Yes                    |
| New Mexico | Nov. 2002    | Yes                    |
| New York   | NA           | Yes                    |
| North Carolina | NA         | Yes                    |
| North Dakota | Oct. 2003   | Yes                    |
| Ohio       | NA           | Yes                    |
| Oklahoma   | NA           | Yes                    |
| Oregon     | Dec. 2003    | Yes                    |
| Pennsylvania | NA          | Yes                    |
| Rhode Island | NA           | Yes                    |
| South Carolina | NA         | Yes                    |
| South Dakota | Mar. 2005   | Yes                    |
| Tennessee  | NA           | Yes                    |
| Texas      | NA           | Yes                    |
| Utah       | NA           | Yes                    |
| Vermont    | NA           | Yes                    |
| Virginia   | NA           | Yes                    |
| Washington | Oct. 2003    | Yes                    |
| West Virginia | NA          | Yes                    |
| Wisconsin  | Jun. 2005    | Yes                    |
| Wyoming    | NA           | Yes                    |
| Hospital state | Calendar year | Total number of surgical procedures | Log of total number of surgical procedures | Mean costs per surgical case | Log Mean costs per surgical case |
|---------------|---------------|------------------------------------|-------------------------------------------|-----------------------------|---------------------------------|
| AK            | 2010          | 352.50 318.91                      | 5.60 1.07                                  | 2409.66 1392.48            | 2 10.09 0.06                   |
|               | 2011          | 389.00 405.88                      | 5.57 1.34                                  | 2849.61 3365.32            | 2 10.25 0.12                   |
| AR            | 2004          | 1303.41 2157.82                     | 5.36 2.50                                  | 5750.00 2145.57            | 22 8.59 0.36                   |
|               | 2005          | 1266.71 1802.66                     | 5.86 2.01                                  | 6588.21 2567.39            | 20 8.71 0.44                   |
|               | 2006          | 1095.63 1635.97                     | 5.41 2.20                                  | 8517.11 9471.11            | 15 8.80 0.60                   |
|               | 2007          | 609.68 1196.46                      | 4.80 2.27                                  | 8088.49 6913.90            | 17 8.80 0.61                   |
|               | 2008          | 1643.27 2325.74                     | 5.42 2.76                                  | 8132.00 3451.52            | 19 8.90 0.50                   |
|               | 2009          | 1400.42 2006.85                     | 5.45 2.63                                  | 9725.37 3875.93            | 16 9.11 0.39                   |
|               | 2010          | 989.94 1946.63                      | 5.03 2.21                                  | 12334.08 5633.30           | 15 9.34 0.41                   |
|               | 2011          | 1383.13 2230.16                     | 5.94 1.71                                  | 11072.76 7855.47           | 12 9.17 0.50                   |
| AZ            | 1998          | 2099.46 2273.16                     | 6.36 2.43                                  |                             |                                |
|               | 1999          | 2491.25 2883.66                     | 6.53 2.41                                  |                             |                                |
|               | 2000          | 3115.64 3147.09                     | 7.22 1.86                                  |                             |                                |
|               | 2001          | 2817.27 2671.47                     | 7.33 1.34                                  |                             |                                |
|               | 2002          | 1829.69 2648.37                     | 5.96 2.37                                  |                             |                                |
|               | 2003          | 3077.92 4407.92                     | 6.09 2.79                                  |                             |                                |
|               | 2004          | 3515.11 4311.27                     | 6.52 2.88                                  |                             |                                |
|               | 2005          | 4043.00 4349.95                     | 7.05 2.46                                  |                             |                                |
|               | 2006          | 3421.53 4125.20                     | 7.15 1.71                                  |                             |                                |
|               | 2007          | 3892.56 4886.74                     | 6.31 3.04                                  |                             |                                |
|               | 2008          | 2790.31 2664.93                     | 6.98 2.02                                  |                             |                                |
|               | 2009          | 2791.87 2514.98                     | 6.96 2.33                                  |                             |                                |
|               | 2010          | 2929.69 3247.85                     | 6.88 2.30                                  |                             |                                |
|               | 2011          | 2121.70 2167.99                     | 6.96 1.54                                  |                             |                                |
| CA            | 1998          | 2330.86 2503.90                     | 7.06 1.57                                  |                             |                                |
|               | 1999          | 2218.62 2375.59                     | 7.02 1.50                                  |                             |                                |
|               | 2000          | 2470.48 2350.32                     | 6.98 1.93                                  |                             |                                |
