Medicare Quality Monitoring System (MQMS) Report: Outcomes of Cancer Surgeries

Final Report

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Opinions and interpretations expressed herein are not necessarily the position of CMS or any other federal agency.
ABOUT MQMS

BACKGROUND

The Medicare Quality Monitoring System (MQMS) is an ongoing system that processes, analyzes, interprets and disseminates health related data to monitor the quality of care delivered to Medicare fee-for-service beneficiaries. The MQMS was initiated to provide useful information to the CMS PROs (Peer Review Organizations, currently renamed as Quality Improvement Organizations) program and has been evolved to address growing public concerns over quality of care, patient safety, provider accountability and patient choice. It is directed by the Centers for Medicare & Medicaid Services (CMS) with assistance from its contractors. MQMS development and production involves a diverse group of CMS staff, including program managers, clinical area team leaders (clinicians), epidemiologists, statisticians, and data analysts in the central and regional offices. CMS also consulted with leading experts in other federal agencies—such as the Agency for Health Care Research and Quality, the Centers for Disease Control—and in quality improvement organizations and academia.

INTENDED USE OF THE MQMS DATA

The MQMS is designed with the intention to support data-driven decision-making regarding quality improvement and payment/coverage policymaking. Development and production of the 2003 MQMS measures and respective methodologies were primarily aiming at providing input for broad and high-level policy making and program planning within CMS.

The 2003 MQMS describes trends, patterns, and variations in health status, disease- and procedure-specific utilization, outcomes and process of care at the national and state level that are related to CMS quality improvement program and initiatives, patient safety and payment/coverage policies. Without further analysis and manipulation of the data, the 2003 MQMS data are inadequate to explain the specific causes of the trends, patterns, and variations.

In addition to CMS internal use, MQMS provides data on Medicare quality of care for the AHRQ National Healthcare Quality Report (NHQR) and National Healthcare Disparities Report (NHDR).
Specifically the MQMS data are to be used for:

- Identifying potential quality problems
- Tracking program implementation
- Suggesting project ideas for quality improvement program
- Targeting interventions
- Prioritizing activities & allocation of resources
- Focusing on a particular problem
- Raising research questions/hypothesis for further investigation

Further well-deliberated multivariate analysis is required for the MQMS data to be meaningful and useful for:

- Drawing conclusions on cause-effect association between the QIOs process of care measures with the MQMS outcome measures
- Evaluating individual QIO, providers in a state or state performance
- Evaluating directly the effectiveness of the QIO program and other CMS quality improvement initiatives and payment/coverage policies

**POPULATION AND HEALTH ISSUES EXAMINED**

The population under study consists of Medicare fee-for-service (FFS) beneficiaries. MQMS is limited to FFS beneficiaries because of the current unavailability of encounter data from Medicare managed care plans. The MQMS 2003 edition monitors the following types of quality measures:

- Mortality and readmission rates, length of stay, and cost of hospitalizations for three conditions —acute myocardial infarction (AMI), heart failure and stroke
- Process of care and progression of diseases for diabetes
- Mortality and readmission rates following cancer-related and cardiac-related high-risk surgical procedures
- Patient safety
- Preventable hospitalization
METHODS

The 2003 MQMS analysis is limited to the national and/or state level, presenting longitudinal and/or cross-sectional descriptive statistics for various demographic and geographic subgroups. The results of MQMS 2003 edition are age-sex adjusted and not risk adjusted. The age-sex adjustment eliminates state-to-state and year-to-year variations in the age and sex composition but not the comorbidities or severity of illness of the population. The age-sex adjusted data preclude interpretation alluding to state or provider performance.

MQMS results are based on data from all fee-for-service beneficiaries and claims, rather than a sample of such beneficiaries and claims. This means that the rates presented in MQMS reports do not contain sampling error. MQMS rates are not presented with confidence intervals or significance testing, since these intervals and tests are based on properties of sampling error. This approach implies that the FFS population is not interpreted as a sample drawn from a super-population, such as all Medicare beneficiaries or FFS beneficiaries from another time period. The one exception is the MQMS diabetes results, which are based on a five percent sample of full-year fee-for-service Medicare beneficiaries. Thus, rates presented in the MQMS diabetes reports are subject to sampling error, and confidence intervals or significance testing are presented.

MQMS results are subject to measurement error in the CMS Denominator File and MedPAR database, as well as to modeling error resulting form the age-sex adjustment. CMS continues to investigate the magnitude of these errors.

PRODUCTS

The MQMS products are a series of reports on quality measures, a set of tables on CMS' web site, plus the data files at the person and aggregate level used to generate the reports and documentation of the methodology and data processing. The reports are available on the CMS website; the data files and documentation reside on the CMS mainframe. To facilitate the use of the data and replication of the analysis, CMS makes available SAS programs and data processing documentation. Access to the data can be granted to CMS analysts on request. Other federal agencies and CMS contractors may obtain the data through a formal data request process.

MQMS 2003 reports include:


About MQMS
This report presents discharge rates, mortality rates and readmission rates for four surgical procedures performed to treat cancer. The procedures are the two lung resections: lobectomy and pneumonectomy, and two gastrointestinal surgeries: pancreatectomy and esophagectomy.

These surgical procedures are responsible for a relatively small proportion of the hospital discharges and costs incurred by Medicare. However, all involve a substantial risk of mortality. They are procedures that are often performed for non-emergency admissions, so that the hospital where they are performed is determined not only by geography but by choice, of the patient or their physician. They are also procedures for which researchers have found volume and mortality to be strongly inversely related. The strength of the correlation indicates that correctly selecting providers can have a large impact on the likelihood of surviving. It also suggests that the outcome is quite sensitive to the ability of the professionals providing treatment or the effectiveness of hospital systems designed to prevent error and manage patients’ conditions.

We track three measures for each of the surgeries. The measures are discharge rates, the proportion of procedures resulting in death within 30 days of the procedure, and the proportion of discharges resulting in readmission to the hospital within 30 days of discharge.

We separate hospitals into quintiles for each procedure according to the volume of Medicare procedures performed in each, in order to track outcomes by hospital volumes. The quintiles are defined by ranking all hospitals by the number of procedures performed over three years and divide the pool of procedures into five roughly equal-sized groups. Quintiles for pancreatectomy and esophagectomy are calculated separately, but the volume of lobectomy and pneumonectomy are considered together, because the procedures are closely related.

