ELSEVIER

CrossMark

Surgery for Obesity and Related Diseases 12 (2016) 144–149

SURGERY FOR OBESITY AND RELATED DISEASES

Original article

# Variation in the use of minimally invasive bariatric surgery

Lindsay E. Kuo, M.D., M.B.A.*, Kristina D. Simmons, Ph.D., Noel N. Williams, M.D., Rachel R. Kelz, M.D., M.S.C.E.

*Department of Surgery, University of Pennsylvania, Philadelphia, Pennsylvania*

Received January 19, 2015; accepted May 13, 2015

**Abstract**

**Background:** Obesity is a significant public health problem in the United States. Despite the known benefits of bariatric surgery, most patients eligible for bariatric surgery do not receive it. Access to minimally invasive bariatric surgery (MIS), the surgical gold standard, may be a limitation.

**Objectives:** We investigated geographic variation in the utilization of laparoscopy for bariatric surgical procedures.

**Methods:** We utilized a unique 3-state inpatient database. Adult patients receiving initial bariatric surgery were included. Patients were divided into hospital service areas (HSAs). Rates of MIS utilization in each HSA were calculated. HSAs were divided into quintiles of utilization. Patient and hospital characteristics were compared across quintiles.

**Results:** Over the 5-year study period, 127,008 patients received bariatric surgery. MIS technology was available in all HSAs. MIS was performed in 88.4% of procedures and was performed in 70.6% of patients in the lowest quintile compared with 97.0% in the highest ($P < .01$). The use of laparoscopy across quintiles varied significantly by rural hospital status: All 7 rural hospitals were located in the lowest quintile of utilization.

**Conclusion:** Variation in the performance of MIS bariatric surgical procedures exists. These differences can likely be attributed to physician preference or patient population. Obesity rates are elevated in rural areas. The implementation of MIS bariatric surgery programs in rural areas may improve the treatment of obesity and downstream co-morbidities in these populations. (Surg Obes Relat Dis 2016;12:144–149.) 

*Keywords:* Geographic variation; Laparoscopy; Bariatric surgery

Obesity is a significant public health problem in the United States. More than one third of all Americans are obese [1]. Obesity is associated with multiple co-morbid diseases and significant healthcare costs [2]. Traditional methods of weight reduction such as dietary modification and exercise do not consistently achieve long-term weight loss [3,4]. As such, surgical intervention became more common in the recent past [5].

Bariatric surgery is a well tolerated and efficacious way of achieving weight loss and treating associated co-morbidities [6]. Recently, it has been found to be a valuable treatment for type 2 diabetes mellitus [7]. Minimally invasive bariatric surgery (MIS) is associated with lower morbidity rates than open procedures and is more cost effective [8–10]. As a result, MIS bariatric procedures are the treatment of choice.

*Correspondence: Lindsay E. Kuo, M.D., Hospital of the University of Pennsylvania, 3400 Spruce St., 4 Maloney, DSE, Philadelphia, PA, 19104.
E-mail: Lindsay.Kuo@uphs.upenn.edu

http://dx.doi.org/10.1016/j.soard.2015.05.007

Despite the benefits of bariatric surgery, most patients eligible for bariatric surgery do not receive it [11]. Geographic rates of bariatric surgery performance vary and do not correlate with the prevalence of obesity [12]. Historical concerns regarding the risks of surgery, especially among a morbidly obese population, likely contributed to the underuse of bariatric surgery in the treatment of obesity. However, given the reduced risks associated with the MIS approach, an examination of the geographic variation of MIS bariatric surgical procedures may provide additional information regarding the underuse of this treatment option. To this end, we investigated geographic variation in the utilization of MIS for bariatric surgical procedures.