|               | 2001          | 2777.43 2780.51                     | 7.22 1.68                                  |                             |                                |
|               | 2002          | 2636.85 2417.21                     | 7.27 1.42                                  |                             |                                |
|               | 2003          | 2548.71 2434.74                     | 7.26 1.31                                  |                             |                                |
|               | 2004          | 2098.06 3147.14                     | 7.28 1.53                                  |                             |                                |
|               | 2005          | 2668.75 2479.17                     | 7.25 1.50                                  |                             |                                |
|               | 2006          | 3016.74 2996.67                     | 7.27 1.63                                  |                             |                                |
|               | 2007          | 2852.38 2782.56                     | 7.24 1.62                                  |                             |                                |
|               | 2008          | 3008.26 2974.03                     | 7.28 1.54                                  |                             |                                |
|               | 2009          | 2749.08 2502.10                     | 7.15 1.74                                  |                             |                                |
|               | 2010          | 2917.49 2701.21                     | 7.24 1.77                                  |                             |                                |
|               | 2011          | 2118.22 2572.49                     | 6.04 2.64                                  |                             |                                |
|               | 1998          | 2000.06 2618.33                     | 5.89 2.74                                  |                             |                                |
|               | 1999          | 1793.05 2551.32                     | 5.54 2.72                                  |                             |                                |
|               | 2000          | 1959.31 2362.98                     | 6.19 2.47                                  |                             |                                |
|               | 2001          | 2199.06 3192.30                     | 5.45 3.06                                  |                             |                                |
Table 7 Descriptive for the main outcomes in inpatient file (NIS) (Continued)

| Year | CT       | FL       | GA       |
|------|----------|----------|----------|
|      | 1998     | 1998     | 1998     |
|      | 1999     | 1999     | 1999     |
|      | 2000     | 2000     | 2000     |
|      | 2001     | 2001     | 2001     |
|      | 2002     | 2002     | 2002     |
|      | 2003     | 2003     | 2003     |
|      | 2004     | 2004     | 2004     |
|      | 2005     | 2005     | 2005     |
|      | 2006     | 2006     | 2006     |
|      | 2007     | 2007     | 2007     |
|      | 2008     | 2008     | 2008     |
|      | 2009     | 2009     | 2009     |
|      | 2010     | 2010     | 2010     |
|      | 2011     | 2011     | 2011     |

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Table 7 Descriptive for the main outcomes in inpatient file (NIS) (Continued)

| Year | Case Males | Case Females | Total Males | Total Females | Total | CHS Score | CHS Score |
|------|------------|--------------|-------------|---------------|-------|------------|------------|
| 2006 | 1899.24    | 3001.79      | 42 5.96     | 2.29          | 42    | 8825.86    | 2360.98    |
| 2007 | 2263.03    | 3518.61      | 38 6.04     | 2.43          | 38    | 9529.58    | 3019.18    |
| 2008 | 1787.58    | 2382.77      | 33 5.78     | 2.48          | 33    | 11587.75   | 4943.59    |
| 2009 | 1902.58    | 3117.79      | 38 5.61     | 2.51          | 38    | 13192.84   | 7595.41    |
| 2010 | 1555.05    | 2097.80      | 39 5.82     | 2.29          | 39    | 15261.72   | 11840.58   |
| 2011 | 1531.57    | 2266.45      | 35 5.60     | 2.50          | 35    | 14821.94   | 5090.16    |
| HI   | 1998       | 1140.75      | 4 6.30      | 1.77          | 4     | .          | .          |
|      | 1999       | 1589.67      | 3 7.12      | 0.96          | 3     | .          | .          |
|      | 2000       | 1775.67      | 3 7.21      | 1.04          | 3     | .          | .          |
|      | 2001       | 2012.00      | 3 7.42      | 0.83          | 3     | .          | .          |
|      | 2002       | 1580.80      | 5 6.03      | 3.39          | 5     | .          | .          |
|      | 2003       | 915.40       | 5 6.64      | 0.69          | 5     | 8995.32    | 3738.26    |
|      | 2004       | 1206.40      | 5 6.63      | 1.19          | 5     | 8027.69    | 3433.08    |
|      | 2005       | 1307.75      | 4 6.91      | 0.86          | 4     | 7571.95    | 1720.19    |
|      | 2006       | 1771.25      | 4 7.15      | 1.08          | 4     | 10007.89   | 658.75     |
|      | 2007       | 1147.33      | 3 6.99      | 0.44          | 3     | 17131.34   | 9267.88    |
|      | 2008       | 2796.00      | .           | .             | .     | 15053.38   | 7084.85    |
|      | 2009       | 1926.75      | 4 7.39      | 0.75          | 4     | 10315.77   | 2827.16    |
|      | 2010       | 949.11       | 1794.65     | 53 5.25      | 68    | .          | .          |
|      | 1999       | 1059.67      | 2052.33     | 54 5.30      | 201   | .          | .          |
|      | 2000       | 1163.16      | 2206.46     | 51 4.92      | 192   | .          | .          |
|      | 2001       | 927.62       | 1832.94     | 37 5.32      | 176   | .          | .          |
|      | 2002       | 1080.00      | 2054.53     | 28 5.36      | 199   | .          | .          |
|      | 2003       | 1079.26      | 2278.38     | 27 5.20      | 203   | 5596.97    | 10074.67   |
|      | 2004       | 894.92       | 2188.72     | 26 4.85      | 224   | 6665.14    | 2304.46    |
|      | 2005       | 912.25       | 2196.46     | 28 4.92      | 211   | 7447.16    | 2289.44    |
|      | 2006       | 933.48       | 1982.12     | 29 5.04      | 216   | 7978.59    | 1480.96    |
