Cardiac Surgery and Percutaneous Coronary Interventions by Hospital: Beginning 2008

OVERVIEW

New York State Department of Health
Office of Quality and Patient Safety
Cardiac Services Program

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Health Data NY

Background

The New York State Department of Health (Department of Health) has been studying the effects of patient and treatment characteristics on outcomes for patients with heart disease for over 20 years. Detailed statistical analyses of the information received from the study have been conducted under the guidance of the Cardiac Advisory Committee, a group of independent practicing cardiac surgeons, cardiologists and other professionals in related fields.

The results have been used to create a cardiac profile system that assesses the performance of hospitals and doctors over time, taking into account the severity of each individual patient's pre–operative conditions. Coronary artery bypass surgery results have been assessed since 1989; PCI results were released in 1996 for the first time.
Designed to improve health in people with heart disease, this program is aimed at:
- understanding the health risks of patients that adversely affect how they will fare during and after PCI or cardiac surgery;
- improving the results of different treatments of heart disease;
- improving cardiac care; and
- providing information to help patients make better decisions about their own care.

Procedures Analyzed

Data from the Cardiac Reporting System is used to assess outcomes on four main types of procedures: percutaneous coronary interventions (PCI), coronary artery bypass graft (CABG) surgery, valve surgery, and transcatheter aortic valve replacement (TAVR). A brief description of these procedures follows:

percutaneous coronary intervention (PCI) (also known as *angioplasty* or *percutaneous transluminal coronary angioplasty)* **–** Typically in this procedure, a balloon catheter is threaded up to the site of blockage in an artery in the heart and is then inflated to push arterial plaque against the wall of the artery to create a wider channel in the artery. Other procedures or devices are frequently used in conjunction with the catheter to remove plaque. Stents are used for most patients and procedures such as atherectomies and ultrasound are sometimes used.

coronary artery bypass graft surgery (CABG) **-** A procedure in which a vein or artery from another part of the body is used to create an alternate path for blood to flow to the heart, bypassing the arterial blockage. Typically, a section of one of the large saphenous veins in the leg, the radial artery in the arm or the mammary artery in the chest is used to construct the bypass. One or more bypasses may be performed during a single operation. When no other major heart surgery (such as valve replacement) is included, the operation is referred to as an isolated CABG.

valve repair- Widening valve openings for stenotic valves or narrowing or tightening valve openings for incompetent valves without having to replace the valves.

valve replacement- Replacement of a diseased valve. New valves are either mechanical (durable materials such as Dacron or titanium) or biological (tissues taken from pigs, cows or human donors).

valve surgery - In this report valve surgery refers to the following valve procedures when done alone or in combination with CABG: Aortic Valve Replacement, Mitral Valve Repair, Mitral Valve Replacement and Multiple Valve Surgery

transcatheter Aortic Valve Replacement (TAVR, also sometimes called Transcatheter Aortic Valve Implantation or TAVI) - This procedure differs from traditional surgical valve replacement in that the replacement valve is delivered to the heart through a catheter rather than through a standard surgical incision. The procedure is performed collaboratively by cardiologists and cardiac surgeons.

Methodology

Hospital or physician performance is an important factor that directly relates to patient outcomes. Whether patients recover quickly, experience complications or die following a procedure is in part a result of the kind of medical care they receive. It is difficult, however, to compare outcomes among hospitals when assessing performance because different hospitals treat different types of patients. Hospitals with sicker patients may have higher rates of complications and death than other hospitals in the state. The following describes how the Department of Health adjusts for patient risk in assessing outcomes of care in different hospitals.

Data Collection, Data Validation and Identifying In-Hospital/30-Day Deaths

As part of the risk-adjustment process, hospitals in NYS where PCI or cardiac surgery is performed provide information to the Department of Health for each patient undergoing those procedures. Data concerning patients' demographic and clinical characteristics are collected by hospitals. Approximately 40 of these characteristics (risk factors) are collected for each patient. Along with information about the hospital, physician and the patient's status at discharge, these data are sent electronically to the Department of Health for analysis.

Data are verified through review of unusual reporting frequencies, cross-matching of PCI or cardiac surgery data with other Department of Health databases and a review of medical records for a selected sample of cases. These activities are extremely helpful in ensuring consistent interpretation of data elements across hospitals.

The analysis bases mortality on deaths occurring during the same hospital stay in which a patient underwent PCI, TAVR, or cardiac surgery and on deaths that occur after hospital discharge but within 30 days of the procedure. In this report, an in-hospital death is defined as a patient who died

subsequent to a procedure during the same acute care admission or was discharged to hospice care and expired within 30 days. Data on deaths occurring after discharge from the hospital are made available by the Department of Health and its Bureau of Vital Statistics, the New York City Department of Health and Mental Hygiene and the National Center for Health Statistics.

Assessing Patient Risk

Each person who develops coronary artery disease has a unique health history. A cardiac profile system has been developed to evaluate the risk of treatment for each individual patient based on his or her history, weighing the important health facts for that person based on the experiences of thousands of patients who have undergone the same procedures in recent years. All important risk factors for each patient are combined to create his or her risk profile. For example, an 80-year-old patient with a heart attack in the past six hours has a very different risk profile than a 40-year-old who has never suffered a heart attack.

The statistical analyses conducted by the Department of Health consist of determining which of the risk factors collected are significantly related to in-hospital/30-day death and determining how to weight the significant risk factors to predict the chance each patient will have of dying in the hospital or after discharge but within 30 days of a procedure, given his or her specific characteristics.