Besides hospital volume quintile, national, state and regional rates, the report presents the following demographic subgroups:
Executive Summary

• Medicare eligibility status
• Medicaid (dual) eligibility
• Race
• Age
• Gender
• Rural and Urban residence

Variations in procedure rates and outcomes in any of these groups may be indications of variations in access or variations in the quality of care received.

Because these procedures are not performed often, we need to combine several years of observations to detect trends and determine long-term rather than transient differences in levels between subgroups. For that reason, we follow 5-year moving averages of the measures for most of our subgroup analyses. We use the average of the rate for the index year and the 4 preceding years as measures. National rates, and rates categorized by hospital volume are presented as 3-year moving averages. In the report, when we reference a particular year, we are actually referring to all the years of data included. Thus, the reported value for 2001 covers the years 1999 through 2001 when it refers to a 3-year average and 1997 through 2001 when it refers to a 5–year average.

We also adjust all rates for the age and sex composition of the denominator. National rates and rates for national subgroups are adjusted by the direct method. State rates are adjusted by the indirect method. In both cases, when the number of discharges or outcomes to be presented falls below 25, we do not report it. Because these surgeries are so seldom performed, most state rates are missing. State, regional and rural/urban designations refer to the patient’s place of residence

National Results

Lobectomy was, by far, the most commonly performed of the four procedures. The discharge rate in 2001 was above 0.4 per thousand beneficiaries. By contrast the other three cancer surgeries monitored in this report were performed at a rate below 0.1 per thousand. Esophagectomy was the least frequently performed, at a rate of less than 0.04 per thousand.

From 1994 to 2001, the discharge rate for esophagectomy was stable, lying between 0.03 and 0.04 per thousand. During that time, pancreatectomy rates increased by about one third, from under 0.05 to over 0.06 and pneumonectomy rates experienced a decrease of a similar magnitude, from over 0.06 to under 0.05. Lobectomy rates increased from about 0.36 in 1994 to 0.42 in 2001.
Changes in cancer incidence do not appear to explain the changing discharge rates. Incidence of cancer of the lung was declining during this time, while esophageal and pancreatic cancer rates changed little.

Mortality differs widely for these surgeries, with pneumonectomy, the most risky, followed by death within 30 days approximately 15 percent of the time and lobectomy, the least risky, resulting in death within 30 days about 5 percent of the time. There is little evidence of a trend in mortality, except for pancreatectomy. The pancreatectomy death rate declined from 104 in 1994 to 85 in 2001.

Readmission rates show less variation than mortality rates across these different surgeries. Lobectomy resulted in the lowest 30-day readmission rate at 131 in 2001, while the other three surgeries resulted in readmission between 210 (pneumonectomy) and 223 (esophagectomy) out of a thousand times. All readmission rates increased between 5 and 10 percent during the 1990s.

**Volume Quintile Results**

Mortality rates for patients undergoing cancer surgery at the hospitals with the highest procedure volumes were much lower than mortality rates for patients at hospitals with the lowest procedure volumes. In 2001, the ratio of mortality in the lowest volume quintile to mortality in the highest ranged from a factor of 1.5 for lobectomy to a factor of over 6 for pancreatectomy.

The ratio of hospital mortality rates favored the highest-volume hospitals over the lowest-volume hospitals more in 2001 than in 1994 for three of the procedures: esophagectomy, pneumonectomy and pancreatectomy. Mortality in top quintile hospitals went from above 50 percent of that in the lowest volume quintile of hospitals in 1994 to less than 30 percent of bottom quintile mortality in 2001. Pancreatectomy mortality was too low to report in top quintile hospitals in 2000, and went from over 20 percent of the bottom quintile rate in 1994 to 15 percent in 2001.

There was no clear relation between hospital procedure volume and readmission rates for any of the four procedures in 2001. For three of four procedures (all but esophagectomy), the readmission rate was highest in the top volume quintile.

Between 1996 and 2001, readmission rates for all four procedures increased more in hospitals that performed the highest volume of procedures than in hospitals that performed the lowest volume.

**Results by Medicare Eligibility**

Discharge rates for these surgeries in 2001 were highest for the aged and lowest for the disabled, most likely reflecting the higher incidence of cancer with increasing age. Aged rates exceeded disabled rates by 100 percent (pneumonectomy and esophagectomy) to over 200 percent (pancreatectomy).
The change in discharge rates from 1996 to 2001 did not differ substantially among the eligibility groups.

Aged mortality rates were substantially greater than disabled for all procedures. Only lobectomy was performed with sufficient volume to report ESRD mortality rates. ESRD mortality following lobectomy was far greater than the other eligibility groups in 2001. ESRD mortality in 2001 was much greater than in 1996, but because ESRD volume was low, it is hard to say how meaningful that is.

Aged readmission rates for all four surgeries increased between 1994 and 2001, but disabled rates for pneumonectomy and pancreatectomy declined.

**Medicaid Eligibility Results**

Discharge rates for three of the surgeries, pancreatectomy and the two lung resections were lower for dually eligible beneficiaries than for non-duals throughout the period from 1994 to 2001. Non-dual discharge rates for pancreatectomy exceeded dual rates by about 30 percent throughout the period, while lobectomy and pneumonectomy rates were about 15 to 20 percent higher for non-duals than duals during that time.

In 2001, mortality rates for all four procedures were higher among dually eligible beneficiaries than among non-duals. From 1996 to 2001, lobectomy mortality of non-duals changed from 10 percent above mortality of duals to 20 percent below.

In most years, duals were substantially more likely to be readmitted within 30 days than were non-duals. The readmission rate for lobectomy was 20 percent lower for non-duals than duals throughout the period. The esophagectomy readmission rate increased disproportionately among duals and went from approximate equality with the non-dual rate at the beginning of the period to nearly 50 percent above the non-dual rate.

**Rates by Race**

All cancer surgery rates were highest among whites in 2001. Lung resection rates among whites were substantially higher than among blacks, while esophagectomy and pancreatectomy rates varied little by race. This pattern persisted throughout the study period. Whites were 60 percent more likely to undergo lobectomy and 80 percent more likely to undergo pneumonectomy than were blacks.

