Key Words: cardiac surgery, operative mortality, outcome reporting, CABG, PCI

Discussion

Dr Maximus. Evaluating the care delivered by hospitals is the goal of quality reporting programs, with accurate reporting imperative for analysis and comparison of outcomes. This is particularly important when outcomes for procedural interventions are analyzed and compared. Death, or operative mortality, is the most important outcome for procedural interventions. Although postoperative death is an important measurable outcome, operative mortality does not have a universal definition. There are several definitions of mortality that are used in various quality reporting programs. Some define an operative mortality as one that occurs during the same admission, death before discharge, and others define it as a certain time interval after surgery, most commonly 30 days. Why is this important? Ratings on mortality are reported by groups such as *Consumer Reports*, which are based on information from the STS. These reports are marketed to the general public as having accurate information and rate hospitals on the basis of mortality rates. Our hypothesis was that depending on the definition of mortality used, the mortality rate for any procedure can vary and that these definitions and rankings may not be accurate. As I mentioned before, there are multiple definitions of mortality. The American Heart Association, for example, uses mortality within 30 days, whereas the American College of Cardiology, American National Cardiovascular Data Registry, American College of Cardiology, and Cardiovascular Data Registry only track mortality that occurs in the hospital. The STS has revised its definition of operative mortality throughout the years. This is a 2011 definition that includes all deaths occurring during the acute episode of care in which the operation was performed; this also includes patient transfer to other acute care facilities even after 30 days. The second part of this definition is deaths occurring after discharge from the hospital, but within 30 days of the procedure, unless the cause of death is clearly unrelated to the operation. Now this is the 2014 definition, which is the most recent, and this includes all deaths regardless of cause occurring during the hospitalization in which the operation was performed, even if after 30 days. This includes patients transferred to other acute care facilities, and the second part is all deaths regardless of cause, occurring after discharge from the hospital but before the end of the 30th postoperative day. We used the California OSHPD Hospitalized Patient Discharge Data Base to use 5 different methods to count postoperative mortality; 2009 was the most recent year data files could be linked to vital statistic death files, which is the year we looked at, and we created the database from January 1, 2009, to December 31, 2009, using patients undergoing CABG, isolated valve, CABG and valve, and PCI procedures. These were all looked at using International Classification of Diseases, 9th Revision codes. PCI procedures were further divided into patients with ACS, which is PCI with ACS, and all other PCI, which basically is elective PCI. This was based on the presence of admission diagnosis codes for acute myocardial infarction. For the definitions we used, the first was death during surgery admission; this is basically the classic definition: any patient who dies while in the hospital where they had the procedure done, regardless of time. The second one is death during surgery admission or connected admission. This is the same as the previous definition but also includes patients who are transferred to another acute care facility, again regardless of time lapse after the procedure. The third definition is death during surgery admission, within 30 days of surgery. This is one of the older STS definitions of operative mortality. The fourth definition we used was death during surgery admission or connected admission or readmission within 30 days of surgery; this includes death during the procedure admission, any transfer, basically, or any patient who is readmitted to another acute care facility within 30 days and dies. This does not include out of hospital deaths. The final definition is probably the most encompassing definition and is closest to the one the STS uses currently. This is death during a surgery admission or a transfer basically, or connected admission, or within 30 days of surgery. One caveat is that skilled nursing facility transfers or skilled nursing facilities may or may not be counted as an acute care facility, because not all skilled nursing facilities report their outcomes or data.

So these are our results. We actually did 2 separate analyses, so I'll be showing 2 different tablets because approximately 8% of patients did not have a unique identifier such as a Social Security number of record linkage number, so they could not be followed through connected hospitalizations or transfers. This first analysis is the one I show here. This has no inclusions due to lack of follow-up. This tablet shows the results of all patients regardless of the ability to follow up. As you can see, for example, isolated CABG, operative mortality ranged from 1.71% to 2.13%. Method 5 obviously was the most inclusive. If you look at PCI without ACS, the range was 0.54% and then doubled using method 5, and it was 0.97%. As I mentioned, method 5 was the most inclusive. This gave 697 surgical deaths, and 17% of these deaths occurred after the hospitalization. A total of 409 PCI deaths occurred after the indexed hospitalization, which was approximately 31%. The highest percentage of post-hospital deaths occurred after elective PCI, which was 45%. As you can see, if you use the ACC-NCDR definition of mortality, PCI with ACS is 3.25%, 0.54%, that's death during surgery admission. However, if you use the STS definition of mortality, it

goes up to 4.44% for PCI with ACS and then 0.97 for PCI with ACS. These mortality rates and results can be considered underreported because the denominator is not adjusted; it includes patients who cannot be tracked. This was our second analysis in which untrackable patients were excluded. Patients who did not have any unique identifiers were excluded and gave a variable number of procedures depending on the definition used. This is due to exclusion criteria. We excluded out-of-state patients, patients who left against medical advice, and any patient without a unique identifier. This caused a reduction in the denominator and the numerator in this group. However, this did not result in significant change in the overall mortality rates. This table can be considered more statistically accurate, because the denominator includes the population at risk for the event being counted in the numerator.