|      | 2007       | 1014.59      | 2045.78     | 27 5.04      | 224   | 8824.55    | 1496.89    |
|      | 2008       | 572.59       | 1409.53     | 27 4.46      | 211   | 11368.58   | 3182.80    |
|      | 2009       | 634.40       | 1439.88     | 25 4.54      | 210   | 16469.25   | 11479.62   |
|      | 2010       | 784.69       | 1891.69     | 26 4.50      | 226   | 16279.03   | 7491.64    |
|      | 2011       | 622.75       | 1059.96     | 24 4.63      | 215   | 17281.74   | 5435.92    |
|      | 1998       | 1915.22      | 2039.10     | 74 6.80      | 150   | .          | .          |
|      | 1999       | 2039.42      | 2380.00     | 69 6.72      | 167   | .          | .          |
|      | 2000       | 2164.01      | 2692.61     | 68 6.70      | 168   | .          | .          |
|      | 2001       | 1943.46      | 2069.21     | 65 6.85      | 148   | 5717.47    | 2415.54    |
|      | 2002       | 1987.61      | 2023.36     | 46 6.67      | 183   | 6270.24    | 2823.11    |
|      | 2003       | 2138.19      | 2206.29     | 42 6.60      | 207   | 6931.04    | 1482.53    |
|      | 2004       | 2040.20      | 2539.70     | 40 6.44      | 220   | 8211.13    | 2369.53    |
|      | 2005       | 1917.23      | 2353.27     | 43 6.46      | 179   | 8605.82    | 2595.79    |
|      | 2006       | 1980.63      | 2282.61     | 40 6.51      | 190   | 10421.62   | 4419.12    |
|      | 2007       | 2510.68      | 3465.31     | 41 6.69      | 191   | 12169.86   | 3928.83    |
|      | 2008       | 2012.68      | 3045.48     | 44 6.18      | 223   | 15546.74   | 14632.14   |

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Table 7 Descriptive for the main outcomes in inpatient file (NIS) (Continued)

| Year | Value1 | Value2 | Value3 | Value4 | Value5 | Value6 | Value7 | Value8 | Value9 | Value10 |
|------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
| 2009 | 2156.28| 3176.05| 40     | 6.23   | 2.45   | 40     | 14185.09| 5070.47| 38     | 9.51    |
| 2010 | 1666.00| 2066.70| 44     | 6.21   | 2.04   | 44     | 19032.69| 14877.23| 44     | 9.73    |
| 2011 | 2171.50| 2927.36| 40     | 6.22   | 2.42   | 40     | 18344.68| 5021.59| 38     | 9.78    |
| 2012 | 1649.25| 2370.52| 24     | 6.24   | 1.65   | 24     | 6884.33 | 2170.24| 19     | 8.79    |
| 2013 | 1591.21| 2183.46| 24     | 6.45   | 1.43   | 24     | 7734.78 | 1865.94| 19     | 8.92    |
| 2014 | 1972.68| 3039.02| 25     | 6.62   | 1.45   | 25     | 9288.90 | 5964.20| 22     | 9.02    |
| 2015 | 1737.81| 2383.75| 26     | 6.46   | 1.55   | 26     | 10825.71| 8876.06| 25     | 9.15    |
| 2016 | 2171.50| 2927.36| 40     | 6.22   | 2.42   | 40     | 18344.68| 5021.59| 38     | 9.78    |
| 2017 | 1666.00| 2066.70| 44     | 6.21   | 2.04   | 44     | 19032.69| 14877.23| 44     | 9.73    |
| 2018 | 2171.50| 2927.36| 40     | 6.22   | 2.42   | 40     | 18344.68| 5021.59| 38     | 9.78    |
| 2019 | 1649.25| 2370.52| 24     | 6.24   | 1.65   | 24     | 6884.33 | 2170.24| 19     | 8.79    |
| 2020 | 1591.21| 2183.46| 24     | 6.45   | 1.43   | 24     | 7734.78 | 1865.94| 19     | 8.92    |
| 2021 | 1972.68| 3039.02| 25     | 6.62   | 1.45   | 25     | 9288.90 | 5964.20| 22     | 9.02    |
| 2022 | 1737.81| 2383.75| 26     | 6.46   | 1.55   | 26     | 10825.71| 8876.06| 25     | 9.15    |
| 2023 | 2171.50| 2927.36| 40     | 6.22   | 2.42   | 40     | 18344.68| 5021.59| 38     | 9.78    |
| 2024 | 1666.00| 2066.70| 44     | 6.21   | 2.04   | 44     | 19032.69| 14877.23| 44     | 9.73    |
| 2025 | 2171.50| 2927.36| 40     | 6.22   | 2.42   | 40     | 18344.68| 5021.59| 38     | 9.78    |
| 2026 | 1649.25| 2370.52| 24     | 6.24   | 1.65   | 24     | 6884.33 | 2170.24| 19     | 8.79    |
| 2027 | 1591.21| 2183.46| 24     | 6.45   | 1.43   | 24     | 7734.78 | 1865.94| 19     | 8.92    |
| 2028 | 1972.68| 3039.02| 25     | 6.62   | 1.45   | 25     | 9288.90 | 5964.20| 22     | 9.02    |
| 2029 | 1737.81| 2383.75| 26     | 6.46   | 1.55   | 26     | 10825.71| 8876.06| 25     | 9.15    |
| 2030 | 2171.50| 2927.36| 40     | 6.22   | 2.42   | 40     | 18344.68| 5021.59| 38     | 9.78    |
Table 7 Descriptive for the main outcomes in inpatient file (NIS) (Continued)

| Year | MD 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | ME 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | MI 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|------|---------|------|------|------|------|------|------|------|------|------|------|------|------|------|-------|------|------|------|------|------|------|------|------|------|------|-------|------|------|------|------|------|------|------|------|------|------|------|
| 2001 | 3410.13 | 3651.13 | 16 | 7.42 | 1.46 | 16 | 8413.99 | 8440.90 | 12 | 8.81 | 0.60 | 12 |
| 2002 | 3442.00 | 3733.66 | 16 | 7.58 | 1.23 | 16 | 8492.44 | 2342.80 | 21 | 9.02 | 0.24 | 21 |
| 2003 | 2534.50 | 2758.85 | 14 | 7.08 | 1.61 | 14 | 9383.10 | 10793.59 | 18 | 9.32 | 0.57 | 18 |
| 2004 | 3447.76 | 4828.80 | 21 | 7.28 | 1.56 | 21 | 8081.33 | 11343.36 | 19 | 9.41 | 0.27 | 19 |
| 2005 | 3722.93 | 5545.08 | 15 | 7.41 | 1.38 | 15 | 13294.67 | 3883.90 | 15 | 9.46 | 0.27 | 15 |
| 2006 | 2954.87 | 3051.40 | 23 | 7.25 | 1.52 | 23 | 8492.44 | 2342.80 | 18 | 9.48 | 0.22 | 18 |
| 2007 | 2370.05 | 3722.28 | 22 | 6.76 | 1.57 | 22 | 13118.39 | 11343.36 | 19 | 9.41 | 0.45 | 19 |
| 2008 | 4083.83 | 3087.75 | 12 | 7.99 | 0.90 | 12 | 5106.37 | 949.44 | 11 | 8.52 | 0.20 | 11 |
| 2009 | 3958.43 | 2949.12 | 14 | 7.97 | 0.89 | 14 | 5944.15 | 1251.39 | 14 | 8.67 | 0.21 | 14 |
| 2010 | 3628.25 | 2696.23 | 13 | 8.03 | 0.92 | 13 | 6257.75 | 1462.82 | 12 | 8.72 | 0.23 | 12 |
| 2011 | 3654.36 | 2574.38 | 14 | 8.03 | 0.92 | 14 | 6998.57 | 1462.82 | 12 | 8.72 | 0.23 | 12 |
| 2012 | 3669.08 | 3385.82 | 12 | 7.83 | 0.93 | 12 | 6998.57 | 1462.82 | 12 | 8.72 | 0.23 | 12 |
| 2013 | 3757.83 | 2852.34 | 12 | 7.71 | 1.47 | 12 | 7709.09 | 1974.82 | 12 | 8.92 | 0.26 | 12 |
| 2014 | 3628.25 | 2564.61 | 12 | 7.92 | 0.82 | 12 | 13287.21 | 4759.14 | 13 | 9.60 | 0.27 | 13 |
| 2015 | 3654.36 | 5632.16 | 11 | 7.50 | 1.26 | 11 | 16360.45 | 4950.32 | 11 | 9.67 | 0.27 | 11 |
| 2016 | 3669.08 | 3385.82 | 12 | 7.83 | 0.93 | 12 | 6998.57 | 1462.82 | 12 | 8.72 | 0.23 | 12 |
| 2017 | 3757.83 | 2852.34 | 12 | 7.71 | 1.47 | 12 | 7709.09 | 1974.82 | 12 | 8.92 | 0.26 | 12 |
| 2018 | 3628.25 | 2564.61 | 12 | 7.92 | 0.82 | 12 | 13287.21 | 4759.14 | 13 | 9.60 | 0.27 | 13 |