Cancer incidence rates were highest among blacks compared to whites for cancers of the pancreas, esophagus and lung. Thus, the lower rates of cancer surgeries among blacks compared to whites are not explained by differing rates of cancer incidence.

Mortality rates following surgery differ little among the races. By contrast, blacks’ death rates for these cancers are substantially higher than whites’.

*Executive Summary*
Readmission rates in 2001 did not differ substantially by race. This similarity results from convergence in readmission rates between blacks and whites, as blacks’ rates increased more for three of four procedures (for esophagectomy, pneumonectomy and lobectomy) than whites’.

**Rates by Age**

In 2001, lobectomy was the most frequently performed surgery in all age groups. A higher proportion of pancreatectomies than the other cancer surgeries were performed on patients 75 and above.

Between 1994 and 2001, an increasing proportion of lobectomies and pneumonectomies were performed on the most elderly patients. Pneumonectomy rates declined among the youngest and increased among the oldest beneficiaries. Lobectomy rates among patients 85 to 94 increased by more than 50 percent.

**Rates by Gender**

Men’s discharge rates for all surgeries exceeded women’s rates. The difference in rates for lobectomy, pancreatectomy and esophagectomy were roughly comparable to differences in cancer incidence rates. In 2001, men were more than 4 times as likely to undergo esophagectomy and almost 4 times as likely to incur esophageal cancer, compared to women. They were 45 percent more likely to undergo pancreatectomy and over a third more likely to have pancreatic cancer. Though the difference between men and women in lobectomy rates corresponds to the 60 percent greater likelihood of lung cancer among men, the male pancreatectomy rate is disproportionately high, relative to the incidence of lung cancer (Ries et al., 2003).

Male mortality rates following pancreatectomy, lobectomy and pneumonectomy exceeded female rates throughout the 1990s.

Men’s readmission rates exceeded women’s rates for all four procedures during the 1990s. Male readmission rates for lobectomy and pneumonectomy were more than 20 percent higher than female rates.

**Regional Findings**

In 2001, discharge rates for three of four cancer surgeries (all but esophagectomy) were lowest in the West.

In 2001, esophagectomy and pancreatectomy mortality were highest in the South. Pancreatectomy mortality in the South exceeded that of other regions by at least 25 percent.
Between 1996 and 2001, lobectomy mortality declined 21 percent in the West, the largest decline of all regions, while pneumonectomy mortality increased 11 percent, the largest increase.

Readmission rates for the four cancer surgeries were lowest in the West. The pancreatectomy readmission rate was less than that of the next lowest region by 20 percent. Compared to 1996, Western readmission rates for pancreatectomy, esophagectomy and lobectomy in 2001 were lower or unchanged, while readmission rates in all other regions increased.

**Results for Rural and Urban Residents**

Throughout the study period rural residents were about 10 percent more likely to undergo pneumonectomy than were their urban counterparts, and about 10 percent less likely to undergo lobectomy. Esophagectomy rates for rural residents converged with urban rates, while rural pancreatectomy rates remained about 20 percent below urban rates.

From 1996 to 2001, the mortality rate for rural pneumonectomy patients increased relative to the rate for urban patients by over 50 percent, from 10 percent below to more than 40 percent above the urban rate.

In 2001, readmission rates for rural patients undergoing any of the four procedures were greater than or equal to the rates of their urban counterparts. Rural pneumonectomy patients were readmitted over 20 percent more often than were urban patients in 2001. Rural readmission rates for all four procedures increased relative to urban rates.
MEDICARE QUALITY MONITORING SYSTEM (MQMS) REPORT:

OUTCOMES OF CANCER SURGERIES

This report presents discharge rates, mortality rates and readmission rates for four surgical procedures performed to treat cancer. The procedures are the two lung resections: lobectomy and pneumonectomy, and two gastrointestinal surgeries: pancreatectomy and esophagectomy.

These surgical procedures are responsible for a relatively small proportion of the hospital discharges and costs incurred by Medicare. However, all involve a substantial risk of mortality. They are procedures that are often performed for non-emergency admissions, so that the hospital where they are performed is determined not only by geography but by choice, of the patient or their physician. They are also procedures for which researchers have found volume and mortality to be strongly inversely related. The strength of the correlation indicates that correctly selecting providers can have a large impact on the likelihood of surviving. It also suggests that the outcome is quite sensitive to the ability of the professionals providing treatment or effectiveness of hospital systems designed to prevent error and manage patients’ conditions.

These procedures were selected for presentation in the MQMS because they are intended to cure disease or prolong life and there is a substantial risk of dying after the procedure. These characteristics make mortality following the procedure a useful measure of quality.

We track three measures for each of the surgeries. The measures are discharge rates, the proportion of procedures resulting in death within 30 days of the procedure, and the proportion of discharges resulting in readmission to the hospital within 30 days of discharge. Discharge rates are useful because they tell us how many of the procedures are being performed and their overall impact on the system. They also tell us who is getting the procedures, and thus possibly whether there are access barriers. Mortality within 30 days is an indication that the procedure has not achieved its objective. National mortality rates tell us the overall effectiveness or riskiness of the procedure while the mortality rates of subgroups alert us to variations in the effectiveness with which treatment is provided. Readmission rates are important indicators of the resource cost of the procedure and may be indicative of variations in its effectiveness.
We separate hospitals into quintiles for each procedure according to the volume of Medicare procedures performed in each, in order to track outcomes by hospital volumes. Work by Birkmeyer et al. (2002) has found Medicare volume to be highly correlated with total volume. The quintiles are defined by the ranking all hospitals according to the number of procedures performed over three years and dividing the pool of procedures into five roughly equal-sized groups. Quintiles for pancreatectomy and esophagectomy are calculated separately, but the volume of lobectomy and pneumonectomy are considered together, because the procedures are closely related.

Besides hospital volume quintile, national, state and regional rates, the report presents the following demographic subgroups:

- Medicare eligibility status
- Medicaid (dual) eligibility
- Race
- Age
- Gender
- Rural and Urban residence

Variations in procedure rates and outcomes in any of these groups may be indications of variations in access or variations in the quality of care received.

