Each July, teaching hospitals experience an influx of new residents and fellows who recently have graduated from medical school or completed residency training programs. During this period, teaching hospitals also assign new positions of responsibility to existing residents and fellows. Medical education is a core mission of teaching hospitals, and, in these hospitals, interns, residents, and fellows play major roles in patient care. This recurrent cycle in which care is delivered by less experienced physicians in the initial month of the academic year has led to the often expressed conventional wisdom of "not to get sick in July."

In addition to the lore surrounding July admissions to teaching hospitals, previous studies have shown that physician experience is an important determinant of outcomes for a wide range of medical conditions and procedures. Moreover, literature from economics and other fields has shown that employee turnover can adversely affect organizational productivity. Given that teaching hospitals face both inexperienced physicians as well as high turnover early in the academic year, it is reasonable to be concerned about the potential for lower quality care around that time.

Based on these concerns, a number of studies over the past 25 years have compared patient outcomes in teaching hospitals during July and later months of the academic year. Indeed, a recent systematic review by Young et al identified 39 studies that examined care delivered in a wide range of clinical settings, including inpatient medical and surgical wards, intensive care units, operating rooms, and emergency rooms. Of these 39 studies, 27 (69%) evaluated hospital mortality, and of these 27 studies, only 6 (22%) found higher mortality among patients who received care in July or the early months of the academic year associated with housestaff turnover. However, as highlighted by Young et al, there was a strong relationship between the methodological quality of studies and the likelihood of finding higher mortality in teaching hospitals during these months. For example, higher mortality was found in 5 of the 11 (45%) studies rated as higher quality compared with only 1 of the 16 (6%) studies rated as lower quality. The adjusted odds of death in the 5 studies with higher mortality ranged from 1.08 to 1.34. In addition, studies that found differences in mortality also tended to be adequately powered to detect differences in mortality (eg, 10–20%) that would be considered clinically significant. Of the 6 high-quality studies that were adequately powered, 4 (67%) found statistically significant differences in mortality.

Although these findings suggest a trend toward higher mortality in July in teaching hospitals, as noted by Young et al, 2 of the 5 higher-quality studies that reported higher mortality only noted the differences in mortality for some, but not all, patient populations. Thus, considerable uncertainty remains about the existence of the "July Phenomenon" and the degree to which it poses patient risks. Moreover, studies that have sought to link the July Phenomenon to other outcomes, such as medication errors and morbidity, have produced inconsistent results.

It is in this context that the findings reported in this issue of Circulation by Jena et al add to our understanding of the potential adverse effects of housestaff inexperience and also highlight reasons why previous studies have yielded conflicting results. Analyzing data from the National Inpatient Sample of >76000 patients admitted to 1451 US hospitals with acute myocardial infarction (AMI) in May and July over a 7-year period (2002–2008), they found that risk-adjusted mortality was significantly lower in May than in July in teaching-intensive hospitals for patients in the highest quartile of severity of illness (18.8% in May versus 22.7% in July, P<0.01). However, differences in mortality in teaching-intensive hospitals for patients in the lowest three quartiles of severity of illness were not significant (2.1% in May versus 1.9% in July). In contrast, no differences in risk-adjusted mortality in higher-severity patients or lower-severity patients were seen in nonteaching and lower-intensive teaching hospitals. Moreover, additional analyses of patients in the highest quartile of severity found that May to July differences in mortality were essentially limited to patients in the highest decile of risk, in whom the adjusted odds of death in July relative to May were 1.40 compared with 1.07 in patients at the 75th to 90th percentile of severity. These findings suggest that the effects of physician inexperience at the start of the academic year may be limited to patients with the highest risk of death. Nevertheless, the study could not identify clinical factors (eg, use of coronary revascularization, bleeding complications) that were related to the increased risk of death in July. Thus, differences in the process of care that may stem from nonclinical factors (eg, experience of housestaff) may not have been captured.

The opinions expressed in this article are not necessarily those of the editors or of the American Heart Association.

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from the relative inexperience of residents and fellows in July or their working in a new and unfamiliar environment remain to be elucidated.

Interestingly, differences in mortality were limited to July. In analyses of individual months, no direct relationship was seen between months of resident experience and risk-adjusted mortality. For example, the adjusted odds of death in teaching-intensive hospitals, relative to other hospitals, were lower in August (0.82) than in September through December. These data suggest that, if the July Phenomenon is real, it likely reflects differences in care that are related to the initial assimilation of new residents and that are remedied in a relatively short period.