| 2019 | 3654.36 | 5632.16 | 11 | 7.50 | 1.26 | 11 | 16360.45 | 4950.32 | 11 | 9.67 | 0.27 | 11 |
| 2020 | 3669.08 | 3385.82 | 12 | 7.83 | 0.93 | 12 | 6998.57 | 1462.82 | 12 | 8.72 | 0.23 | 12 |
| 2021 | 3757.83 | 2852.34 | 12 | 7.71 | 1.47 | 12 | 7709.09 | 1974.82 | 12 | 8.92 | 0.26 | 12 |
| 2022 | 3628.25 | 2564.61 | 12 | 7.92 | 0.82 | 12 | 13287.21 | 4759.14 | 13 | 9.60 | 0.27 | 13 |
| 2023 | 3654.36 | 5632.16 | 11 | 7.50 | 1.26 | 11 | 16360.45 | 4950.32 | 11 | 9.67 | 0.27 | 11 |
| 2024 | 3669.08 | 3385.82 | 12 | 7.83 | 0.93 | 12 | 6998.57 | 1462.82 | 12 | 8.72 | 0.23 | 12 |
| 2025 | 3757.83 | 2852.34 | 12 | 7.71 | 1.47 | 12 | 7709.09 | 1974.82 | 12 | 8.92 | 0.26 | 12 |
| 2026 | 3628.25 | 2564.61 | 12 | 7.92 | 0.82 | 12 | 13287.21 | 4759.14 | 13 | 9.60 | 0.27 | 13 |
| 2027 | 3654.36 | 5632.16 | 11 | 7.50 | 1.26 | 11 | 16360.45 | 4950.32 | 11 | 9.67 | 0.27 | 11 |
| 2028 | 3669.08 | 3385.82 | 12 | 7.83 | 0.93 | 12 | 6998.57 | 1462.82 | 12 | 8.72 | 0.23 | 12 |
| 2029 | 3757.83 | 2852.34 | 12 | 7.71 | 1.47 | 12 | 7709.09 | 1974.82 | 12 | 8.92 | 0.26 | 12 |
| 2030 | 3628.25 | 2564.61 | 12 | 7.92 | 0.82 | 12 | 13287.21 | 4759.14 | 13 | 9.60 | 0.27 | 13 |
| 2031 | 3654.36 | 5632.16 | 11 | 7.50 | 1.26 | 11 | 16360.45 | 4950.32 | 11 | 9.67 | 0.27 | 11 |
Table 7 Descriptive for the main outcomes in inpatient file (NIS) (Continued)

| State | Year | Value 1 | Value 2 | Value 3 | Value 4 | Value 5 | Value 6 | Value 7 | Value 8 | Value 9 | Value 10 |
|-------|------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|
| MN    | 2001 | 1593.49 | 2871.27 | 37      | 5.55    | 2.41    | 37      | 4813.53 | 1573.53 | 32      | 8.44     | 0.29     | 32       |
|       | 2002 | 1396.35 | 2597.47 | 31      | 5.69    | 2.13    | 31      | 5584.56 | 2184.26 | 24      | 8.56     | 0.35     | 24       |
|       | 2003 | 1724.89 | 3706.60 | 27      | 5.71    | 2.20    | 27      | 9131.42 | 2342.33 | 14      | 9.09     | 0.24     | 14       |
| MN    | 2004 | 2001    | 1384.87 | 1789.82 | 38      | 6.36    | 1.44    | 38      | .       | .       | .        | 0        | 0        |
|       | 2005 | 2346.20 | 3602.97 | 35      | 6.36    | 2.20    | 35      | .       | .       | .       | 0        | 0        | 0        |
|       | 2006 | 2832.67 | 4342.81 | 18      | 6.73    | 1.95    | 18      | 6225.39 | 1784.52 | 15      | 8.70     | 0.29     | 15       |
| MN    | 2007 | 5777.71 | 2661.17 | 28      | 5.76    | 2.30    | 28      | 13660.25| 6083.18 | 27      | 9.45     | 0.38     | 27       |
|       | 2008 | 1291.23 | 1666.76 | 21      | 6.05    | 1.78    | 21      | 4983.54 | 1252.15 | 17      | 8.48     | 0.27     | 17       |
| MO    | 1998 | 1381.10 | 1666.76 | 21      | 6.05    | 1.78    | 21      | .       | .       | .       | 0        | 0        | 0        |
|       | 1999 | 2107.66 | 2901.98 | 38      | 6.15    | 2.43    | 38      | .       | .       | .       | 0        | 0        | 0        |
|       | 2000 | 2191.96 | 4237.76 | 25      | 5.93    | 2.52    | 25      | .       | .       | .       | 0        | 0        | 0        |
|       | 2001 | 2332.17 | 4237.76 | 24      | 6.06    | 2.40    | 24      | .       | .       | .       | 0        | 0        | 0        |
|       | 2002 | 2535.93 | 3404.55 | 29      | 6.22    | 2.53    | 29      | .       | .       | .       | 0        | 0        | 0        |
| MS    | 2010 | 2255.48 | 2573.19 | 27      | 6.63    | 1.98    | 27      | .       | .       | .       | 0        | 0        | 0        |
|       | 2011 | 2380.37 | 2904.91 | 27      | 5.99    | 2.55    | 27      | .       | .       | .       | 0        | 0        | 0        |
| MT    | 2009 | 596.00  | 1867.11 | 17      | 5.43    | 2.50    | 17      | .       | .       | .       | 0        | 0        | 0        |
|       | 2010 | 910.38  | 1783.19 | 8       | 5.23    | 2.17    | 8       | .       | .       | .       | 0        | 0        | 0        |
|       | 2011 | 452.80  | 821.81  | 5       | 4.29    | 2.75    | 5       | .       | .       | .       | 0        | 0        | 0        |
| NC    | 2000 | 2442.09 | 3148.80 | 35      | 6.90    | 1.56    | 35      | .       | .       | .       | 0        | 0        | 0        |
|       | 2001 | 2527.59 | 3508.26 | 34      | 6.61    | 2.03    | 34      | 4601.95 | 1324.24 | 29      | 8.40     | 0.26     | 29       |
|       | 2002 | 1780.33 | 2997.44 | 33      | 6.26    | 2.05    | 33      | 5084.64 | 1048.73 | 21      | 8.52     | 0.19     | 21       |
|       | 2003 | 2282.53 | 3427.70 | 38      | 6.65    | 2.05    | 38      | 6019.75 | 2049.56 | 29      | 8.66     | 0.29     | 29       |
|       | 2004 | 2433.35 | 3271.46 | 34      | 6.69    | 1.94    | 34      | 6036.25 | 1159.98 | 23      | 8.69     | 0.21     | 23       |
|       | 2005 | 2701.42 | 3844.66 | 31      | 6.61    | 2.23    | 31      | 8377.00 | 4083.28 | 26      | 8.96     | 0.34     | 26       |
|       | 2006 | 2969.15 | 4299.20 | 27      | 6.45    | 2.56    | 27      | 8933.45 | 2630.25 | 22      | 9.06     | 0.26     | 22       |
|       | 2007 | 2806.31 | 4039.36 | 29      | 6.49    | 2.44    | 29      | 11426.09| 5569.56 | 24      | 9.27     | 0.36     | 24       |
|       | 2008 | 2356.43 | 3188.32 | 28      | 6.72    | 1.86    | 28      | 11853.39| 4375.17 | 25      | 9.33     | 0.30     | 25       |
|       | 2009 | 2685.00 | 4077.54 | 29      | 6.47    | 2.18    | 29      | 13271.58| 6450.74 | 27      | 9.42     | 0.34     | 27       |
|       | 2010 | 2947.85 | 4413.61 | 26      | 6.71    | 2.10    | 26      | 14580.08| 7988.63 | 23      | 9.57     | 0.44     | 23       |
|       | 2011 | 2290.96 | 4080.40 | 27      | 5.98    | 2.43    | 27      | 14709.72| 3748.94 | 23      | 9.57     | 0.24     | 23       |
| ND    | 2011 | 766.00  | 1381.47 | 4       | 5.01    | 2.15    | 4       | 12425.76| 5162.41 | 4       | 9.36     | 0.44     | 4        |
| NE    | 2001 | 562.05  | 1222.06 | 20      | 3.93    | 2.37    | 20      | .       | .       | .       | 0        | 0        | 0        |
|       | 2002 | 533.53  | 1360.54 | 19      | 4.23    | 2.06    | 19      | .       | .       | .       | 0        | 0        | 0        |
Table 7  Descriptive for the main outcomes in inpatient file (NIS) (Continued)

| Year | NH 2003 | 570.63 | 1396.58 | 16 | 4.25 | 2.12 | 16 | . | . | 0 | . | . | 0 |
|------|----------|--------|---------|----|------|------|----|---|---|---|---|---|---|
