Robert Wood Johnson Foundation

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Stroke Patients Join Heart Attack Patients in a Statewide Database in New Jersey

Expanding the New Jersey myocardial infarction data acquisition system to include stroke patients

SUMMARY

The Myocardial Infarction Data Acquisition System (MIDAS) at the University of Medicine and Dentistry of New Jersey-Robert Wood Johnson Medical School, in New Brunswick, is the only database in the world that includes information on virtually all acute myocardial infarctions (heart attacks) in a state.

From 2007 through 2011, researchers at the university expanded MIDAS to include data on more than 900,000 stroke hospital admissions in New Jersey from 1994 through 2009. The research team used the new data, as well as existing information, to conduct research leading to the publication of more than 20 articles in professional journals.

Key Findings

Principal Investigator John B. Kostis, MD, identified the following studies, reported in professional journals, as key:

The Effect of Weekend Versus Weekday Hospital Admissions for Strokes

- Between 1996 and 2007, the percentage of New Jersey stroke patients who died within 90 days of hospital admission was greater for those admitted on weekends and holidays than for those admitted on weekdays (17.2% versus 16.5%). In the view of researchers this statistically significant increase, which could account for several thousand deaths annually in the United States, may be related to decreased hospital staffing during weekends. (*Stroke*[1])

Trends in Mortality From Heart Attacks

Between 1986 and 2007, in-hospital deaths from heart attack in New Jersey decreased from 16.9 percent to 7.5 percent. However, deaths occurring from 30 days after

[1] McKinney JS, Deng Y, Kasner SE and Kostis JB. "Comprehensive Stroke Centers Overcome the Weekend Versus Weekday Gap in Stroke Treatment and Mortality." *Stroke*, 42(9): 2403–2409, 2011. Abstract available online.

discharge out to one year after discharge *increased* by 1.2 percent. The increase was especially evident among older age groups and was due to deaths that were unrelated to cardiovascular events.

For researchers this suggests that better long-term outcomes for such patients requires expanding care strategies beyond cardiovascular issues to target chronic diseases.(*Circulation: Cardiovascular Quality and Outcomes*[2])

The Effect of Statin Drugs in Decreasing Cardiovascular Events in Women

- In 18 studies done before 2010, statin therapy was associated with significant decreases in cardiovascular events and in all-cause mortality for both men and women. Statin therapy therefore should be used in appropriate patients without regard to sex. (*Journal of the American College of Cardiology*[3])

Funding

The Robert Wood Johnson Foundation (RWJF) supported this project with a grant of $250,000.

CONTEXT

In 2007, the Myocardial Infarction Data Acquisition System (MIDAS) at the University of Medicine and Dentistry of New Jersey–Robert Wood Johnson Medical School was the only statewide database on heart attacks with longitudinal follow-up for mortality, cause of death, recurrent hospitalization and diagnostic and interventional (invasive) cardiac procedures. It included data for more than 500,000 New Jersey heart attack patients, along with longitudinal follow-up for up to 20 years for all patients.

MIDAS has helped state regulators, hospital administrators, the scientific community, and patients by providing data on heart attack occurrence rates, management, length of stay, comorbidities, complications, and outcomes in different patient subsets.

The database also had another potential: to provide similar information regarding stroke patients. Stroke is an affliction that, according to the CDC, causes some 137,000 deaths a year in the United States.

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[2] Kostis WJ, Deng Y, Pantazopoulos JS, Moreyra AE and Kostis JB. "Trends in Mortality of Acute Myocardial Infarction After Discharge From the Hospital." *Circulation: Cardiovascular Quality and Outcomes*, 3(6): 581–589, 2010. Available online.

[3] Kostis WJ, Cheng JQ, Dobrzynski JM, Cabrera J and Kostis JB. "Meta-Analysis of Statin Effects in Women Versus Men." *Journal of the American College of Cardiology*, 59(6): 572–582, 2012. Abstract available online.

RWJF's Interest in This Area

Although the Robert Wood Johnson Foundation has operated on a national scale since its formation in 1972, it has continued funding a limited number of local institutions and projects in the New Brunswick area and throughout New Jersey. It does so in part to honor the legacy of its founder, and in part to recognize the special responsibilities to the communities and the state in which it is located. RWJF's Anthology's chapter, "Tending Our Backyard," tells the story of the Foundation's grantmaking in New Jersey.

