The Status of Adult Inpatient Care by Family Physicians at US Academic Medical Centers and Affiliated Teaching Hospitals 2003 to 2012: The Impact of the Hospitalist Movement

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BACKGROUND AND OBJECTIVES: Over the past 10–15 years, the number of hospitalists has grown from a few hundred to over 30,000, and hospitalists have assumed a greater proportion of the care of hospitalized patients. No existing studies report on the impact this movement has had on the characteristics of the hospital practice of family physicians in teaching hospitals. To explore this impact we examined the volume and scope of discharges by family physicians at teaching hospitals in 2003 and 2012, the most recent decade of hospitalist growth. We also compared the characteristics of family physicians’ hospital practices in 2012 with hospitalists in 2012 to assess for differences in hospital performance.

METHODS: We used the University Health Consortium (UHC) Clinical Database to capture adult non-pregnancy-related inpatient discharges in US teaching hospitals by family physicians and hospitalists in 2003 and 2012. We calculated the proportion of inpatient discharges by specialty in all UHC hospitals; did a qualitative comparison of frequent discharge diagnoses; and analyzed length of stay, case mix index, 7- and 30-day readmission rates, and mortality by specialty using UHCs risk adjustment methodology.

RESULTS: The proportion of all inpatient discharges by family physicians in UHC hospitals was stable between 2003 and 2012 (2.7% versus 2.6%) though the volume increased. Over the same time, the proportion of discharges attributable to hospitalists increased (0.0% to 13.9%) with a concomitant decrease in proportion of discharges from general medicine (18.4% to 13.9%) and all other specialties (78.9% to 73.2%). Fourteen of the top 20 discharge diagnoses by family physicians from UHC hospitals were the same between 2003 and 2012. Family physicians and hospitalists shared 17 of the top 20 discharge diagnoses in 2012. Length of hospital stay was stable for family medicine across time and lower than that of hospitalists (4.5 versus 5.5 days; P<.001). Seven- and 30-day readmission rates for any cause were lower for hospitalists but there was no difference in either rate when limited to readmission for the same DRG. Hospitalists cared for a somewhat more complex patient mix.

CONCLUSIONS: The growth of hospitalists has had little to no impact on the proportion of inpatient discharges in teaching hospitals by family physicians. Quality of care as judged by length of stay, mortality, and readmission rates was comparable between family physicians and hospitals in 2012.

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Past studies investigating inpatient care by hospitalists and family physicians are limited by small sample sizes, evaluation in only one hospital, examination of a limited number of diagnoses such as pneumonia, and are all based on samples at particular points in time. In the largest analysis to date, Lindemaur et al reported a retrospective cohort study in 2007 describing the outcomes of common discharge diagnoses of 76,926 patients by hospitalists, general internists, and family physicians. Hospitalists had a modestly shorter length of stay (0.4 days) and lower costs ($268) but similar rates of death and 14-day readmission rates when compared to family physicians. However, none of these studies address the impact of the hospitalist movement on the volume, scope, and outcomes of family medicine adult inpatient care longitudinally in a large national sample.

The purpose of this study was to determine if the volume of discharges, scope of discharge diagnoses, or outcomes of non-pregnancy-related adult inpatient care by family physicians in US academic health centers and teaching hospitals changed between 2003 and 2012, the most recent 10 years during which the hospitalist movement has experienced such dramatic growth.

Methods
The source of data for this study was the University HealthSystem Consortium (UHC). UHC is an alliance of 113 academic medical centers and 254 of their affiliated teaching hospitals, representing approximately 90% of the nation’s nonprofit academic medical centers in the United States (www.uhc.edu). All UHC hospital members submit clinical and administrative data monthly, which is then aggregated for analysis in the Clinical Data Base/Resource Manager (CDB/RM). The CDB/RM provides comparative data and analytic tools to benchmark cost, length of stay, complications, mortality, readmission rates, and other outcomes of interest using a risk adjustment methodology described below.

We collected data from all hospitals that reported to the UHC in both 2003 and 2012 (n=98) but focused our analysis on those that also coded for hospitalist as a unique and specific identifier of the discharging physician in 2012 (n=40). We included only adult inpatient discharges (>18 years of age) and excluding pregnancy-related discharges. UHC hospitals did not begin coding for hospitalist as the specialty of the discharging physician until 2006 in this sample so data specific to hospitalists were not available in 2003. UHC considers the discharging physician as a hospitalist when the discharging service is a hospitalist service. We chose only to use 2012 hospitalist data, assuming that coding for hospitalists was more accurate and complete in 2012 than in prior years. We used the data to provide historical comparisons for family medicine (2003 to 2012) and contemporary comparisons between family medicine and hospitalists (2012).

We performed three sets of analyses. First, we analyzed the relative changes in discharge volume and the proportion of all included discharges by family physicians, hospitalists, general internists, and all other specialists to determine the overall impact of hospitalist growth on the volume and proportion of family medicine adult inpatient care relative to hospitalists, general internists, and all other specialties.

To assess potential changes in the types of patients cared for by family physicians, we identified the top 20 discharge diagnoses for family medicine in 2003 and in 2012 and for hospital medicine in 2012. We then identified those that were common or unique in the historical and contemporary comparisons. We collapsed similar diagnostic codes into one when appropriate (eg, systolic heart failure, diastolic heart failure, and congestive heart failure not otherwise specified were collapsed into a single diagnosis of heart failure). Finally, we conducted a comparative analysis between family physicians in 2003 and 2012 and hospitalists in 2012 for the following performance measures: observed and expected length of stay (LOS), LOS index, observed and expected mortality, mortality index, percent ICU cases, 7- and 30-day readmit rates for both any or related diagnosis related group (DRG), and case mix index (CMI).