|      | 2004     | 713.53 | 1827.72 | 19 | 3.51 | 2.64 | 19 | . | . | 0 | . | . | 0 |
|      | 2005     | 510.33 | 1040.81 | 15 | 4.45 | 2.08 | 15 | . | . | 0 | . | . | 0 |
|      | 2006     | 801.33 | 1100.69 | 15 | 4.72 | 2.56 | 15 | . | . | 0 | . | . | 0 |
|      | 2007     | 639.33 | 1698.76 | 15 | 3.78 | 2.36 | 15 | . | . | 0 | . | . | 0 |
|      | 2008     | 813.94 | 1701.11 | 15 | 4.48 | 2.21 | 15 | . | . | 0 | . | . | 0 |
|      | 2009     | 911.50 | 1960.16 | 16 | 3.78 | 2.36 | 15 | . | . | 0 | . | . | 0 |
|      | 2010     | 813.94 | 1701.11 | 15 | 4.48 | 2.21 | 15 | . | . | 0 | . | . | 0 |
|      | 2011     | 440.38 | 700.19  | 13 | 4.26 | 2.29 | 13 | . | . | 0 | . | . | 0 |
|      | 2003     | 789.67 | 954.14  | 6  | 6.01 | 1.25 | 6  | . | . | 0 | . | . | 0 |
|      | 2004     | 1587.75| 2546.31 | 8  | 6.59 | 1.24 | 8  | . | . | 0 | . | . | 0 |
|      | 2005     | 1873.50| 2401.78 | 10 | 6.83 | 1.29 | 10 | . | . | 0 | . | . | 0 |
|      | 2006     | 1634.78| 2675.53 | 9  | 6.48 | 1.39 | 9  | . | . | 0 | . | . | 0 |
|      | 2007     | 1736.75| 1766.40 | 4  | 6.90 | 1.32 | 4  | . | . | 0 | . | . | 0 |
|      | 2008     | 2649.80| 3523.12 | 5  | 7.14 | 1.43 | 5  | . | . | 0 | . | . | 0 |
|      | 2009     | 4104.00| 3571.86 | 17 | 7.94 | 0.93 | 17 | . | . | 0 | . | . | 0 |
|      | 1999     | 2952.24| 2252.43 | 17 | 7.72 | 0.76 | 17 | . | . | 0 | . | . | 0 |
|      | 2000     | 3773.38| 3415.28 | 16 | 7.94 | 0.78 | 16 | . | . | 0 | . | . | 0 |
|      | 2001     | 3084.86| 2365.69 | 14 | 7.80 | 0.70 | 14 | . | . | 0 | . | . | 0 |
|      | 2002     | 4277.36| 4395.13 | 14 | 7.95 | 0.92 | 14 | . | . | 0 | . | . | 0 |
|      | 2003     | 3127.31| 1839.55 | 16 | 7.86 | 0.68 | 16 | . | . | 0 | . | . | 0 |
|      | 2004     | 4299.23| 3217.16 | 22 | 8.11 | 0.76 | 22 | . | . | 0 | . | . | 0 |
|      | 2005     | 3516.14| 3766.92 | 22 | 7.66 | 1.26 | 22 | . | . | 0 | . | . | 0 |
|      | 2006     | 3169.64| 2372.15 | 22 | 7.55 | 1.53 | 22 | . | . | 0 | . | . | 0 |
|      | 2007     | 3520.62| 3285.25 | 21 | 7.43 | 1.78 | 21 | . | . | 0 | . | . | 0 |
|      | 2008     | 3853.06| 3194.61 | 16 | 7.26 | 2.26 | 16 | . | . | 0 | . | . | 0 |
|      | 2009     | 3955.79| 3702.55 | 14 | 7.80 | 1.26 | 14 | . | . | 0 | . | . | 0 |
|      | 2010     | 4224.00| 2393.15 | 14 | 8.19 | 0.59 | 14 | . | . | 0 | . | . | 0 |
|      | 2011     | 3132.64| 2052.52 | 14 | 7.58 | 1.44 | 14 | . | . | 0 | . | . | 0 |
|      | 2009     | 655.71 | 527.19  | 7  | 5.84 | 1.68 | 7  | . | . | 0 | . | . | 0 |
|      | 2010     | 696.56 | 905.38  | 9  | 5.05 | 2.62 | 9  | . | . | 0 | . | . | 0 |
|      | 2011     | 1492.38| 2788.29 | 8  | 6.12 | 1.75 | 8  | . | . | 0 | . | . | 0 |
|      | 2002     | 2201.25| 3100.49 | 8  | 6.09 | 2.68 | 8  | . | . | 0 | . | . | 0 |
|      | 2003     | 2253.29| 2768.57 | 7  | 5.18 | 3.54 | 7  | . | . | 0 | . | . | 0 |
|      | 2004     | 4368.00| 3669.72 | 5  | 7.89 | 1.26 | 5  | . | . | 0 | . | . | 0 |
|      | 2005     | 1277.33| 2140.73 | 6  | 5.72 | 2.14 | 6  | . | . | 0 | . | . | 0 |
|      | 2006     | 2686.33| 3136.24 | 9  | 6.35 | 2.91 | 9  | . | . | 0 | . | . | 0 |
|      | 2007     | 2927.75| 3811.88 | 8  | 6.41 | 2.97 | 8  | . | . | 0 | . | . | 0 |
|      | 2008     | 1591.73| 2078.72 | 11 | 5.77 | 2.85 | 11 | . | . | 0 | . | . | 0 |
|      | 2009     | 2274.13| 3016.42 | 8  | 6.82 | 1.60 | 8  | . | . | 0 | . | . | 0 |
|      | 2010     | 2738.36| 3289.76 | 11 | 6.60 | 2.20 | 11 | . | . | 0 | . | . | 0 |
|      | 2011     | 2290.71| 2654.78 | 7  | 6.59 | 2.05 | 7  | . | . | 0 | . | . | 0 |
|      | 1998     | 2132.19| 2436.21 | 52 | 6.66 | 2.18 | 52 | . | . | 0 | . | . | 0 |
|      | 1999     | 2416.58| 2747.45 | 45 | 7.07 | 1.61 | 45 | . | . | 0 | . | . | 0 |
Table 7 Descriptive for the main outcomes in inpatient file (NIS) (Continued)

| Year | Mean    | SD      | Median | SD     | Median | SD     | Median | SD | Median | SD | Median | SD |
|------|---------|---------|--------|--------|--------|--------|--------|----|--------|----|--------|----|
| 2000 | 2853.49 | 3129.06 | 45     | 1.11   | 45     | .      | .      | 0  | .      | .  | .      | .  |
| 2001 | 3242.28 | 4043.79 | 43     | 1.44   | 43     | .      | .      | .  | .      | .  | .      | .  |
| 2002 | 2766.66 | 3293.78 | 44     | 1.48   | 44     | .      | .      | .  | .      | .  | .      | .  |
| 2003 | 3427.55 | 3942.44 | 42     | 2.07   | 42     | .      | .      | .  | .      | .  | .      | .  |
| 2004 | 2883.38 | 3912.49 | 63     | 1.84   | 63     | .      | .      | .  | .      | .  | .      | .  |
| 2005 | 3028.80 | 3697.53 | 64     | 1.94   | 64     | .      | .      | .  | .      | .  | .      | .  |
| 2006 | 3020.45 | 4156.70 | 62     | 1.69   | 62     | .      | .      | .  | .      | .  | .      | .  |
| 2007 | 3196.18 | 3713.86 | 55     | 1.76   | 55     | .      | .      | .  | .      | .  | .      | .  |
| 2008 | 3427.55 | 3942.44 | 42     | 2.07   | 42     | .      | .      | .  | .      | .  | .      | .  |
| 2009 | 3323.08 | 4009.90 | 38     | 1.11   | 38     | .      | .      | .  | .      | .  | .      | .  |
| 2010 | 2737.21 | 3092.45 | 34     | 1.42   | 34     | .      | .      | .  | .      | .  | .      | .  |
| 2011 | 2527.00 | 3307.23 | 37     | 1.32   | 37     | .      | .      | .  | .      | .  | .      | .  |
| OH   | 2002    | 2587.85 | 2724.95| 33     | 1.95   | 33     | .      | .  | .      | .  | .      | .  |
| 2003 | 2527.94 | 2588.13 | 34     | 1.19   | 34     | .      | .      | .  | .      | .  | .      | .  |
| 2004 | 2786.47 | 2714.96 | 36     | 1.30   | 36     | .      | .      | .  | .      | .  | .      | .  |
| 2005 | 2935.29 | 3930.51 | 34     | 1.65   | 34     | .      | .      | .  | .      | .  | .      | .  |
| 2006 | 2953.63 | 4831.75 | 40     | 1.57   | 40     | .      | .      | .  | .      | .  | .      | .  |
| 2007 | 2786.47 | 2714.96 | 36     | 1.30   | 36     | .      | .      | .  | .      | .  | .      | .  |
| 2008 | 2527.00 | 3307.23 | 37     | 1.32   | 37     | .      | .      | .  | .      | .  | .      | .  |
| 2009 | 2587.85 | 2724.95 | 33     | 1.95   | 33     | .      | .      | .  | .      | .  | .      | .  |
| 2010 | 2527.94 | 2588.13 | 34     | 1.19   | 34     | .      | .      | .  | .      | .  | .      | .  |
| 2011 | 2737.21 | 3092.45 | 34     | 1.42   | 34     | .      | .      | .  | .      | .  | .      | .  |
| OK   | 2005    | 973.03  | 2084.27| 38     | 4.45   | 38     | .      | .  | .      | .  | .      | .  |