THE PROJECT AND ITS FINDINGS

Under this grant, the research team at the University of Medicine and Dentistry of New Jersey–Robert Wood Johnson Medical School expanded MIDAS to include data on more than 900,000 New Jersey strokes hospitalizations from 1994 through 2009. The grant, which ran from 2007 through 2011, also supported other core activities including maintenance of the database and data input.

The research team used the new data on stroke patients, as well as existing information, to conduct research leading to the publication of 21 articles in professional journals. (See the Bibliography for details.)

Principal Investigator Kostis identified the following studies as key:

The Effect of Weekend Versus Weekday Hospital Admissions for Strokes

While a 2007 study[4] using MIDAS data conclusively showed that heart attack patients admitted to hospitals on weekends were less likely to receive invasive cardiac procedures and were slightly more likely to die than those admitted on weekdays, studies of weekend disparities in stroke care have produced inconsistent findings.

To understand more clearly this so-called weekend effect as it pertains to strokes, the research team conducted a study using MIDAS data to:

- Compare 90-day mortality rates among patients admitted to New Jersey hospitals with acute ischemic stroke on weekends and holidays and those admitted on weekdays. Prior research focused on in-hospital mortality with variable results, and had not included holidays.
- Determine whether any differences in mortality could be explained by:
  - Improvements over time in the care provided to stroke patients

[4] Kostis WJ, Demissie K, Marcella SW, Shao Y-H, Wilson AC and Moreyra AE. "Weekend Versus Weekday Admission and Mortality From Myocardial Infarction." *New England Journal of Medicine*, 356(11): 1099–1109, 2007. Available online.

— The designation of the hospital as a stroke center (New Jersey hospitals are designated by the state as either comprehensive stroke centers, primary stroke centers, or non-stroke centers, based on their level of specialized care.)

Researchers examined data for 134,441 patients admitted between 1996 and 2007 to hospitals with a primary diagnosis of stroke. A total of 27.8 percent had been admitted on a weekend or holiday. Overall 23.4 percent had been admitted to a comprehensive stroke center, 51.5 percent to a primary stroke center and 25.1 percent to a non-stroke center. The research team assessed out-of-hospital deaths by matching MIDAS records with New Jersey death registration files.

Findings

Researchers reported these findings in an article in *Stroke*:[5]

- **The percentage of stroke patients who died within 90 days of hospital admission was greater for those admitted on weekends and holidays than for those admitted on weekdays (17.2% versus 16.5%).** Researchers felt that this statistically significant increase, which could account for several thousand deaths annually in the United States, may be related to decreased staffing and procedures in hospitals during the weekends.
- **For patients admitted to comprehensive stroke centers no difference in 90-day mortality was observed on weekends versus weekdays.** Researchers felt this indicates that the statewide designation process for stroke centers may exert a positive effect on stroke care.

Mortality Trends for Heart Attack Patients After Discharge From the Hospital

In the decades leading up to 2010, researchers observed a marked decrease of in-hospital deaths of patients admitted with heart attacks. Longer-term mortality had also declined, but in some studies this decline was less pronounced than mortality occurring before discharge, implying that mortality after discharge had worsened.

To better understand trends in post-discharge mortality of heart attack patients, the research team used data from MIDAS to examine the outcomes and other variables (e.g., patient characteristics, other diseases, complications, interventions, and length of hospital stay) of 285,397 patients 35 years or older who were discharged from a New Jersey hospital for a first heart attack between 1986 and 2007. For out-of-hospital death information, the team matched MIDAS records to the New Jersey death registration files.

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[5] McKinney JS, Deng Y, Kasner SE and Kostis JB. "Comprehensive Stroke Centers Overcome the Weekend Versus Weekday Gap in Stroke Treatment and Mortality." *Stroke*, 42(9): 2403–2409, 2011. Available online.

Findings

Researchers reported these findings in an article in *Circulation: Cardiovascular Quality and Outcomes*:[6]

- **In-hospital deaths from heart attacks during 1986–2007 decreased from 16.9 percent to 7.5 percent; however, there was an *increase* in mortality from the time of hospital discharge out to one year (from 12.1% to 13.9%).**
- **Deaths from admission to 30 days after admission—a critical indicator, which in this study was not influenced by the length of stay in the hospital—were nearly cut in half in this same period, from 18.2 percent to 10.2 percent.**
- **While in-hospital deaths and deaths within a month of discharge had declined substantially, deaths from 30 days after discharge out to one year after during these years *increased* by 1.2 percent.** For researchers, this increase is a small but important signal, because the increase was especially evident among older age groups and was due to deaths that were not related to cardiovascular events. Instead, they were chiefly from respiratory and renal diseases, septicemia and cancer. Addressing these latter causes may result in better long-term outcomes.