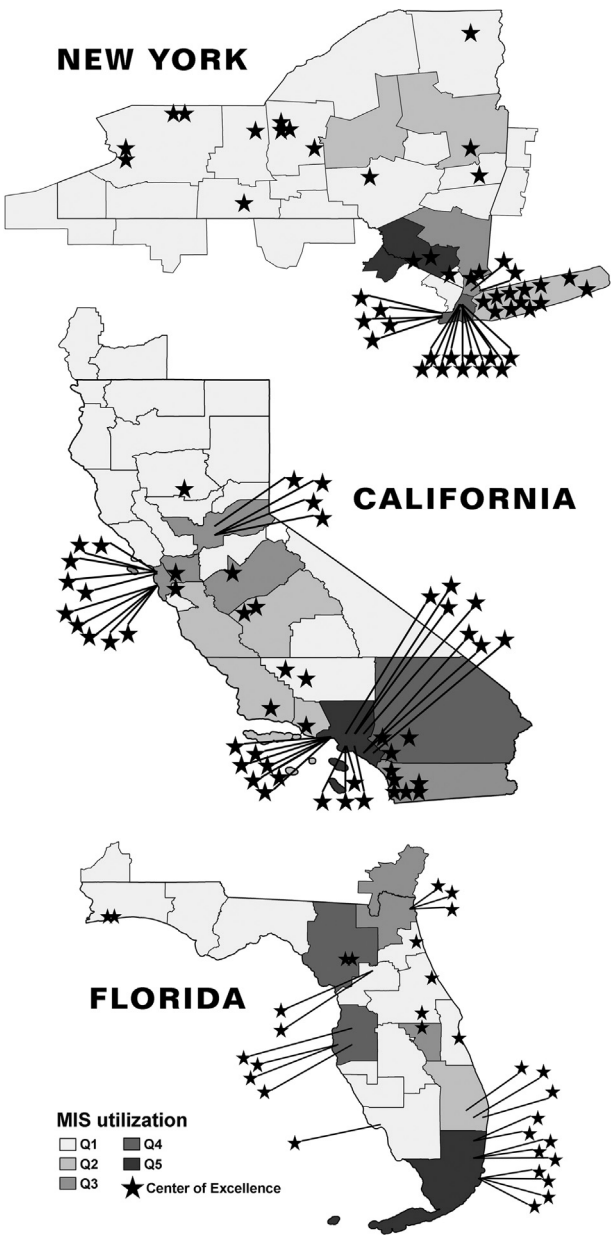


Fig. 1. Utilization of minimally invasive bariatric surgery (MIS) in health service areas (HSAs).

## Methods

### *Data sources*

We used a unique 3-state inpatient database of all inpatient discharge data for adult patients hospitalized over a 5-year period in California, Florida, and New York. These 3 states were selected based on data from the Agency for Healthcare Research and Quality Healthcare Cost and Utilization Project Nationwide Inpatient Sample database (2007–2008), which provided information on operative volume. Each state was selected on the basis of high operative volume and availability of data. The 3 state data sets offer information on all discharges from all acute inpatient facilities, not a sampling of institutions, and data are not limited to patients older than 65 years. Each of the state databases is publicly available, and specific information on each database is available elsewhere [13–15]. Based on the availability of data at the time of this study, the years 2007–2011 were included for New York and California and 2008–2012 for Florida.

Data from the Centers for Disease Control and Prevention (CDC) Behavioral Risk Surveillance System on the prevalence of obesity in each county [16] were obtained and linked to our data set.

### *Patient and hospital characteristics*

All obese patients aged 18 years or older who underwent a bariatric surgical procedure were included in the study. Bariatric surgical procedures were identified using the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) codes and a diagnosis-related group code for weight loss surgery (Table 1) [17,18]. Patients were excluded if information was missing on patient age, gender, race, or geographic region. Patients were classified by surgical technique and open or MIS approach using ICD-9-CM codes.

Using information from the data set, patient characteristics including age, gender, race (white, black, or other), and ethnicity (Hispanic, non-Hispanic, unknown) were examined. ICD-9-CM codes for body mass index (BMI) were used to group the degrees of obesity as follows: class 1 (BMI 30–34.9 kg/m$^2$, V85.1–V85.34), class 2 (BMI 35–39.9 kg/m$^2$, V85.36–V85.39), and class 3 (BMI $>$40 kg/m$^2$, V85.4–V85.45) [19]. The presence of medical comorbidities, as classified by Elixhauser et al., was examined [20].

The 3 states were divided into 65 hospital service areas (HSAs). HSAs are geographic regions composed of a county or a cluster of counties in which patients receive the majority of their medical care. The process of dividing states or geographic regions into HSAs has been described elsewhere [21]. Patients were assigned to HSAs according to the hospital in which the procedure was performed. The