Predicting Patient Mortality Rates for Providers

The statistical methods used to predict mortality on the basis of the significant risk factors are tested to determine whether they are sufficiently accurate in predicting mortality for patients who are extremely ill prior to undergoing the procedure as well as for patients who are relatively healthy. These tests have confirmed that the models are reasonably accurate in predicting how patients of all different risk levels will fare when undergoing PCI or cardiac surgery.
The mortality rate for each hospital and cardiologist is also predicted using the statistical model. This is accomplished by adding the predicted probabilities of death for each of the provider's patients and dividing by the number of patients. The resulting rate is an estimate of what the provider's mortality rate would have been if the hospital's performance was identical to the state performance. The percentage is called the predicted or expected mortality rate (EMR). A hospital's EMR is contrasted with its observed mortality rate (OMR), which is the number of PCI patients who died divided by the total number of PCI patients.

Computing the Risk-Adjusted Mortality Rate

The risk-adjusted mortality rate (RAMR) represents the best estimate, based on the associated statistical model, of what the provider's mortality rate would have been if the provider had a mix of patients identical to the statewide mix. Thus, the RAMR has, to the extent possible, ironed out differences among providers in patient severity of illness, since it arrives at a mortality rate for each

provider based on an identical group of patients.

To get the RAMR, the OMR is first divided by the provider's EMR. If the resulting ratio is larger than one, the provider has a higher mortality rate than expected on the basis of its patient mix; if it is smaller than one, the provider has a lower mortality rate than expected from its patient mix. The ratio is then multiplied by the overall statewide rate to obtain the provider's RAMR. There is no Statewide EMR or RAMR, because the statewide data is not risk-adjusted since it comprises the entire population of interest. The Statewide OMR (number of total cases divided by number of total deaths) serves as the basis for comparison for each hospital's EMR and RAMR.

Interpreting the Risk-Adjusted Mortality Rate

If the RAMR is significantly lower than the statewide mortality rate, the hospital has a better performance than the state as a whole; if the RAMR is significantly higher than the statewide mortality rate, the hospital has a worse performance than the state as a whole.

The RAMR is used in this report as a measure of quality of care provided by hospitals and cardiologists. However, there are reasons that a provider's RAMR may not be indicative of its true quality. For example, extreme outcome rates may occur due to chance alone. This is particularly true for low-volume providers, for whom very high or very low rates are more likely to occur than for high-volume providers. To prevent misinterpretation of differences caused by chance variation, expected ranges (confidence intervals) are included in the reported results.

Differences in hospital coding of risk factors could be an additional reason that a hospital's RAMR may not be reflective of quality of care. The Department of Health monitors the quality of coded data by reviewing patients' medical records to ascertain the presence of key risk factors. When significant coding problems are discovered, hospitals are required to correct these data and are subject to subsequent monitoring.

Observations

The dataset contains hospital-level results for PCI, CABG, valve surgery (with or without CABG), and TAVR. PCI at the hospital level is analyzed by "All Cases," "Emergency Cases" and "Non- Emergency Cases". "Emergency Cases" are those with a myocardial infarction (heart attack) within 24 hours before the procedure or hemodynamic instability; all other cases are considered "Non-Emergency Cases."

Physician-level data for PCI presents cardiologists' outcomes for "All Cases" and "Non- Emergency Cases." For cardiac surgery, surgeon level results are presented for Isolated CABG (that is CABG without any other major cardiac operation at the same time) and the combined group of Isolated CABG, valve surgery, and CABG performed at the same time as valve surgery. Physician information is presented for each physician who (a) performed 200 or more procedures during the three-year

analysis period, and/or (b) performed at least one procedure in each of the three years.

For various reasons, some cases are excluded from analysis in NYS outcome reports. These exclusions are described below.

- At the time St. Vincent's Hospital in Manhattan closed in April of 2010, the cardiac data validation process for 2009 discharges was incomplete. Because the accuracy of risk factors, procedural information and outcomes for these cases cannot be verified, any cases reported by this hospital with a discharge in 2009 are excluded from all analyses. No records were reported for this hospital in 2010.
- In addition, records for patients residing outside the United States are excluded because these patients could not be followed after hospital discharge.
- Some cases must be excluded from analysis because each 30-day mortality can only be associated with a single case for each analysis. That is, a patient with two PCIs within 30 days of death is counted only as one death. Since PCI, TAVR and cardiac surgery are analyzed separately, the same patients may be counted as a death in multiple datasets if they had multiple procedures.
- Beginning with 2010 discharges, patients with hypoxic brain injury who expired after PCI under certain conditions were also excluded from PCI analysis. This exclusion was later expanded to include patients with pre-PCI heart attack, cardiac arrest and coma-like condition even if they did not expire due to hypoxic brain injury.
- Beginning with patients discharged in 2006, the Department of Health, with the advice of the Cardiac Advisory Committee, began a trial period of excluding any patients meeting the NYS Cardiac Data System definition of pre-operative cardiogenic shock from publicly released reports and analyses.

Limitations

- Provider results should be compared to the NYS result. It is important to look at the "Comparison Result" data when assessing outcomes, this data indicates which results are statistically different from the statewide results.
- Some providers may have made important changes in the time period since the data were collected. Historical results may not reflect current performance.

Supporting Documents/References

For additional details about the data and to obtain the annual NYS Cardiac Data System reports, see our website, at:
http://www.health.ny.gov/health_care/consumer_information/cardiac_surgery/index.htm

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