Chapter 1

INTRODUCTION TO THE ACS NSQIP PEDIATRIC

1.1 Overview

A highly visible and important issue facing the medical profession and the healthcare industry today is the quality of care provided to patients. To that end numerous stakeholders; providers, payors and private industry are all investing large resources in efforts to measure, report and improve clinical care.

The National Surgical Quality Improvement Program (NSQIP), which was singled out by the Institute of Medicine’s Report, Leadership by Example, as “one of the most highly regarded VHA initiatives employing performance measures” is well aligned to meet these demands. The American College of Surgeons is confident that the ACS NSQIP is one of the best ways to benchmark and improve surgical care.

Surgical procedures vary from medical treatments of diseases, lending themselves to observational outcome studies. Whether patients live or die, have complications, are cured, have their symptoms relieved, return to work or play, and are satisfied with their care are very important issues vital to the assessment of the quality of surgical care. The Department of Veterans Affairs Health System (VHA) addressed surgical quality improvement by developing the National Surgical Quality Improvement Program (NSQIP) a prospective, peer-controlled, validated methodology that computes and reports 30-day risk-adjusted surgical outcomes. After years of study and testing in the private sector, the American College of Surgeons has made ACS NSQIP available to eligible hospitals in the United States and Canada.

1.2 Background and History

NSQIP started in the Veteran’s Health Administration (VHA). In the mid-1980’s the VHA came under a barrage of criticism, from various media sources, regarding high mortality rates associated with operative procedures. As a result, the United States Congress passed Public Law 99-166, in December 1985, stating that among other measures the VHA should report their outcomes in comparison to national averages and that they must be risk-adjustment to account for the severity of illness of the VHA surgical patient population. Initial efforts focused on analyzing existing administrative databases and by conducting limited reviews of data solicited from the field. It was recognized by an ad-hoc advisory group that (1) it was impossible to make meaningful comparisons of the VA surgical results to ‘national standards’ because those standards did not exist, and (2) any attempt to compare surgical results should take into account the preoperative surgical risk of the patients whose outcomes are being compared. A Steering Committee was established and charged with the task of developing a system of outcome reporting for all types of surgery in the VHA that would account for a patient’s risk factors and would allow for an
assessment of the quality of surgical results. Additionally the Steering Committee realized the requirement for meaningful comparison of these results between the VA medical centers, and, potentially, other health care sectors in the US. The development of patient risk models was the necessary first step in this endeavor. The VHA was in a unique position to develop the NSQIP because of the centralized authority of all the VHA Hospitals and the existence of a uniform electronic medical record in the VHA.

As of December 31, 1993, information about patient preoperative risk and postoperative outcomes had been recorded for 500,000 non-cardiac surgical procedures. Risk assessment models were developed for surgical mortality and morbidity for groups of common surgical procedures as well as for seven surgical subspecialties (general, vascular, urology, orthopedics, neurosurgery, ENT, and thoracic surgery).

In 1994 the NVASRS expanded to all 128 VHA hospitals that performed surgery and became the National Surgical Quality Improvement Program (NSQIP). In 1995 a validation study was conducted to determine the validity of the risk-adjusted surgical morbidity and mortality rates as measures of quality of care. This study focused on assessing the processes and structures of care in surgical services in order to determine which sites had higher- or lower-than-expected risk-adjusted mortality and morbidity rates.

As of 2003, there are over 1.3 million major surgical cases in the VHA database. Impressive results from the NSQIP in the VHA have demonstrated a 27% decrease in 30-day surgical mortality and a 45% decrease in 30-day surgical morbidity.¹