Because these procedures are not performed often, we need to combine several years of observations to detect trends and determine long-term rather than transient differences in levels between subgroups. For that reason, we follow 5-year moving averages of the measures for most of our subgroup analysis. We use the average of the rate for the index year and the 4 preceding years as measures. National rates, and rates categorized by hospital volume are presented as 3-year moving averages. In the report, when we reference a particular year, we are actually referring to all the years of data included. Thus, the reported value for 2001 covers the years 1999 through 2001 when it refers to a 3-year average and 1997 through 2001 when it refers to a 5–year average.

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Results are presented in four graphical forms. Some rates are shown in graphs depicting the 3-year moving average of each year from 1994 to 2001. Other graphs
depict only the 3-year average in 2001, the most recent year of this report. These graphs are broken down by patient subgroup, and present vertical bars for each procedure and subgroup. Another type of graph shows the percentage change in 3-year rates between 1994 and 2001, also broken down by procedure and subgroup. The last type of graph shows the ratio of two subgroups’ 3-year averages. A ratio of one means that rates for the two subgroups are equal. A ratio of greater than one means that the rate for the first named subgroup is higher than the rate for the second.

We do not report measures adjusted for the patient’s clinical condition at the time of admission. The national and state rates we are presenting are indicative of the national or state system’s performance rather a hospital’s. For that reason, the patient’s condition on admission is as important an indicator of system performance as the hospital’s and physician’s ability to overcome the problems of the individual patients presented to them. Risk-adjustment is appropriate for the comparison of hospital quintiles, if there is evidence that the clinical condition of patients varies according to the volume of the procedures performed. The evidence that this is so is weak. Because the evidence of systematic differences in patient riskiness and the adjustment models that can be developed from administrative data are both weak, we do not adjust patient outcomes by patient risk at the time of admission. This decision may be revisited at a later date.
I. NATIONAL RESULTS

A. DISCHARGE RATES

Figure I.1. Cancer Procedures: Three-year Average Discharge Rate Per 1000 Beneficiaries

Lobectomy was, by far, the most common of the four procedures. The discharge rate in 2001 was above 0.4 per thousand beneficiaries. By contrast the other three cancer surgeries monitored in this report were performed at a rate below 0.1 per thousand. Esophagectomy was the least frequently performed, at a rate of less than 0.04 per thousand.

From 1994 to 2001, the discharge rate for esophagectomy was stable, lying between 0.03 and 0.04 per thousand. During that time, pancreatectomy rates increased by about one third, from under 0.05 to over 0.06 and pneumonectomy rates experienced a decrease of a similar magnitude, from over 0.06 to under 0.05. Lobectomy rates increased from about 0.36 in 1994 to 0.42 in 2001. Some of the increase in lobectomy may represent a change in practice that substitutes lobectomy for pneumonectomy. Recent years have also seen the introduction of video-assisted thoracoscopic surgery, a less invasive procedure than open thoracotomy. However the increase in lobectomy rates is 5 times the decrease in pneumonectomy rates, so the change may include additional expansion of the indications for lobectomy.

Changes in cancer incidence do not appear to explain the changing discharge rates. Incidence of cancer of the lung was declining during this time, while esophageal and pancreatic cancer rates changed little. The age-adjusted incidence of new lung and bronchial cancer cases declined from 97.5 per 100,000 in 1992 to 79.8 in 2000 for men, while remaining essentially unchanged for women, at 49.9 in 1992 and 49.8 in 2000. The
esophageal cancer rate increased from 7.3 per 100,000 to 7.7 for men, while the female rate remained at 1.8. New pancreatic cancer cases in men were 12.6 per 100,000 in 1992 and 12.2 per 100,000 in 2000, while the female rate was 9.3 in both years (Ries et al., 2003).
B. MORTALITY RATES

Figure I.2. Cancer Procedures: Three-year Average 30-day Mortality Per 1000 Beneficiaries With Surgery

Mortality differs widely for these surgeries, with pneumonectomy, the most risky, followed by death within 30 days approximately 15 percent of the time and lobectomy, the least risky, resulting in death within 30 days about 5 percent of the time. There is little evidence of a trend in mortality, except for pancreatectomy. The pancreatectomy death rate declined from 104 in 1994 to 85 in 2001. Goodney et al. (2002) monitored these surgeries for a Medicare population similar to this from 1994 to 1999 and found no significant change in operative mortality for any cancer surgery. Their analysis controlled for hospital volume, however, which increased for most beneficiaries during this time.
C. READMISSION RATES

Readmission rates show less variation than mortality rates across these different surgeries. Lobectomy resulted in the lowest 30-day readmission rate at 131 in 2001, while the other three surgeries resulted in readmission between 210 (pneumonectomy) and 223 (esophagectomy) out of a thousand times. All readmission rates increased between 5 and 10 percent during the 1990s.
II. HOSPITAL VOLUME QUINTILE RESULTS

A. MORTALITY RATES

Figure II.1. 2001 Cancer Surgery 30-Day Mortality by Hospital Volume Quintile

Mortality rates for patients undergoing cancer surgery at the hospitals with the highest procedure volumes (quintile 5) were much lower than mortality rates for patients at hospitals with the lowest procedure volumes (quintile 1). In 2001, the ratio of mortality in quintile 1 to mortality in quintile 5 ranged from a factor of 1.5 for lobectomy to a factor of over 6 for pancreatocomy.
The gap in mortality rates between highest volume and lowest volume hospitals widened from 1994 to 2001 for three of the procedures (esophagectomy, pneumonectomy, and pancreatectomy), as evidenced by the shrinking ratio of mortality of high-volume to low-volume hospitals. Mortality in high-volume hospitals went from over 50 percent of that in the low-volume hospitals in 1994 to less than 30 percent of the low-volume mortality in 2001. Pancreatectomy mortality was too low to report in high-volume hospitals in 2000, and went from over 20 percent of the low volume rate in 1994 to 15 percent in 2001.
B. READMISSION RATES

**Figure II.3. 2001 Cancer Surgery 30-Day Readmits by Hospital Volume Quintile**

There was no clear relation between hospital procedure volume and readmission rates for any of the four procedures in 2001. For three of four procedures (all but esophagectomy), the readmission rate was highest in the top volume quintile.

