



# Ethnic and economic disparities effect on management of hyperparathyroidism

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## KEYWORDS:

Parathyroid disorders;  
Primary  
hyperparathyroidism;  
Parathyroidectomy;  
Surgeon volume;  
Demographic factors;  
Health services cost

## Abstract

**BACKGROUND:** Successful parathyroidectomy requires advanced surgeon experience. We aim to examine population characteristics at risk of being managed by low-volume surgeons.

**METHODS:** A cross-sectional study was performed utilizing the Nationwide Inpatient Sample database, 2004 to 2009. The study population included adult inpatients who underwent parathyroidectomy for primary hyperparathyroidism.

**RESULTS:** A total of 3,503 discharge records were included. Men, Hispanics, and those with Medicaid/Medicare health coverage were more likely to be managed by low-volume surgeons ( $P < .05$  each). Low-volume surgeons were more likely to operate in rural (odds ratio [OR], 3.99; 95% confidence interval [CI], 1.95 to 8.16;  $P < .001$ ) or nonteaching hospitals (OR, 2.15; 95% CI, 1.42 to 3.27;  $P < .001$ ). Southern region of the United States had a high prevalence of low-volume surgeons compared with other regions (Southern: 51.3%, Northeast: 24.3%, Midwest: 25.6%, and West: 27.6%,  $P < .001$ ). Operations by the low-volume surgeons associated with a higher risk of postoperative complications (OR, 1.81; 95% CI, 1.11 to 2.97) and a hospital stay more than 2 days (OR, 7.12; 95% CI, 3.75 to 13.45;  $P < .001$ ).

**CONCLUSIONS:** Certain populations are at risk of management by low-volume surgeons based on their demographic and economic characteristics.

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Primary hyperparathyroidism (PHPT) is the third most common global endocrine disorder.<sup>1</sup> The true prevalence of PHPT varies considerably among different populations.<sup>1-8</sup>

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Some studies estimated a prevalence of 1 to 4 per 1,000 and an overall incidence rate of 27 to 30 per 100,000 person-years.<sup>1</sup>

Parathyroidectomy is the mainstay treatment of PHPT.<sup>1,9,10</sup> Over the last 20 years, parathyroidectomy has undergone a dramatic evolution in terms of approach and an increase in its utilization.<sup>9,11-13</sup> It is estimated that the use of parathyroidectomy will increase and that 97,700 to 173,509 parathyroidectomies procedures will be performed in 2020.<sup>14</sup> This increase is attributed to both improved imaging modalities and surgical techniques that have made it a relatively safe operation.<sup>14</sup> Major complications of parathyroid surgery include

operative failure, permanent hypoparathyroidism, recurrent laryngeal nerve paralysis, and hematoma, whereas mortality remains rare.<sup>15</sup>

The relationship between higher volume health professionals and more favorable outcomes has been demonstrated for several clinical disciplines.<sup>16–24</sup> In regard to parathyroidectomy, it is estimated that experienced surgeons are able to identify an affected gland in 95% of cases.<sup>1</sup> Two main studies have addressed the volume–outcome association for parathyroidectomy.<sup>25,26</sup> In 1998, Sosa et al<sup>25</sup> showed that surgeons who performed more than 50 parathyroidectomies per year were less likely to have postoperative complications for both initial and reoperative parathyroidectomy compared with low-volume surgeons (<15 parathyroidectomies per year). However, the study depended on self-reported survey questionnaires sent only to members of the American Association of Endocrine Surgeons, which leaves the possibility of respondent and selection biases.<sup>25</sup> The second, by Stavrakis et al,<sup>26</sup> reported a similar inverse association between surgeon volume and risk of complications for parathyroid procedures including biopsies. They also showed that for operations done by high-volume surgeons, hospital charges were lower compared with the low-volume surgeon group.<sup>26</sup>

Demographic and socioeconomic disparities regarding access to certain health services, and the consequent inequalities in health outcomes, have been recognized for different medical fields, including cancer management and cardiovascular interventions.<sup>27–35</sup> We hypothesized that similar to other operations, parathyroid procedures are not exempt from these disparities.

