also declined in nonteaching hospitals but more gradually (18.6% [95% CI, 18.2%-19.0%] mortality prereform, 15.2% [95% CI, 14.8%-15.6%] short-term, and 11.7% [95% CI, 11.3%-12.1%] long-term; $P=.02$ and $P=.001$ for short- and long-term difference-in-difference, respectively). Compared with trends in nonteaching hospitals, reform was not associated with changes in adjusted mortality in very minor or minor teaching hospitals for high-risk patients with AMI, CHF, or stroke. However, reform was associated with short- and long-term reductions in adjusted inpatient mortality for high-risk patients with pneumonia in very minor or minor teaching hospitals ($P=.02$ and $P=.02$ for short- and long-term difference-in-difference, respectively, compared with nonteaching hospitals). Reform was not associated with changes in mortality for low-risk patients (Supplemental Table, available online at http://www.mayoclinicproceedings.org).

Discussion. Our study found that the 2003 ACGME reforms were associated with similar short- and long-term reductions in inpatient mortality for high-risk patients with pneumonia, CHF, and stroke in major and very major teaching hospitals, consistent with the hypothesis that reductions in resident fatigue may improve outcomes among high-risk patients who are plausibly most susceptible to fatigue-associated errors.[3] Alternatively, implementation of hospital safeguards such as intensive care unit intensivist staffing may contribute to our findings. Previous studies have suggested that older medical patients with specific comorbidities experienced larger reductions in mortality after duty hour reform[4]; other investigations have suggested no effect for the highest-risk patients.[3] Although our study was limited by a primary outcome of inpatient (rather than 30-day) mortality and an inability to account for multiple hospitalizations of the same individual over time,[4] our findings are reassuring that ACGME reform has not had long-term adverse impacts on hospital mortality and instead may have benefited high-risk medical patients.

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Supplemental Online Material. Supplemental material can be found online at http://www.mayoclinicproceedings.org.

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Adverse Cardiac Effects of Bisphosphonates

To the Editor: Pittman et al[1] recently reported that bisphosphonate use was associated with an increased risk of incident acute myocardial infarction (AMI) in their observational study of elderly veterans with a history of osteoporotic fractures. Of note, they also reported that "the timing of AMI correlated closely with the timing of bisphosphonate therapy initiation."

In 2012, Boonen et al[2] reported that annual intravenous infusion of 5 mg of the bisphosphonate zoledronic acid was associated with significantly more AMI events than placebo in men over age 50 with osteoporosis ($P=.03$) but stated that "none of the events were considered by the investigator to be related to the study drug." It was not explained

how the investigator determined whether zoledronic acid played a role in causing the significant increase in AMI events associated with its use. It should be noted that this study was funded by the manufacturer and that the significant increase in myocardial infarction in the patients receiving the study drug was not mentioned in the article's abstract but rather was buried in the "Safety" section of their article.

An earlier study of a similar regimen of zoledronic acid vs placebo for treatment of postmenopausal osteoporosis found that serious atrial fibrillation occurred more frequently in the zoledronic acid group ($P<.001$).[3]

Given that we now have at least 3 studies documenting significantly increased rates of adverse cardiac outcomes with the use of bisphosphonates, it may be time to conduct a large randomized clinical trial examining the cardiac safety of bisphosphonate therapy.

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Data Previously Presented: Dr Keller writes an ongoing series of comments on PubMed Commons (a blog). The observations made in this letter were previously included in his blog, at the following link: http://www.ncbi.nlm.nih.gov/pubmed/23113482#cm23113482_3697.

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In reply—Adverse Cardiac Effects of Bisphosphonates

I appreciate Dr Keller's comments and agree with his call for additional research focusing on the cardiovascular effects of bisphosphonate therapy. A prospective clinical study would be a welcome addition to our knowledge base on this topic. Given the association of oral calcium supplementation with myocardial infarction and other cardiovascular events,[1] future studies of bisphosphonates and cardiovascular events should also analyze the effects of oral calcium supplementation. There is a paucity of data on female subjects, and future studies should be designed to include this population.

Bisphosphonates remain a staple of osteoporosis management and a vital tool for fracture prevention. However, the emerging awareness of the association between cardiovascular events and bisphosphonate therapy prompts clinicians to further personalize osteoporosis management. The World Health Organization Fracture Risk Assessment Tool (FRAX)[2] and the National Osteoporosis Foundation's *Clinician's Guide to Prevention and Treatment of Osteoporosis*,[3] which incorporates the FRAX score, are useful aids. They may assist clinicians to minimize unnecessary bisphosphonate exposure in some patients who have low bone mineral density (BMD) but not osteoporosis. (An important caveat is that FRAX is most useful in patients with a low femoral neck BMD, and it may underestimate fracture risk in patients who have low BMD at the lumbar spine but a relatively normal BMD at the femoral neck.)

Additionally, health care professionals may submit a MedWatch voluntary report[4] when adverse cardiovascular events occur in patients taking bisphosphonates. Such reports may provide a springboard for increased awareness and for future research on this subject.

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CORRECTION

In the article "**Lipoprotein(a), Cardiovascular Disease, and Contemporary Management**," published in the November 2013 issue of *Mayo Clinic Proceedings* (2013;88(11):1294-1311), Lp(a) cholesterol and Lp(a)-C should read as Lp(a) throughout the article.

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