**Figure II.4. Ratio of Cancer Surgery Readmits by Hospital Volume: High Volume/low volume**

*MQMS: Outcomes of Cancer Surgeries*
Between 1996 and 2001, readmission rates for all four procedures increased more in hospitals that performed the highest volume of procedures than in hospitals that performed the lowest volume.
III. RESULTS BY MEDICARE ELIGIBILITY

A. DISCHARGE RATES

Figure III.1. 2001 Cancer Surgery Rates by Medicare Eligibility Status

Discharge rates for these surgeries in 2001 were highest for the aged and lowest for the disabled, most likely reflecting the higher cancer incidence with older age. Aged rates exceeded disabled rates by 100 percent (pneumonectomy and esophagectomy) to over 200 percent (pancreatectomy).
The change in discharge rates from 1996 to 2001 did not differ substantially among the eligibility groups.

**B. MORTALITY RATES**

Figure III.3. 2001 Cancer Surgery 30-Day Mortality by Medicare Eligibility Status
Aged mortality rates were substantially greater than disabled for all procedures. Only lobectomy was performed with sufficient volume to report ESRD mortality rates. ESRD mortality following lobectomy was far greater than the other eligibility groups in 2001. As shown in Figure III.4, ESRD mortality in 2001 was much greater than in 1996, but because volume was low, it is hard to say how meaningful that change is.

**Figure III.4. Change in Cancer Surgery Mortality, 1996-2001, by Medicare Eligibility**

![Chart showing changes in cancer surgery mortality](chart)

**C. READMISSION RATES**

**Figure III.5. 2001 Cancer Surgery 30-Day Readmits by Medicare Eligibility Status**

![Chart showing 2001 cancer surgery 30-day readmits](chart)

*MQMS: Outcomes of Cancer Surgeries*
Readmission rates for lobectomy patients with ESRD were much higher than those of aged and disabled lobectomy patients in 2001.

Figure III.6. Change in Cancer Surgery Readmits, 1996-2001, by Medicare Eligibility

Aged readmission rates for all four surgeries increased between 1994 and 2001, but disabled rates for pneumonectomy and pancreatectomy declined.
IV. MEDICAID ELIGIBILITY RESULTS

A. DISCHARGE RATES

Figure IV.1. Ratio of Cancer Surgery Discharge Rates by Medicaid Status: Non-Dual/Dual

Discharge rates for three of the surgeries, pancreatectomy and the two lung resections were higher for non-dually eligible beneficiaries than for duals throughout the period from 1994 to 2001. Non-dual discharge rates for pancreatectomy exceeded dual rates by about 30 percent throughout the period, while lobectomy and pneumonectomy rates were about 15 to 20 percent higher for non-duals than duals during that time.
B. MORTALITY RATES

Figure IV.2. Ratio of Cancer Surgery Mortality by Medicaid Status: Non-Dual/Dual

In 2001, mortality rates for all four procedures were lower among non-dually eligible beneficiaries than among duals. From 1996 to 2001, the lobectomy mortality of non-duals changed from 10 percent above the mortality of duals to 20 percent below.

C. READMISSION RATES

Figure IV.3. Ratio of Cancer Surgery Readmits by Medicaid Status: Non-Dual/Dual

MQMS: Outcome of Cancer Surgeries
In most years, non-duals were substantially less likely to be readmitted within 30 days than were duals. The readmission rate for lobectomy was 20 percent lower for non-duals than duals throughout the period. The esophagectomy readmission rate for duals increased disproportionately relative to that for the non-duals, so that the ratio went from approximate equality with the non-dual rate at the beginning of the period (a ratio of one) to nearly 50 percent higher than the non-dual rate (a ratio of roughly 0.7).
V. RATES BY RACE

A. DISCHARGE RATES

Figure V.1. 2001 Cancer Surgery Rates by Race

All cancer surgery rates were highest among whites in 2001. Lung resection rates among whites were substantially higher than among blacks, while esophagectomy and pancreatectomy rates varied little by race. This pattern persisted throughout the study period. Whites were 60 percent more likely to undergo lobectomy and 80 percent more likely to undergo pneumonectomy than were blacks.

Cancer incidence rates were higher among blacks compared to whites for cancers of the pancreas, esophagus and lung during this time. In 2000, the black pancreas cancer rate was 15.5 per 100,000 and the white rate, 10.5. The incidence rate of esophageal cancer was 6.9 for blacks and 4.6 for whites. The black lung cancer rate was 78.5 and the white, 62.6 (Ries et al., 2003). Thus, the lower rates of cancer surgeries among blacks compared to whites are not explained by differing rates of cancer between the two groups.
B. MORTALITY RATES

Figure V.2. 2001 Cancer Surgery 30-Day Mortality by Race

Mortality rates in the 30 days following surgery differ little among the races. By contrast, blacks are substantially more likely to die of these cancers than are whites (Ries et al., 2003).

C. READMISSION RATES

Figure V.3. 2001 Cancer Surgery 30-Day Readmits by Race

MQMS: Outcomes of Cancer Surgeries
Readmission rates in 2001 did not differ substantially by race. This similarity is the result of a convergence in readmission rates between blacks and whites from 1996 to 2001. Blacks started with lower readmission rates than did whites in 1996, but as Figure V.4 shows, blacks’ rates increased more, for three out of four procedures, than did whites’ (esophagectomy, pneumonectomy, and lobectomy).

Figure V.4. Change in Cancer Surgery Readmits, 1996-2001, by Race
VI. RATES BY AGE

A. DISCHARGE RATES

In 2001, lobectomy was the most frequently performed surgery in all age groups. A higher proportion of pancreatectomies than the other cancer surgeries were performed on patients 75 and above.