| 2006 | 1382.65 | 2751.57 | 37     | 5.02   | 37     | .      | .      | .  | .      | .  | .      | .  |
| 2007 | 1165.94 | 2019.20 | 33     | 4.99   | 33     | .      | .      | .  | .      | .  | .      | .  |
| 2008 | 907.56  | 4831.75 | 40     | 1.57   | 40     | .      | .      | .  | .      | .  | .      | .  |
| 2009 | 1104.82 | 2458.02 | 33     | 5.00   | 33     | .      | .      | .  | .      | .  | .      | .  |
| 2010 | 1341.72 | 2576.75 | 29     | 5.30   | 29     | .      | .      | .  | .      | .  | .      | .  |
| 2011 | 1104.82 | 2458.02 | 33     | 5.00   | 33     | .      | .      | .  | .      | .  | .      | .  |
| OR   | 1998    | 1143.94 | 1866.50| 18     | 5.91   | 18     | .      | .  | .      | .  | .      | .  |
| 1999 | 1732.29 | 2261.67 | 17     | 6.24   | 17     | .      | .      | .  | .      | .  | .      | .  |
| 2000 | 1630.78 | 2488.82 | 18     | 6.20   | 18     | .      | .      | .  | .      | .  | .      | .  |
| 2001 | 1424.00 | 2134.01 | 19     | 6.03   | 19     | .      | .      | .  | .      | .  | .      | .  |
| 2002 | 2397.56 | 4019.29 | 16     | 6.43   | 16     | .      | .      | .  | .      | .  | .      | .  |
| 2003 | 1203.31 | 1619.97 | 16     | 5.98   | 16     | .      | .      | .  | .      | .  | .      | .  |
| 2004 | 1203.31 | 1619.97 | 16     | 5.98   | 16     | .      | .      | .  | .      | .  | .      | .  |
| 2005 | 2312.77 | 3800.60 | 13     | 6.80   | 13     | .      | .      | .  | .      | .  | .      | .  |
| 2006 | 1246.38 | 2102.70 | 16     | 6.18   | 16     | .      | .      | .  | .      | .  | .      | .  |
| 2007 | 2257.20 | 3245.54 | 15     | 6.41   | 15     | .      | .      | .  | .      | .  | .      | .  |
| 2008 | 1826.40 | 2653.57 | 15     | 6.58   | 15     | .      | .      | .  | .      | .  | .      | .  |
| 2009 | 1935.00 | 3184.08 | 17     | 6.25   | 17     | .      | .      | .  | .      | .  | .      | .  |
| 2010 | 2430.36 | 3640.99 | 14     | 6.61   | 14     | .      | .      | .  | .      | .  | .      | .  |
| 2011 | 1850.64 | 3201.19 | 14     | 6.08   | 14     | .      | .      | .  | .      | .  | .      | .  |
| PA   | 1998    | 2004.91 | 1946.07| 47     | 7.14   | 42     | .      | .  | .      | .  | .      | .  |
| 1999 | 2282.86 | 2820.36 | 42     | 7.14   | 42     | .      | .      | .  | .      | .  | .      | .  |
| Year | RI   | SC     | SD     | TN     |
|------|------|--------|--------|--------|
| 2000 | 2262.83 | 2459.99 | 42     | 7.12   |
| 2001 | 2591.44 | 3177.39 | 41     | 7.15   |
| 2002 | 2357.03 | 2555.95 | 40     | 7.21   |
| 2003 | 2845.40 | 4667.72 | 40     | 7.13   |
| 2004 | 2856.68 | 4943.77 | 38     | 6.67   |
| 2005 | 2776.63 | 3268.88 | 35     | 6.71   |
| 2006 | 2782.76 | 3753.00 | 41     | 6.98   |
| 2007 | 2701.51 | 4629.25 | 41     | 6.84   |
| 2008 | 1331.00 | 1815.00 | 3      | 7.19   |
| 2009 | 1490.95 | 1779.83 | 3      | 6.27   |
| 2010 | 2222.11 | 2272.63 | 3      | 6.54   |
| 2011 | 2272.63 | 2340.67 | 3      | 6.73   |
| 2002 | 4083.75 | 3034.67 | 3      | 6.29   |
| 2003 | 1490.95 | 2651.17 | 8      | 4.24   |
| 2004 | 1779.83 | 2905.95 | 12     | 6.91   |
| 2005 | 1501.39 | 2096.51 | 7      | 3.73   |
| 2006 | 1490.95 | 226.89  | 9      | 3.27   |
| 2007 | 1779.83 | 1299.72 | 14     | 7.04   |
| 2008 | 2180.50 | 2262.83 | 14     | 6.80   |
| 2009 | 2222.11 | 3299.72 | 14     | 7.04   |
| 2010 | 2180.50 | 3299.72 | 14     | 7.04   |
| 2011 | 2222.11 | 2099.40 | 5      | 5.10   |
| 2002 | 831.13  | 1923.49 | 8      | 4.24   |
| 2003 | 232.00  | 432.07  | 4      | 3.68   |
| 2004 | 2099.40 | 3852.53 | 5      | 5.10   |
| 2005 | 1198.66 | 191.03  | 7      | 1.84   |
| 2006 | 226.89  | 403.08  | 9      | 3.27   |
| 2007 | 145.75  | 243.34  | 8      | 3.06   |
| 2008 | 179.00  | 290.30  | 4      | 4.20   |
| 2009 | 374.40  | 738.66  | 5      | 4.35   |
| 2010 | 281.40  | 498.81  | 5      | 4.15   |
| 2011 | 1116.33 | 2205.73 | 6      | 3.82   |
| 2000 | 2262.83 | 2459.99 | 42     | 7.12   |
| 2001 | 2591.44 | 3177.39 | 41     | 7.15   |
| 2002 | 2357.03 | 2555.95 | 40     | 7.21   |
| 2003 | 2845.40 | 4667.72 | 40     | 7.13   |
| 2004 | 2856.68 | 4943.77 | 38     | 6.67   |
| 2005 | 2776.63 | 3268.88 | 35     | 6.71   |
| 2006 | 2782.76 | 3753.00 | 41     | 6.98   |
| 2007 | 2701.51 | 4629.25 | 41     | 6.84   |
| 2008 | 1331.00 | 1815.00 | 3      | 7.19   |
| 2009 | 1490.95 | 1779.83 | 3      | 6.27   |
| 2010 | 2222.11 | 2272.63 | 3      | 6.54   |
| 2011 | 2222.11 | 2340.67 | 3      | 6.73   |
Table 7 Descriptive for the main outcomes in inpatient file (NIS) (Continued)

| Year | TX 2000 | 2280.67 | 3318.77 | 86 | 6.63 | 1.83 | 86 | . | . | 0 | . | . | 0 |
|------|---------|---------|---------|----|------|------|----|---|---|---|---|---|---|
| 2001 | 2366.51 | 2957.74 | 88 | 6.67 | 1.93 | 88 | . | . | 0 | . | . | 0 |
| 2002 | 2147.48 | 2706.98 | 91 | 6.41 | 2.21 | 91 | . | . | 0 | . | . | 0 |
| 2003 | 2335.74 | 3213.95 | 95 | 6.39 | 2.19 | 95 | . | . | 0 | . | . | 0 |
| 2004 | 2265.84 | 3261.44 | 93 | 6.46 | 1.98 | 93 | . | . | 0 | . | . | 0 |
| 2005 | 1772.21 | 2742.68 | 106 | 6.04 | 2.09 | 106 | . | . | 0 | . | . | 0 |
| 2006 | 1778.82 | 2528.57 | 97 | 6.04 | 2.23 | 97 | 11686.68 | 10867.66 | 70 | 9.10 | 0.67 | 70 |
| 2007 | 1753.61 | 2467.78 | 101 | 5.97 | 2.27 | 101 | 12129.51 | 11358.05 | 68 | 9.21 | 0.53 | 68 |
| 2008 | 1813.89 | 2547.18 | 93 | 6.13 | 2.19 | 93 | 13974.49 | 12296.02 | 77 | 9.34 | 0.58 | 77 |
| 2009 | 1787.28 | 2829.91 | 90 | 6.11 | 2.10 | 90 | 16376.05 | 13945.55 | 72 | 9.50 | 0.57 | 72 |
| 2010 | 1653.41 | 2937.94 | 94 | 6.13 | 2.05 | 94 | 20025.22 | 16300.70 | 77 | 9.67 | 0.64 | 77 |
| 2011 | 2068.35 | 3832.54 | 86 | 6.08 | 2.10 | 86 | 22936.73 | 17392.40 | 65 | 9.83 | 0.62 | 65 |
| UT 1998 | 951.13 | 1272.27 | 16 | 5.66 | 1.82 | 16 | . | . | 0 | . | . | 0 |
| 1999 | 1043.24 | 1710.57 | 17 | 5.59 | 1.93 | 17 | . | . | 0 | . | . | 0 |
| 2000 | 303.07 | 341.56 | 14 | 5.03 | 1.27 | 14 | . | . | 0 | . | . | 0 |
| 2001 | 1192.63 | 2499.33 | 16 | 5.49 | 1.91 | 16 | 3912.22 | 1205.23 | 14 | 8.23 | 0.31 | 14 |
| 2002 | 1711.67 | 3005.40 | 15 | 5.70 | 2.27 | 15 | 4483.40 | 1303.96 | 13 | 8.37 | 0.27 | 13 |
| 2003 | 2156.69 | 3032.01 | 13 | 6.24 | 2.06 | 13 | 5476.93 | 2136.16 | 13 | 8.55 | 0.35 | 13 |
| 2004 | 1291.25 | 2351.85 | 12 | 5.45 | 2.13 | 12 | 5652.46 | 998.71 | 12 | 8.63 | 0.18 | 12 |