In this study, we aim to assess the association of ethnic disparity and access to centers with high surgeon volumes. We sought to examine the demographic and socioeconomic factors of patients being managed by low-volume surgeons and to identify the hospital characteristics where low-volume surgeons are more likely to operate. The parameters are assessed for the entire United States, using the Nationwide Inpatient Sample (NIS) for 2004 to 2009.

## Methods

The study is a cross-sectional analysis using the NIS database for the years 2004 to 2009. NIS is part of the Healthcare Cost and Utilization Project, sponsored by the Agency for Healthcare Research and Quality. This is the largest all-payer inpatient care database publicly available in the United States. It contains data from approximately 8 million hospital stays from about 1,000 hospitals sampled to approximate a 20% stratified sample of US community hospitals.<sup>36</sup> The use of the NIS is publicly available de-identified data that are exempt from approval of the Institutional Review Board. *International Classification of Disease*, Ninth Revision (*ICD-9*), was used in defining the diagnoses and procedures of interest.

The study population consisted of adult ( $\geq 18$  years) inpatients who underwent parathyroidectomy (*ICD-9*: 06.81 and 06.89) as the primary procedure and had the diagnosis of PHPT (*ICD-9*: 252.01).

The main objective of the study was devised to assess population and hospital characteristics at risk of management by low-volume surgeon group. The specific risk factors examined were age ( $\leq 40$ ,  $>40$  to  $\leq 60$ ,  $>60$  years old), sex, race (white, black, Hispanic, and other), annual household income (quartile classification:  $< \$39,000$ ;  $\$39,000$  to  $\$47,999$ ;  $\$48,000$  to  $\$62,999$ ;  $> \$62,999$ ), main payer of health service (Medicare, Medicaid, private insurance, and self-pay), hospital region (Northeast, Midwest, West, and South),<sup>36</sup> hospital location (urban and rural),<sup>36</sup> and hospital teaching status (teaching vs nonteaching hospital).<sup>36</sup> We also examined surgeon volume–outcome relationship. The main outcomes of interest included postoperative complications, length of stay ( $\leq 2$  days [75th percentile] vs  $> 2$  days), cost of health services, and the total charges billed to insurance companies. Dichotomized complications were defined as the presence of one or more of the general or specific complications related to parathyroidectomy based on the secondary diagnoses made during a given hospital stay. Surgeon volume was categorized based on quartile classification into low surgeon volume ( $< 25$ th percentile): 1 to 2 parathyroidectomies per year; intermediate surgeon volume (25th to 75th percentile): 3 to 19 parathyroidectomies per year; and high surgeon volume ( $> 75$ th percentile):  $\geq 20$  parathyroidectomies per year.

Other factors that were assessed for their confounding effect included: (1) type of parathyroid disease (benign, malignant neoplasm, and uncertain neoplasm); (2) obesity (body mass index  $\geq 30$ ); (3) a modification of the Charlson Comorbidity Index Score (none, mild, moderate, and severe)<sup>37</sup>; (4) inpatient death; (5) whether neck dissection was performed; (6) whether radio-guided parathyroidectomy was performed; (7) whether parathyroid tissue reimplantation was performed; and (8) hospital bed size (small, medium, and large).<sup>36</sup>

Statistical analysis used weighted data reflecting the national estimate. The records' weights are available in the NIS data and are calculated based on the stratification variables that were used in sampling methodology. These variables are hospital geographic region, urban/rural location, teaching status, bed size, and ownership.

Cross-tabulation and chi-square test were used to examine the association between each of the independent factors and the outcome of interest. Factors with significant association were considered confounders and were included in multivariate logistic regression models. Multivariate logistic regression models were used to calculate the odds ratio (OR) and 95% confidence interval (CI). ANOVA was used to test for differences in cost and total charges by surgeon volume groups for all cases and stratified by postoperative complication status (absent vs present). Significance level was set as  $\alpha = .05$ . All data analyses

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