MQMS: Outcomes of Cancer Surgeries
Between 1994 and 2001, an increasing proportion of lobectomies and pneumonectomies were performed on the most elderly patients. Pneumonectomy rates declined among the youngest and increased among the oldest beneficiaries. Lobectomy rates among patients 85 to 94 increased by more than 50 percent.
VII. GENDER

A. DISCHARGE RATES

Figure VII.1. Ratio of Cancer Surgery Discharge Rates by Gender: Male/Female

Men’s discharge rates for all surgeries exceeded women’s rates. The difference in rates for lobectomy, pancreatectomy and esophagectomy were roughly comparable to differences in cancer incidence rates. In 2001, men were almost 4 times as likely to incur esophageal cancer as women, and the discharge rate for esophagectomy is more than 4 times higher for men than for women. Men were over a third more likely to have pancreatic cancer, and had a 45 percent higher discharge rate for pancreatectomy. Though the difference in lobectomy rates between men and women corresponds to the 60 percent greater likelihood of lung cancer among men, the male pneumonectomy rate was disproportionately high, relative to the incidence of lung cancer (Ries et al., 2003).
B. MORTALITY

Figure VII.2. Ratio of Cancer Surgery Mortality by Gender: Male/Female

Male mortality rates following pancreatectomy, lobectomy and pneumonectomy exceeded female rates throughout the 1990s.

C. READMISSION

Figure VII.3. Ratio of Cancer Surgery Readmits by Gender: Male/Female
Men’s readmission rates exceeded women’s rates for all four procedures during the 1990s. Male readmission rates for lobectomy and pneumonectomy were more than 20 percent higher than female rates.
VIII. REGIONAL FINDINGS

A. DISCHARGE RATES

Figure VIII.1. 2001 Cancer Surgery Rates by Geographic Region

In 2001, discharge rates for three of four cancer surgeries (all but esophagectomy) were lowest in the West.
B. MORTALITY RATES

Figure VIII.2. 2001 Cancer Surgery Mortality by Geographic Region

In 2001, esophagectomy and pancreatectomy mortality were highest in the South. Pancreatectomy mortality in the South exceeded that of other regions by at least 25 percent.

Figure VIII.3. Change in Cancer Surgery Mortality, 1996-2001, by Geographic Region

MQMS: Outcomes of Cancer Surgeries
Between 1996 and 2001, lobectomy mortality declined 21 percent in the West, the largest decline for this procedure among all regions, while pneumonectomy mortality increased 11 percent, the largest increase. The West was also the site of the largest decrease in esophagectomy mortality (36 percent) of all regions.

C. READMISSION RATES

Figure VIII.4. 2001 Cancer Surgery Readmits by Geographic Region

Readmission rates for the four cancer surgeries were lowest in the West. The pancreatectomy readmission rate was less than that of the next lowest region by 20 percent.
Compared to 1996, Western readmission rates for pancreatectomy, esophagectomy and lobectomy in 2001 were lower or unchanged, while readmission rates in all other regions increased.
IX. RESULTS FOR RURAL AND URBAN RESIDENTS

A. DISCHARGE RATES

Throughout the study period rural residents were about 10 percent more likely to undergo pneumonectomy than were their urban counterparts, and about 10 percent less likely to undergo lobectomy. Esophagectomy rates for rural residents converged with urban rates, while rural pancreatectomy rates remained about 20 percent below urban rates.
B. MORTALITY RATES

Figure IX.2. Ratio of Cancer Surgery Mortality: Rural/urban

From 1996 to 2001, the mortality rate for rural pneumonectomy patients increased relative to the rate for urban patients by over 50 percent, from 10 percent below to more than 40 percent above the urban rate.

C. READMISSION RATES

Figure IX.3. Ratio of Cancer Surgery Readmits: Rural/urban

MQMS: Outcomes of Cancer Surgeries
In 2001, readmission rates for rural patients undergoing any of the four procedures were greater than or equal to the rates of their urban counterparts. Rural pneumonectomy patients were readmitted over 20 percent more often than were urban patients in 2001. Rural readmission rates for all four procedures increased relative to urban rates.
X. DISCUSSION

Our results have a number of implications relevant for further research. They suggest that the volume mortality relationship for these procedures is strong and may be growing stronger over time. The reasons for the relationship and its apparent strengthening are both important research topics. There is also evidence here of disparities in treatment and perhaps access to care, as blacks’ higher cancer incidence is associated with equal or lower surgery rates. The evidence indicates that lobectomy is replacing pneumonectomy for most lung cancer. Rural areas may be lagging in this change in treatment of lung cancer, resulting in increased mortality. The results also suggest that practice in the West is substantially different than other regions, using a lower level of surgical and hospital care. We should investigate the ramifications of this difference for mortality and quality of life.

A CMS panel was convened to review the surgeries chosen for MQMS, outcomes measures, risk-adjustment methods and analytic categories.

The panel was curious about the choice of cancer procedures for monitoring, because they are rarely performed. The procedures were selected because the risk of death is high, because they are usually performed not to palliate suffering but in an effort to prolong life, and because the procedures appear to be highly sensitive to volume. Of eight cancer procedures monitored by Birkmeyer et al. (2002), we chose to monitor four. Four were excluded because they were believed the most likely of the eight to be palliative. The four excluded are cystectomy, gastrectomy, nephrectomy and colectomy.

The panel discussed whether patient outcome rates should be adjusted for more than patient age and sex. We did not risk adjust because the only provider level analysis performed was the volume analysis. Previous research does not show much evidence that higher volume hospitals admit patients with more comorbidities. Acuity may increase with volume, but acuity cannot usually be detected with administrative data. The panel thought it would still be worthwhile to monitor the distribution of case complexity, both over time and between quintiles.

Some on the panel were concerned about presenting results based on the patient’s place of residence, as opposed to the location of the hospital where care was actually rendered. However, discharge rates by patient residence tell us what kind of care patients in different regions are getting, and whether they appear to be receiving too much or not enough treatment depending on where they live. For example, the report indicates that rural residents are no less likely to receive these surgeries and that rural residents have increasing access to surgery.

Arguments for reporting by patient place of residence extend to outcomes. Patients can easily be referred across state lines for elective surgery. Thus, a measure of state performance, or of the performance of rural relative to urban regions, is how well patients, or their doctors, are doing in finding good hospitals for care. Some panelists felt it important to know where patients are being treated and whether patients at rural
hospitals or the hospitals in particular states are doing well. Monitoring outcomes by hospital location is straightforward but suffers from the drawback that discharges cannot be monitored as population rates. We would have to monitor the total number of procedures or the proportion of all procedures performed by hospital location.