Beginning in 1999, the NSQIP expanded into the private sector with an initiative involving three alpha sites: Emory University in Atlanta, University of Kentucky in Lexington, and the University of Michigan in Ann Arbor. The goal of this initiative was to determine the feasibility and applicability of the NSQIP in the private sector. This alpha test determined that the risk-adjustment models were predictive of outcomes in the private sector. The NSQIP expanded again to a beta test involving 18 private sector sites: Emory University in Atlanta, University of Kentucky in Lexington, University of Michigan in Ann Arbor, Washington University in St. Louis, University of Florida in Gainesville, St. Louis University, University of Utah, Brigham & Women's Hospital in Boston, University of California, San Francisco, University of Maryland, Baltimore, New York Presbyterian Hospital (Columbia and Cornell campuses), University of Virginia, and Massachusetts General Hospital, as well as four community hospitals - Faulkner Hospital, Newton-Wellesley Hospital, Salem Hospital and Union Hospital. Results from studies to date have demonstrated that the NSQIP models are extremely applicable to the private sector patient population and the data collection methods are equally applicable.²

As of September 2004, the American College of Surgeons is supporting and directing the private sector expansion of the ACS NSQIP to all qualified sites.
1.3 Pediatric Pilot Program

The ACS began a collaborative effort with the American Pediatric Surgical Association (APSA) in 2007, to develop the ACS Pediatric NSQIP. The alpha phase of the Pediatric NSQIP began in 2008, with the beta phase commencing in 2009. The objective of the pilot program was to assess all aspects of the program including, but not limited to, development of data definitions, data collection worksheets, workstation for data entry, and data analysis methodology.

1.4 Data Collection

The ACS NSQIP-P collects over 1300 data points from none pediatric surgical specialties, on patients less than 18 of age.

The ACS NSQIP-P collects the following data points on every patient:

- Demographics - 7 variables (Includes IDN)
- Surgical Profile - 11 variables
- Pre-operative Data - 45 clinical variables and 13 laboratory variables
- Intra-operative Data - 11 clinical variables and 4 occurrence variables
- Post-operative Occurrence Data - 21 clinical variables
- Discharge Date - 12 clinical variables
- Neonatal Data - 10 clinical variables

At each participating hospital, a specially trained, dedicated Surgical Clinical Reviewer (SCR) collects the preoperative, intraoperative, and postoperative outcome data on all cases that meet program criteria, and enters this information into a secure database. This data is transmitted to Outcome Sciences where after performing data checks, for valid data entry, the data is subjected to statistical analysis.¹

1.5 Risk-Adjustment (detailed description)

Risk-adjusted models for ACS NSQIP participating hospitals are computed every 6 months, using data from the previous 12-month period (with a 6 month lag due to case locking and time required for the analysis) and are reported semi-annually in the SAR (Semi-annual Report). Risk-adjusted results are computed for 30-Day postoperative Mortality, Morbidity for Overall (Non-Multispecialty), Overall (Multispecialty), General Surgery, Colorectal Surgery, Vascular Surgery, additional surgical subspecialty cases, and other models as new ACS NSQIP programs come online (e.g. Targeted). Also included in the SAR are risk-adjusted results focusing on specific surgical occurrences. Risk adjustment is important because it takes into account differences in patient and procedure mix between hospitals, thus permitting fair comparisons of hospitals. ACS NSQIP modeling techniques have evolved and improved over time as new statistical techniques have become available. Our current risk-adjustment modeling process generally follows the below described process, though certain models might be approached somewhat differently.
For each outcome, a linear risk is assigned to each clinical grouping of CPT codes. This is usually accomplished by modeling CPT group as a categorical predictor for each binary outcome (e.g., death). The linear transformed (logit) predicted probability associated with each CPT category is then used in follow-on models.

Forward stepwise logistic regression is then used to develop a predictive model for each outcome. At the first step the predictor that is most strongly associated with the outcome is selected. After that, correlations between all remaining unselected variables and the outcome are adjusted for predictors already in the model, and the variable with the next strongest association is entered. This continues until no remaining variable is capable of significantly improving the model. This process chooses a useful predictive set from 50 or more potential predictive variables.

The variables selected by the logistic regression are then used in a hierarchical model. One important advantage of hierarchical models, as we have implemented them, is that they are able to pool information about what is known about all hospitals with what is known about a specific hospital to achieve a best prediction about hospital quality. Particularly when the hospital sample size is small, this pooling results in the hospital quality estimate being “shrunk” towards the mean of all hospitals. For technical reasons, the best hospital quality metric derived from a hierarchical model is the odds ratio.