In summary, a significant number of cardiac procedural deaths occurred after transfer at discharge from the index hospitalization, 17% in the surgical group compared with 31% in the PCI group. PCI mortality was more dependent on the method used to define mortality compared with the surgical patients, and a larger percentage of deaths occurred after hospital discharge and within 30 days of the procedure. You can see that this was almost doubled in the PCI group, and we think that has significant implications on outcome reporting. By comparing the PCI group with the surgery groups, you can see that after home discharge it is important for a complete picture of mortality after PCI. The issue of whether or not death during skilled nursing facility admission should be counted as an operative mortality is a subject of debate. It was even a subject of debate within our own group. By using the second analysis and definitions 3, 4, and 5, patients who died in a skilled nursing facility within 30 days would be counted as an operative death, but those who died after 30 days would not be counted. Limitations of our study include that the data came from an administrative dataset that some people would challenge as not as precise as clinical data. The data are dependent on International Classification of Diseases, version 9 codes for diagnosis and on the California Statistics Death Files, and 2009 has the most current available death files, which is why we used data from 2009. A lack of (1:07:48.4) XXX in identifiers, which is why we did 2 separate analyses. Eight percent of patients could not be tracked. Patients who were transferred to skilled nursing facilities were not counted in mortality calculations in our second analysis unless they died within 30 days.

Mortality rates from the same procedure can be variable and depend on the definition chosen, as well as the ability and tenacity of programmers to pursue data. We found that up to 20% of hospitals were not able to track their patients long-term. Comparative outcome reporting should require validation, and this study shows the importance of the definition of operative mortality and the need for accurate reporting of (1:08:28.8) XXX clinical registries such as the STS, and comparison of PCI versus CABG is complicated by the difference in definitions between STS-NDB and the ACC-NCDR.

Dr S. Moffatt-Bruce *(Columbus, Ohio)*. The number of organizations that are issuing reports on hospitals and physician quality are increasing, and frankly, it has become a cottage industry over the last decade. Despite a positive intent to provide a metric of safe and patient-centered care, these measures are being put forward in public data, but I think it leads to contradiction. I think it leads to confusion for not only the public and providers but also the governing boards and ultimately the public's ability to make decisions. You have outlined that, and you've really set the platform as to why this is so important. In 2008, Rothberg had an article in *Health Affairs* that showed there was variability not only in public reporting between institutions but also within the *same* institution, and this was pertinent to not only *Consumer Reports* that you mention in your talk, which is a newcomer to the public reporting arena, but also in the Leapfrog, Healthgrades, Hospital Compare, and *U.S. News & World Report*. In an attempt to render some clarity to this important public reporting, the Association of American Medical Colleges in 2010 convened a group of experts to put forth guiding principles for public reporting of performance data. We came up with 3 guiding principles, and I want to comment on your proposal as it portends to those 3. The 3 different guiding principles are around purpose, transparency, and validity. Purpose—that the target audience and intended purpose be well defined—you have done that today in your talk and in your article. Transparency—all information necessary to understand the data be available and that the limitations be clear—I think you've clearly outlined the limitations of your data, but perhaps because you don't have a risk adjustment, which I'll speak to, it's not meeting the mark. Validity—an accurate reflection of the characteristic being measured—well you're dead or alive, so I think that you've met that, but perhaps the meaningful time frame is lacking. In 2015, Peter Pronovost published another article: ''National Hospital Rating Systems Share Few Common Scores and May Generate Confusion Instead of Clarity.'' I think that clearly sums up where we are at this point in our adventure in public reporting of performance, and I think there remain 700 top 100 hospitals depending on who is doing the ranking and who is reading them. I have 3 questions, and perhaps we do not have all the answers today as we all struggle with health care performance measurement. First, your data come from an administrative dataset, and that is kind of the reality of what we work with currently. Do you think, though, considering that was from 2009, that if you were to restudy with more concurrent data that your result would look similar today?