The volume outcome correlation indicates that policy to steer patients to specific providers can affect overall outcomes for these procedures. A policy to affect outcomes may be carried out through regulation or through dissemination of information about hospital volume. We can monitor the surgeries and the volumes of the hospitals where they are performed to determine whether sorting of patients into the hospitals that produce the best outcomes is occurring. The panel was interested in knowing whether the number of hospitals where the procedures are performed has increased and whether procedures are increasingly concentrated in a few facilities.

The panel discussed the reasons for the inverse correlation of mortality and volume. The reasons discussed were surgeon and hospital experience versus the referral patterns of primary doctors.

While correlation of surgeon volume and hospital volume may explain the volume outcome relation for some procedures, cancer procedures exhibit a hospital volume outcome relation, even controlling for physician volume.

The panel discussed the role of transportation time in choosing a hospital. Most felt that physician referral patterns were the primary cause of patients’ hospital choice. The panel felt that research into doctors’ choices for referrals and for hospitals is the most policy-relevant research focus.

The panel discussed whether, if policymakers were trying to direct patients from low volume to high volume sites, they should use a regulatory approach or attempt to change behavior by public release of information. Generally, panel members seemed to feel that because of the number of hospitals already performing the procedure, a regulatory approach would be too contentious. A combination of public dissemination and research into the relative roles of physician and hospital volume and research into how doctors make referrals are the most likely to be fruitful.


APPENDIX A

MEASURE SPECIFICATIONS
### A. DISCHARGE RATE, READMISSION RATE, AND MORTALITY RATE

<table>
<thead>
<tr>
<th>Measure</th>
<th>Rate of discharges from short-stay hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case Definition</td>
<td>Depends on the surgery. See Section B, which includes Case selection criteria for each surgery.</td>
</tr>
<tr>
<td>Population</td>
<td>Beneficiaries eligible for Medicare in January of each calendar year, enrolled in Part A for the full year, and not enrolled in Medicare managed care at any point in the year. Beneficiaries who died during the calendar year but who would have otherwise qualified are included.</td>
</tr>
</tbody>
</table>
| Computation | Numerator: Number of surgical discharges in a 3-year or 5-year period  
Denominator: Number of beneficiaries in the population in a 3-year or 5-year period  
Rates are expressed in thousands. |
| Rationale | Description of surgery use |
| Data Sources | MedPAR File  
Denominator File  
CMS Cross-Reference File |
| Exclusions | Missing or invalid values for state, sex, race, Medicare Status  
Discharges from all hospitals other than short-stay hospitals  
Duplicate records  
Discharges from stand-alone emergency rooms  
Discharges with invalid procedure codes  
Discharges for Medicare beneficiaries whose Health Insurance Claim Number (HICNO) does not have a match in CMS’s Cross-Reference File  
Overlapping beneficiary acute-care, short-stay hospital claims |
## Appendix A: Measure Specification

### Adjustment
Rates are age/sex adjusted using the Medicare Part A FFS population as of July 1, 1999, as the standard population.

National-level results are standardized with 18 age/sex groups using direct standardization. State-level results are standardized using indirect standardization, due to smaller sample sizes. Both methods are described in Anderson et al. (1998).

### Period
1992-2001. For 3-year averages, the first year reported is 1994, which includes the years 1992 to 1994. For 5-year averages, 1996 is the first year.

### Stratifiers
- **Age** (0-54, 55-64, 65-69, 70-74, 75-79, 80-84, 85-89, 90-94, 95+) on July 1 of the reference year.
- **Race** (white, black, other)
- **Sex**
- **Reason for Medicare eligibility** (aged without ESRD, disabled without ESRD, ESRD).
- **Dual enrollment** defined as enrolled in Medicare Part A and with Medicaid buy-in at least one month during the calendar year.*
- **Urban/rural** based on the metropolitan statistical area (MSA) and Bureau of Economic Analysis (BEA) State and County Crosswalk File developed for the CMS’ Prospective Payment System. All counties in an MSA are designated as urban; all other counties are considered rural.
- **Census region** of the beneficiary’s residence on March 31 of the year following the reference year
- **State** of the beneficiary’s residence on March 31 of the year following the reference year

* The Medicare data do not record true dual enrollment status but only whether a state Medicaid program pays the beneficiary’s Medicare premiums, co-pays, and deductibles. The payment of these Medicare expenses by Medicaid does not always translate into full Medicaid coverage. Nevertheless, the buy-in indicator in the Medicare data is a reasonably accurate indicator of beneficiary poverty.
<table>
<thead>
<tr>
<th>Measure</th>
<th>Beneficiary-level readmission rates following surgical discharges, by type of readmission (for all causes) within 30 days of discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case Definition</td>
<td>Depends on the surgery. See Section B, which includes Case selection criteria for each surgery.</td>
</tr>
<tr>
<td>Population</td>
<td>Medicare beneficiaries eligible for Medicare in January of each calendar year, and enrolled in Part A and FFS for the full calendar year, who had a discharge for the relevant. Beneficiaries who died during the calendar year but who would have otherwise qualified are included.</td>
</tr>
</tbody>
</table>
| Computation | Numerator: Number of beneficiaries hospitalized for all causes within 30 days of first surgical discharge in a year during a 3-year or 5-year period  
Denominator: Number of beneficiaries with at least one surgical discharge in a year during a 3-year or 5-year period  
Rates are expressed in thousands. Rates with numerators of 25 or less are suppressed in tables.  
Readmissions include same-day readmissions to the same facility. Maryland readmission rates may not be comparable to those in other states. Maryland is the only state with a waiver from the CMS’s prospective payment system. Due to Maryland’s all-payer system, transfers may have been counted as readmissions, inflating readmission rates, especially short-term rates.  
Rates do not include beneficiaries who entered managed care or died within the window follow-up period. |
| Rationale | Description of surgical outcomes |
| Data Sources | MedPAR File  
Denominator File  
CMS Cross-Reference File |
### Exclusions
- Missing or invalid values for state, sex, race, Medicare Status
- Discharges from all hospitals other than short-stay hospitals
- Duplicate records
- Discharges from stand-alone emergency rooms
- Discharges with invalid procedure codes
- Discharges for Medicare beneficiaries whose Health Insurance Claim Number (HICNO) does not have a match in CMS’s Cross-Reference File
- Overlapping beneficiary acute-care, short-stay hospital claims

### Adjustment
Rates are age/sex adjusted using the Medicare Part A FFS population as of July 1, 1999, as the standard population.