An additional important finding of the current study was that May to July differences in mortality in high-severity patients were limited to the 98 teaching hospitals with the highest ratio (>0.60) of residents per bed. Other teaching hospitals with lower resident/bed ratios had similar risk-adjusted mortality in May and July. Thus, the influence of resident physician inexperience may be limited to a smaller number of teaching hospitals that are most dependent on resident physicians for care delivery.

An important strength of the current study is its inclusion of a large national sample of hospitals, in contrast to most previous studies that involved single hospitals or a relatively small number of hospitals in a single region. Although the study relied on administrative data, which may lack information on important clinical parameters, the analysis was based on a “difference in difference” approach that compared May to July differences in mortality in teaching-intensive and other hospitals. Thus, potential limitations of administrative data with regard to the ability to risk-adjust outcomes are much less of a concern, as long as unmeasured aspects of severity are similar across different months.

So, should the findings of Jena et al\textsuperscript{14} be a cause for concern? Perhaps, but several other factors and caveats should be acknowledged. First, the study only examined patients with a single diagnosis, AMI, which accounts for barely 2\% of admissions to US hospitals.

It is possible that factors associated with resident inexperience and turnover that lead to higher mortality in July among the most severely ill patients are unique to specific diagnoses, such as AMI. Thus, the generalizability of the current findings to other diagnoses needs to be established. Moreover, the current study was limited in its ability to examine differences in care that might lead to higher mortality early in the academic year. Additional research to identify the specific care processes associated with the higher mortality may provide important insights into ways to improve AMI care for all patients.

Second, the effects on mortality were limited to a single month in teaching-intensive hospitals, but, even during this month, risk-adjusted mortality was similar in teaching-intensive and other hospitals. For all other months, the adjusted odds of death in teaching-intensive hospitals relative to other hospitals were <1.0 for high-severity patients, reaching statistical significance for 7 of these months (range, 0.74 in March to 0.94 in October). For lower-severity patients, adjusted odds ratios for the risk of death in teaching-intensive hospitals were <1.0 for all 12 months, reaching statistical significance for 10 months, including July (adjusted odds ratio, 0.64). Thus, overall, patients with AMI fared better in teaching-intensive hospitals, findings that have been demonstrated previously.\textsuperscript{16,17}

Third, it is possible that the increased mortality in July for high-severity patients represents a spurious finding. Curiously, the adjusted odds of death for lower-severity patients in teaching-intensive hospitals, relative to other hospitals, were lower in July (0.64) than for the 11 other months (range, 0.68–0.89). Reasons why resident inexperience might lead to higher mortality for more severely ill patients and lower mortality for less severely ill patients are unclear.

However, perhaps the most worrisome finding was that May to July differences in mortality in high-severity patients in teaching-intensive hospitals increased over time with adjusted odds of death of 1.53 to 1.78 during 2006 to 2008 and 0.87 to 1.27 during 2002 to 2005. These post hoc analyses require confirmation. However, the findings raise concern that changes in the structure of residency and fellowship training programs that occurred in response to national resident duty-hour regulations in 2003 may have had unintended adverse consequences on outcomes early in the academic year—for example, through losses in continuity, increases in patient handoffs, or through changes over time in the cultures and expectations of residency training programs—although previous studies have not found associations between duty-hour regulations and increases in mortality over the course of the entire academic year.\textsuperscript{18}

It is also important to recognize that there have been innumerable other changes in healthcare delivery that took place between 2002 and 2008 that could lead to increases in July mortality. For example, during this period, many health systems were introducing new electronic medical record systems. Although the potential benefits of such systems are well chronicled, it is likely that there is an initial steep learning curve associated with the use of electronic medical records that are magnified as new residents and fellows face the challenges of adapting to new patient care responsibilities and working in new clinical environments. In addition, most teaching hospitals were establishing new nonteaching services in response to duty-hour regulations. Similar to teaching services, the nonteaching services often involved the assimilation of new attending physicians in July, many of whom were recent graduates of residency training programs. If future studies do confirm that mortality differences in the early part of the academic year are indeed increasing, then it would be critical to more directly examine factors that may responsible for such differences.

In conclusion, the work by Jena et al\textsuperscript{14} provides new insights about the increased risk of death that may be associated with admission to teaching hospitals during the initial month of the academic year—notably, that such risks may be limited to the most severely ill patients in the most teaching-intensive hospitals. However, like many well-done studies, the study also raises a number of important questions for future research regarding the specific factors that may underlie the July Phenomenon. Elucidating these factors may have important insights for improving quality of care and patient outcomes in all hospitals.
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None.

References

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