  In an editorial[7] accompanying the article in the journal, Véronique L. Roger, MD, MPH, notes that this finding of a shift in the cause of death for this group from cardiovascular to non-cardiovascular marks a "substantial paradigm shift." Specifically, the central implication of this shift is that "improving long-term outcomes requires expanding care strategies beyond the boundaries of the heart to target chronic diseases."

The Effect of Statin Drugs in Decreasing Cardiovascular Events in Women

Randomized controlled clinical trials and meta-analyses (research that analyzes data from other independent studies) have shown that the use of statin drugs decreases the incidence of cardiovascular events in both apparently healthy individuals and those with evident cardiovascular disease. However, there has been insufficient information on the benefits of statins in women, especially for women not yet suffering from cardiovascular disease.

To understand the effect of statins in decreasing cardiovascular events in women, researchers conducted a meta-analysis of 18 randomized clinical trials done prior to 2010

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[6] Kostis WJ, Deng Y, Pantazopoulos JS, Moreyra AE and Kostis JB. "Trends in Mortality of Acute Myocardial Infarction After Discharge From the Hospital." *Circulation: Cardiovascular Quality and Outcomes*, 3(6): 581–589, 2010. Available online.

[7] Roger VL. "Myocardial Infarction Outcomes: 'The Times, They Are A-Changin … '" *Circulation: Cardiovascular Quality and Outcomes*, 3(6): 568–570, 2010. Available online.

that studied the use of statin therapy with clinical outcomes for men and women. The analysis included 141,235 subjects, including 40,275 women.[8]

Eight of the studies were designed as primary-prevention trials (although five of the primary-prevention studies did include a proportion of patients with cardiovascular disease), and 10 were secondary-prevention studies.

Primary prevention is care intended to prevent the onset of disease. An example of primary prevention is immunization. Secondary prevention aims at treating asymptomatic persons who have developed risk factors for a disease or have been diagnosed with the disease in its pre-clinical or asymptomatic phase. An example of secondary prevention is screening individuals for a disease that exhibits an extended latency period.

Findings

Researchers reported these findings for 18 studies done prior to 2010 in an article in the *Journal of the American College of Cardiology*:[9]

- **Statin therapy is associated with significant decreases in cardiovascular events and in all-cause mortality in both women and men.** Statin therapy therefore should be used in appropriate patients without regard to sex.
- **The treatment effect in women is more pronounced in the secondary-prevention studies—that is, of asymptomatic women who had developed risk factors or who had a diagnosis of pre-clinical cardiovascular disease—compared with the reduction in outcomes found in the primary-prevention studies.**

Other Funding

Schering-Plough Corporation provided an additional $250,000 for this project.

AFTERWARD

With funding from Schering-Plough and other funders, the research team continues to use MIDAS data to pursue its research agenda on cardiovascular disease. As of February 2012, papers under review included the following titles:

- "Temporal Trends in Incidence of Stroke Among Children: A 14-Year Statewide Study" by Gandhi SK, McKinney JS, Sedjro JE, Cheng JQ, Deng Y, Cosgrove NM, Cabrera J and Kostis JB. *Stroke.* In press, June 2012.

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[8] Although the study did not use data from MIDAS, it was conducted with funding from RWJF under this grant.

[9] Kostis WJ, Cheng JQ, Dobrzynski JM, Cabrera J and Kostis JB. "Meta-Analysis of Statin Effects in Women Versus Men." *Journal of the American College of Cardiology*, 59(6): 572–582, 2012. Abstract available online.

- “Sex Differences in Ischemic Stroke Mortality” by McKinney JS, Deng Y, Paolucci U and Kostis JB.
- “Trends in Mortality of Acute Ischemic Stroke After Hospital Discharge” by McKinney JS, Deng Y, Paolucci U and Kostis JB.
- “Racial Disparities in Ischemic Stroke Mortality” by McKinney JS, Deng Y, Paolucci U and Kostis JB.

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