National-level results are standardized with 18 age/sex groups using direct standardization. State-level results are standardized using indirect standardization, due to smaller sample sizes. Both methods are described in Anderson et al. (1998).

### Period
1992-2001. For 3-year averages, the first year reported is 1994, which includes the years 1992 to 1994. For 5-year averages, 1996 is the first year.
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</tr>
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</tr>
<tr>
<td>Census region</td>
<td>of the beneficiary’s residence on March 31 of the year following the reference year</td>
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<tr>
<td>State</td>
<td>of the beneficiary’s residence on March 31 of the year following the reference year</td>
</tr>
<tr>
<td>Hospital volume quintile</td>
<td>based on the number of similar procedures performed at the index provider during a 3-year or 5-year period. See Section C.</td>
</tr>
</tbody>
</table>

* The Medicare data do not record true dual enrollment status but only whether a state Medicaid program pays the beneficiary’s Medicare premiums, co-pays, and deductibles. The payment of these Medicare expenses by Medicaid does not always translate into full Medicaid coverage. Nevertheless, the buy-in indicator in the Medicare data is a reasonably accurate indicator of beneficiary poverty.
### Measure
Mortality rates among beneficiaries with a surgical hospitalization

### Case Definition
Depends on the surgery. See Section B, which includes Case selection criteria for each surgery.

### Population
Medicare beneficiaries eligible for Medicare in January of each calendar year, and enrolled in Part A and FFS for the full calendar year, who had a discharge for the relevant. Beneficiaries who died during the calendar year but who would have otherwise qualified are included.

### Computation
- **Numerator:** Number of beneficiaries who died within 30 days from the day of the first (index) surgical procedure in the year during a 3-year or 5-year period
- **Denominator:** Number of beneficiaries receiving surgery each year in a 3-year or 5-year period

Rates are expressed in thousands. Rates with numerators of 25 or less are suppressed in tables.

Rate do not include beneficiaries who switched to managed care within the window follow-up period.

### Rationale
Description of surgical outcomes

### Data Sources
- MedPAR File
- Denominator File
- CMS Cross-Reference File

### Exclusions
- Missing or invalid values for state, sex, race, Medicare Status
- Discharges from all hospitals other than short-stay hospitals
- Duplicate records
- Discharges from stand-alone emergency rooms
- Discharges with invalid procedure codes
- Discharges for Medicare beneficiaries whose Health Insurance Claim Number (HICNO) does not have a match in CMS’s Cross-Reference File
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*Appendix A: Measure Specification*
### Appendix A: Measure Specification

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* The Medicare data do not record true dual enrollment status but only whether a state Medicaid program pays the beneficiary’s Medicare premiums, co-pays, and deductibles. The payment of these Medicare expenses by Medicaid does not always translate into full Medicaid coverage. Nevertheless, the buy-in indicator in the Medicare data is a reasonably accurate indicator of beneficiary poverty.
B. CASE SELECTION CRITERIA

ESOPHAGECTOMY

ICD-9-CM procedure codes:
43.99 OTHER TOTAL GASTRECTOMY
42.40 ESOPHAGECTOMY, NOS
42.41 PARTIAL ESOPHAGECTOMY
42.42 TOTAL ESOPHAGECTOMY

AND
ICD-9-CM diagnosis codes (all 4th and 5th digits):
150 MALIGNANT NEOPLASM OF ESOPHAGUS

PANCREATECTOMY

ICD-9-CM procedure codes:
52.51 PROXIMAL PANCREATECTOMY
52.53 RADIAL SUBTOTAL PANCREATECTOMY
52.7 RADICAL PANCREATEICODUODENECTOMY

AND
ICD-9-CM diagnosis codes (all 4th and 5th digits):
152 MALIGNANT NEOPLASM OF SMALL INTESTINE, INCLUDING DUODENUM
156 MALIGNANT NEOPLASM OF GALLBLADDER AND EXTRAHEPATIC BILE DUCTS
157 MALIGNANT NEOPLASM OF PANCREAS

LOBECTOMY

ICD-9-CM procedure codes:
32.4 LOBECTOMY OF LUNG

AND
ICD-9-CM diagnosis codes (all 4th and 5th digits):
162 MALIGNANT NEOPLASM OF TRACHEA, BRONCHUS, AND LUNG
163 MALIGNANT NEOPLASM OF PLEURA
164 MALIGNANT NEOPLASM OF THYMUS, HEART, AND MEDIASTINUM
165 MALIGNANT NEOPLASM OF OTHER AND ILL-DEFINED SITES WITHIN THE RESPIRATORY SYSTEM AND INTRATHORACIC ORGANS

PNEUMONECTOMY

ICD-9-CM procedure codes:
32.5 COMPLETE PNEUMONECTOMY

AND
ICD-9-CM diagnosis codes (all 4th and 5th digits):
162 MALIGNANT NEOPLASM OF TRACHEA, BRONCHUS, AND LUNG
163 MALIGNANT NEOPLASM OF PLEURA
164 MALIGNANT NEOPLASM OF THYMUS, HEART, AND MEDIASTINUM
165 MALIGNANT NEOPLASM OF OTHER AND ILL-DEFINED SITES WITHIN THE RESPIRATORY SYSTEM AND INTRATHORACIC ORGANS

Appendix A: Measure Specification
C. HOSPITAL VOLUME CASE SELECTION CRITERIA

ESOPHAGECTOMY

*ICD-9-CM procedure codes:*
43.99 OTHER TOTAL GASTRECTOMY
42.40 ESOPHAGECTOMY, NOS
42.41 PARTIAL ESOPHAGECTOMY
42.43 TOTAL ESOPHAGECTOMY

PANCREATECTOMY

*ICD-9-CM procedure codes:*
52.51 PROXIMAL PANCREATECTOMY
52.53 RADIAL SUBTOTAL PANCREATECTOMY
52.8 RADICAL PANCREATICODUODENECTOMY

LUNG RESECTIONS

*ICD-9-CM procedure codes:*
32.6 LOBECTOMY OF LUNG
32.7 COMPLETE PNEUMONECTOMY