| 2005 | 1149.21 | 1475.50 | 14 | 5.87 | 2.02 | 14 | 6114.30 | 1903.72 | 12 | 8.68 | 0.29 | 12 |
| 2006 | 2051.31 | 3181.74 | 13 | 6.12 | 2.03 | 13 | 8116.65 | 2674.15 | 11 | 8.96 | 0.28 | 11 |
| 2007 | 951.67 | 1642.12 | 12 | 5.76 | 1.68 | 12 | 8199.12 | 2194.26 | 11 | 8.98 | 0.29 | 11 |
| 2008 | 1800.54 | 3130.25 | 13 | 6.00 | 2.09 | 13 | 12319.15 | 10752.92 | 12 | 9.24 | 0.53 | 12 |
| 2009 | 1146.50 | 2418.00 | 8 | 5.08 | 2.18 | 8 | 19066.46 | 24818.49 | 8 | 9.47 | 0.79 | 8 |
| 2010 | 2356.40 | 2982.92 | 10 | 6.76 | 1.83 | 10 | 12233.34 | 4199.51 | 10 | 9.36 | 0.34 | 10 |
| 2011 | 2027.78 | 2315.16 | 9 | 6.69 | 1.83 | 9 | 11938.88 | 2741.62 | 9 | 9.36 | 0.23 | 9 |
| VA 1999 | 2163.83 | 3145.65 | 47 | 6.86 | 1.51 | 47 | . | . | 0 | . | . | 0 |
| 2000 | 2957.81 | 4416.64 | 21 | 6.99 | 1.51 | 21 | . | . | 0 | . | . | 0 |
| 2001 | 2650.17 | 4247.87 | 24 | 6.65 | 2.07 | 24 | 5364.76 | 1758.76 | 21 | 8.55 | 0.28 | 21 |
| 2002 | 2027.21 | 2361.63 | 19 | 7.01 | 1.15 | 19 | 5466.07 | 1717.03 | 18 | 8.57 | 0.27 | 18 |
| 2003 | 3626.33 | 5260.93 | 18 | 7.37 | 1.31 | 18 | 6327.16 | 1961.95 | 17 | 8.71 | 0.28 | 17 |
| 2004 | 3353.11 | 5117.73 | 18 | 7.08 | 1.69 | 18 | 7853.96 | 3415.77 | 16 | 8.90 | 0.36 | 16 |
| 2005 | 3331.60 | 5168.00 | 20 | 6.70 | 2.24 | 20 | 9050.88 | 2449.50 | 19 | 9.08 | 0.26 | 19 |
| Year | VT 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|------|---------|------|------|------|------|------|------|------|------|------|------|
|      | 821.25  | 628.20| 775.25| 1633.14| 1836.50| 2619.26| 2427.50| 686.00| 1607.50| 2827.67| 2011.25|
|      | 680.87  | 570.37| 603.56| 3181.02| 3420.63| 2948.99| 3864.77| 432.75| 3159.69| 4280.13| 3598.76|
|      | 0.99    | 0.81  | 0.68  | 1.24  | 1.42  | 1.46  | 0.68  | 6.45  | 1.37  | 1.81  | 5.98  |
|      | 4       | 5     | 4     | 7     | 6     | 7     | 4     | 2     | 7     | 3     | 4     |
|      | 2007    | 3      | 17    | 6.82  | 2.07  | 17    | 2.07  | 6.77  | 2.06  | 17    | 6.88  |
|      | 2008    | 3551.24| 5334.38| 11820.56| 12479.85| 10806.18| 4125.97| 3187.60| 16     | 2.07  | 17    |
|      | 2009    | 3149.15| 4461.06| 15278.79| 3187.60| 5666.61| 11820.56| 12479.85| 16     | 2.07  | 17    |
|      | 2010    | 3420.63| 4320.27| 14843.37| 2824.93| 1089.40| 3187.60| 12479.85| 16     | 2.07  | 17    |
|      | 2011    | 2619.26| 2948.99| 15971.69| 815.50| 15971.69| 5666.61| 11820.56| 16     | 2.07  | 17    |
|      |         |        |       |       |       |       |       |       |       |       |       |
| WA   | 1998    | 1678.91| 1930.03| 2030.09| 1888.52| 1625.94| 1838.39| 1561.40| 1477.54| 1730.17| 1580.05|
|      | 2740.89| 1930.03| 2693.00| 2971.38| 2971.38| 2337.00| 2499.92| 2452.53| 2870.39| 2452.53| 2452.53|
|      | 22      | 22     | 23    | 23    | 23    | 23    | 24    | 24    | 35    | 29    | 30    |
|      | 6.05    | 6.57   | 6.37  | 6.60  | 6.57  | 6.57  | 6.60  | 6.57  | 6.37  | 6.57  | 6.57  |
|      | 2.01    | 1.57   | 1.84  | 1.63  | 1.57  | 1.57  | 1.84  | 1.63  | 1.57  | 1.57  | 1.57  |
|      | 22      | 23     | 23    | 23    | 23    | 23    | 23    | 23    | 23    | 23    | 23    |
|      | 0       | 0      | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
|      |         |        |       |       |       |       |       |       |       |       |       |
| WI   | 1998    | 1625.94| 1930.03| 2030.09| 1888.52| 1625.94| 1838.39| 1561.40| 1477.54| 1730.17| 1580.05|
|      | 2337.00| 2971.38| 2693.00| 2971.38| 2971.38| 2337.00| 2499.92| 2452.53| 2870.39| 2452.53| 2452.53|
|      | 66      | 23     | 23    | 23    | 23    | 23    | 24    | 24    | 35    | 29    | 30    |
|      | 6.45    | 6.57   | 6.37  | 6.60  | 6.57  | 6.57  | 6.60  | 6.57  | 6.37  | 6.57  | 6.57  |
|      | 1.51    | 1.57   | 1.84  | 1.63  | 1.57  | 1.57  | 1.84  | 1.63  | 1.57  | 1.57  | 1.57  |
|      | 66      | 23     | 23    | 23    | 23    | 23    | 24    | 24    | 35    | 29    | 30    |
|      | 0       | 0      | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
Table 7 Descriptive for the main outcomes in inpatient file (NIS) (Continued)

| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| WV   |      |      |      |      |      |      |      |      |      |      |      |      |
|      | 472.63 | 557.48 | 19 | 4.94 | 2.21 | 19 | . | . | 0 | . | . | 0 |
|      | 248.80 | 278.53 | 15 | 4.51 | 1.88 | 15 | 3888.09 | 534.79 | 5 | 8.26 | 0.13 | 5 |
|      | 1351.47 | 3077.94 | 19 | 5.29 | 2.30 | 19 | 4409.61 | 2031.18 | 8 | 8.27 | 0.57 | 8 |
|      | 1049.50 | 1569.87 | 18 | 5.31 | 2.37 | 18 | 5942.96 | 2070.32 | 16 | 8.63 | 0.36 | 16 |
|      | 814.67 | 1118.55 | 15 | 5.64 | 1.77 | 15 | 5359.41 | 1357.20 | 6 | 8.56 | 0.25 | 6 |
|      | 2531.00 | 3497.98 | 14 | 6.77 | 2.06 | 14 | 7780.89 | 2124.96 | 9 | 8.92 | 0.29 | 9 |
|      | 823.38 | 1262.49 | 13 | 5.26 | 2.11 | 13 | 7300.30 | 1453.31 | 6 | 8.88 | 0.20 | 6 |
|      | 1574.67 | 2429.76 | 15 | 5.42 | 2.68 | 15 | 9333.81 | 3269.12 | 8 | 9.09 | 0.32 | 8 |
|      | 1678.00 | 2495.48 | 13 | 5.05 | 3.14 | 13 | 10792.28 | 5094.92 | 11 | 9.17 | 0.52 | 11 |
|      | 919.25 | 1309.24 | 12 | 5.92 | 1.59 | 12 | 10234.95 | 1996.01 | 11 | 9.22 | 0.19 | 11 |
|      | 1210.15 | 1406.11 | 13 | 6.14 | 1.83 | 13 | 14794.36 | 10101.22 | 11 | 9.48 | 0.45 | 11 |
|      | 2780.43 | 4238.53 | 7 | 6.30 | 2.34 | 7 | 19117.61 | 11847.47 | 7 | 9.74 | 0.48 | 7 |
| WY   |      |      |      |      |      |      |      |      |      |      |      |      |
|      | 430.00 | 270.70 | 4 | 5.90 | 0.67 | 4 | 12490.09 | 4404.88 | 4 | 9.39 | 0.35 | 4 |
|      | 257.00 | 318.24 | 6 | 4.54 | 1.86 | 6 | 13683.53 | 3694.38 | 4 | 9.50 | 0.25 | 4 |
|      | 414.00 | 355.24 | 7 | 5.56 | 1.16 | 7 | 14386.57 | 4346.47 | 7 | 9.54 | 0.29 | 7 |
|      | 319.14 | 300.32 | 7 | 5.17 | 1.38 | 7 | 13824.34 | 1395.73 | 7 | 9.53 | 0.11 | 7 |
|      | 405.00 | 254.13 | 6 | 5.58 | 1.35 | 6 | 17362.34 | 5164.73 | 6 | 9.72 | 0.33 | 6 |
| Hospital state | Calendar year | Total number of surgical procedures | Log of total number of surgical procedures |
|----------------|---------------|----------------------------------|------------------------------------------|
|                |               | Mean    | Std     | N   | Mean    | Std     | N   |
| CA             | 2007          | 3515.62 | 3625.26 | 853 | 7.57    | 1.32    | 852 |
|                | 2008          | 3432.36 | 3886.85 | 831 | 7.48    | 1.38    | 831 |