The odds ratio is ratio of odds (number of patients exhibiting the event/number of patients not exhibiting the event) for a target group to the odds for a comparison group. An odds ratio of 1.0 implies that the event is equally likely in both groups. An odds ratio greater than 1.0 implies that the event is more likely in the first group and an odds ratio less than 1.0 implies that the event is less likely in the first group. For example, an odds ratio of 1.5 for ASA class 3 versus ASA class 1, means that there is a 50% increase in odds for the event for patients with ASA class 3. For ACS NSQIP hierarchical modeling, an odds ratio is also constructed for the effect of hospital on the outcome. For these odds ratios, the numerator is the odds for the hospital (where the “observed” number of events and number of non-events are adjusted by the statistical model) and the denominator is the average odds for all hospitals. If the odds ratio is equal to 1.0, the hospital is doing as expected. If the odds ratio is greater than 1.0, the hospital is doing worse than expected. If the odds ratio is less than 1.0, the hospital is doing better than expected.

1.6 Use of ACS NSQIP for Quality Improvement
Bi-annually, the statistical results of the data are reported back to the participating sites for their review and utilization in quality improvement. This comprehensive report includes the ORs and the hierarchical regression models. These ORs provide an overview of the assessment of quality of care in the surgical service. Through detailed study of the additional reports, the comparative outcome statistics start to guide the user towards areas for process improvement.
Additionally, a suite of continuously updated and continuously available, online reports are on the website for each site to use and review. Some of the reports that are currently available are postoperative mortality and morbidity, as well as for preoperative risk factors, wound class, and CPT codes, all of which are benchmarked against the average of all the private sector sites participating in the ACS NSQIP. These reports are currently utilized by the participating sites for early and ongoing identification of areas for quality improvement.
The ACS NSQIP also provides best practice guidelines and hospital case studies to all participating sites for utilization towards quality improvement initiatives at the hospital level.

### 1.7 Reliable Data

The ACS NSQIP’s strength is ‘reliable data’. Appropriate decisions cannot be made on data if the reliability of that data is questionable. The ACS NSQIP goes to great lengths to assure the reliability of the data through a variety of means, such as, consistent, detailed initial training, continuing education modules, inter-rater reliability site visits and testing, regular online case studies, regular conference calls, and an annual conference to review all aspects of the Program and the data collection process. Participants in the Program have come to trust the reliability of the data and use the online reports in conjunction with the bi-annual reports to identify opportunities to improve of the processes and outcome of surgical care.

### 1.8 Structure of the ACS Pediatric NSQIP

The American College of Surgeons has the overall responsibility for the ACS Pediatric NSQIP and specifically manages all of the contractual, financial, and marketing efforts of the Program. The ACS provides stewardship and education about the Program to interested participants and regulatory bodies and provides oversight of all of the functions of the Program.

Oversight for the ACS Pediatric NSQIP is provided by the Pediatric Measurement and Evaluation, and Steering committees, in conjunction with the ACS. The roles of these governing bodies is to maintain, and oversee the processes, structures, and functions of the ACS NSQIP-P including but not limited to, the reliable collection of the data, annual review of the risk-adjusted outcomes with provision of feedback, strategic planning, scientific mining of the data, and peer review.

The day-to-day management of the ACS NSQIP-P resides within the American College of Surgeons. The American College of Surgeons provides program, and clinical oversight of the SCRs in the field, while Outcome Sciences provides the IT infrastructure. Each SCR has access to a dedicated team of Clinical Support Specialists available to assist with clinical issues. Technical support staff, from Outcome Sciences, is available to provide support for all information technology issues.

Statistical analysis of all Program data is performed by the American College of Surgeons.

### 1.9 About this Operations Manual

This operations manual is intended to provide detailed guidelines for the SCR to assess cases and collect data for the ACS NSQIP-P. While not all questions can be answered within a single source, this manual is a compendium of years of experience with the NSQIP-P. Questions not answered in this source should be addressed with
the Clinical Support Specialists. We hope that you find this manual a useful reference to guide your practice and we welcome feedback for future improvements.