|                | 2009          | 4068.27 | 4485.46 | 584 | 7.73    | 1.24    | 584 |
|                | 2010          | 4377.43 | 4874.96 | 497 | 7.78    | 1.27    | 497 |
|                | 2011          | 4527.95 | 5071.43 | 458 | 7.77    | 1.37    | 458 |
| CO             | 2008          | 4870.29 | 5532.98 | 78  | 7.42    | 2.09    | 78  |
|                | 2009          | 5103.38 | 5509.80 | 74  | 7.67    | 1.74    | 74  |
|                | 2010          | 5498.03 | 5641.74 | 73  | 7.80    | 1.62    | 73  |
|                | 2011          | 5576.49 | 5952.14 | 78  | 7.77    | 1.66    | 78  |
|                | 2012          | 5473.14 | 5843.59 | 78  | 7.65    | 1.89    | 78  |
| FL             | 2007          | 5410.50 | 5283.45 | 572 | 8.19    | 1.03    | 572 |
|                | 2008          | 5337.35 | 5276.53 | 587 | 8.17    | 1.05    | 587 |
|                | 2009          | 5223.05 | 4927.84 | 588 | 8.17    | 1.01    | 588 |
|                | 2010          | 5109.85 | 4912.04 | 590 | 8.13    | 1.04    | 590 |
|                | 2011          | 4832.48 | 4472.26 | 605 | 8.08    | 1.06    | 605 |
|                | 2012          | 4834.20 | 4207.72 | 599 | 8.13    | 0.95    | 599 |
|                | 2013          | 4792.27 | 4237.82 | 605 | 8.09    | 1.05    | 605 |
| KY             | 2007          | 7385.13 | 8979.66 | 104 | 8.13    | 1.42    | 104 |
|                | 2008          | 13539.70| 16737.80| 105 | 8.86    | 1.21    | 105 |
|                | 2009          | 13416.91| 17141.52| 131 | 8.83    | 1.22    | 131 |
|                | 2010          | 11449.95| 14604.36| 150 | 8.67    | 1.24    | 150 |
|                | 2011          | 10718.50| 14358.56| 164 | 8.53    | 1.39    | 164 |
|                | 2012          | 10301.86| 14306.77| 177 | 8.38    | 1.52    | 177 |
|                | 2013          | 14892.33| 20248.58| 206 | 8.69    | 1.58    | 206 |
| MD             | 1998          | 6807.10 | 5681.28 | 52  | 8.49    | 0.90    | 52  |
|                | 1999          | 6884.13 | 5819.98 | 52  | 8.47    | 0.96    | 52  |
|                | 2000          | 7560.06 | 6166.07 | 49  | 8.64    | 0.82    | 49  |
|                | 2001          | 8000.85 | 6432.89 | 48  | 8.66    | 0.93    | 48  |
|                | 2002          | 8250.75 | 6402.70 | 48  | 8.74    | 0.80    | 48  |
|                | 2003          | 17713.54| 22895.29| 48  | 9.29    | 0.96    | 48  |
|                | 2004          | 18459.33| 23312.07| 48  | 9.39    | 0.85    | 48  |
|                | 2005          | 19235.23| 23951.71| 48  | 9.43    | 0.88    | 48  |
|                | 2006          | 20425.46| 26811.17| 48  | 9.48    | 0.86    | 48  |
|                | 2007          | 38515.06| 44829.21| 52  | 9.93    | 1.45    | 52  |
|                | 2008          | 64059.83| 71433.03| 52  | 10.52   | 1.35    | 52  |
|                | 2009          | 65421.62| 84632.03| 52  | 10.51   | 1.35    | 52  |
|                | 2010          | 65719.71| 86014.19| 51  | 10.51   | 1.34    | 51  |
|                | 2011          | 64722.55| 89320.17| 53  | 10.26   | 1.83    | 53  |
|                | 2012          | 64992.65| 93877.46| 54  | 10.13   | 2.11    | 54  |
| NJ             | 2008          | 5504.35 | 4211.93 | 79  | 8.13    | 1.33    | 79  |
|                | 2009          | 6039.51 | 4190.19 | 75  | 8.28    | 1.32    | 75  |
|                | 2010          | 6359.12 | 4434.84 | 74  | 8.40    | 1.12    | 74  |
|                | 2011          | 6489.85 | 4579.18 | 74  | 8.39    | 1.23    | 74  |
|                | 2012          | 6287.65 | 4574.22 | 75  | 8.26    | 1.53    | 75  |
|                | 2013          | 6199.96 | 4668.46 | 75  | 8.22    | 1.48    | 75  |
Authors’ contribution
For this manuscript, JES led the study and had primary responsibility of the manuscript. RO provided scientific input and writing. PL led the statistical analysis, and TM provided input and editing. CS provided research support and editing. All authors read and approved the final manuscript.

Competing interests
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References
1. CMS. Medicare Medicaid programs; hospital Conditions of Participation: anesthesia services. Final rule. Fed Regist. 2001;66(219):56762–9.
2. Sun E, Dexter F, Miller TR. The Effect of “Opt-Out” Regulation on Access to Surgical Care for Urgent Cases in the United States: Evidence from the National Inpatient Sample. Anesth Analg. 2016;122(6):1983–91.
3. Census Bureau US. Estimates of the total resident population and resident population age 18 years and older for the United States, States, and Puerto Rico: July 1, 2015 (SCPRC-EST2015-18 + POP-RES). 2015.
4. Dulisse B, Cromwell J. No harm found when nurse anesthetists work without supervision by physicians. Health Aff. 2010;29(8):1469–75.
5. Lewis SR, Nicholson A, Smith AF, Alderson P. Physician anesthetists versus non-physician providers of anaesthesia for surgical patients. Cochrane Database Syst Rev. 2014; Issue 7. Art. No.: CD010357:1–78.
6. Manchikanti L, Caraway DL, Falco FJ, Benyamin RM, Hansen H, Hirsch JA. CMS proposal for interventional pain management by nurse anesthetists: evidence by proclamation with poor prognosis. Pain Physician. 2012;15(E5):E641–64.
7. Daugherty L, Fonseca R, Kumar K, Michaud P. An Analysis of the Labor Markets for Anesthesiology. Santa Monica, CA: RAND Corporation; 2010. http://www.rand.org/pubs/technical_reports/TR688.html.
8. Sun E, Dexter F, Miller TR. The effect of “opt-out” regulation on access to surgical care for urgent cases in the United States: Evidence from the National Inpatient Sample. Anesth Analg. 2016;122(6):1983–91.
9. Sun E, Miller TR, Halzack N. In the United States, “opt-out” States Show no increase in access to anesthesia services for Medicare beneficiaries compared with non-“opt-out” States. Anesth Analg Case Rep. 2016;6(9):283–5.
10. Cullen KA, Hall MJ, Golosinsky A. Ambulatory Surgery in the United States, 2006. National Health Statistics Reports; no 11. Revised. U.S. Centers for Disease Control and Prevention: Hyattsville, MD, 2009.
11. Pope G, Kautter J, Ellis R, Ash AS, Ayanian JZ, Jezkova L, Ingber MJ, Levy JM, Robit J. Risk adjustment of Medicare capitation payments using the CMS-HCC Model. Health Care Financ Rev. 2004;25(4):119–41.
12. Kennedy P. Estimation with correctly interpreted dummy variables in semilogarithmic equations. Am Econ Rev. 1981;71(4):801.