Performance measures were calculated from all discharged patients, not only the most frequent diagnoses. We used the standard UHC risk adjustment methodology to calculate severity of illness by CMI and to adjust performance measures. This methodology involves: (1) selection of a patient population within the UHC CDB/RM to serve as the basis of the model to provide norms, (2) use of multiple regression techniques to predict LOS and probability of mortality based on the normative patient population, (3) assignment of an expected LOS and expected mortality rate to each patient.

Logistic regression models are constructed for the binary outcome variable in-hospital mortality. Means for all patients were used to summarize LOS. The analyses were performed using SAS version 9.2 (SAS Institute Inc, Cary, NC) and R version 2.9.2 (R Foundation for Statistical Computing, Vienna, Austria).

The data extraction and analysis were performed by co-authors who were UHC staff research analysts (SM, SH) at the time that the work was completed. The physician coauthors were provided with aggregate data only that could not be linked to specific discharging physicians or hospitals. This study was exempted by the Institutional Review Board at the University of Michigan.

Results
The volume of discharges of non-pregnant adult inpatients by family physicians increased by 2,377 from 2003 to 2012, whereas the relative proportion of all discharges made by family physicians remained essentially stable (2.7% versus 2.6%).
In contrast, the volume and proportion of discharges by general internal medicine physicians declined by 51,493 and 9.1%, respectively. The relative proportion of discharges by all other specialties declined 5.7% as well, although the total volume increased. Discharges coded as hospitalist as the specialty increased from zero in 2003 to 127,985 in 2012, 13.9% of the total discharges (see Table 1).

Seventeen of the most frequent discharges (top 20) by family physicians and hospitalists in 2012 were identical (see Table 2). Hospitalists discharged patients with sickle cell crisis and acute respiratory failure more frequently than family physicians. There were four diagnoses that family physicians discharged frequently in 2003, hypovolemia, coronary artery disease, venous thrombosis, and pyelonephritis, that were not in the top 20 for either family medicine or hospital medicine in 2012. Fourteen of the top 20 diagnoses for family medicine in 2003 and 2012 were the same.

Table 3 displays a comparison of selected performance measures between family physicians in 2003 and 2012 and hospitalists in 2012. Within family medicine, observed LOS was unchanged between 2003 and 2012 but the expected LOS increased from 4.6 to 4.8, resulting in a slight improvement in the LOS index from 1.0 to 0.9. In contrast, hospitalist patients in 2012 experienced a 5.5 day observed LOS while the expected LOS was 5.2, which gave an LOS index of 1.05.

Hospitalists in 2012 cared for somewhat sicker patients than family physicians in 2012 (CMI 1.2 versus 1.3) and had a significantly higher percentage of ICU cases (12.6% versus 35.5%). Both hospitalists and family physicians had strikingly low observed mortality rates (1.1% and 1/6%) compared to expected mortality rates (2.2% and 3.1%) and therefore low mortality indexes (0.50 and 0.52). Of interest, the observed mortality rates and mortality index for family physicians declined from 2003 to 2012 (2.2% versus 1.1%; 0.85 versus 0.50).
Among family medicine patients readmitted for all DRGs, there was a statistically significant increase over time in 30-day readmission rates between 2003 and 2012 (15.1% to 17.5%) but the 7-day readmission rate declined slightly over time (6.9% to 6.7%). For patients readmitted for the same DRG by family physicians, there was a slight, but statistically insignificant, reduction between 2003 and 2012. In 2012, hospitalists had lower readmission rates than family physicians for readmissions attributed to any DRG, but there was no significant difference for readmissions attributed to the same DRG.

Discussion
As expected, hospitalists increased their share of adult inpatient discharges substantially. The increase appears to have been accompanied by an overall increase in discharge volume in these 40 hospitals and a relative decline in the proportion of discharges from general internists, family physicians, and from all other specialties except family medicine. The volume of discharges by family physicians has increased slightly, and the proportion of discharges attributed to family physicians is similar between 2003 and 2012 in these hospitals. The proportionate decline in discharges by general internists (8.1%) and all other specialties except family medicine (5.7%) in 2012, when added together (13.8%), corresponds closely to the increased proportion of discharges by hospitalists (13.9%) in 2012. We conclude that the shifts in inpatient care have been away from general internists and all other specialties except family physicians to hospitalists (almost all of whom are trained as general internists but limit their practice to hospital medicine).

The majority of the most frequent discharge diagnoses by family physicians in 2003 were also present for family physicians in 2012 as well as for hospitalists in 2012 (see Table 2), which suggests that the scope of inpatient family medicine has changed very little over this 10-year period and was similar to hospitalists in 2012. There were several minor shifts in the most common diagnoses of adult inpatients discharged by family physicians from 2003 to 2012. For example, more outpatient options for managing venous thrombosis, pyelonephritis, and hypovolemia have become available. The diagnoses were among the frequent discharges by family physicians in 2003, but none of these diagnoses were among the most frequent for either family medicine or hospital medicine in 2012. Similarly, coronary artery disease, on the family medicine list in 2003, did not appear on either family medicine or hospital medicine in 2012. We speculate that these patients are more commonly now being attended to by cardiologists rather than family physicians or hospitalists. Hospitalists had two diagnoses in their most frequent diagnoses list that did not appear on either family medicine or hospital medicine in 2012: sickle cell crisis and acute respiratory failure. This is consistent with findings that hospitalists care for sicker patients and more ICU patients than family physicians. These minor shifts in frequent discharge

<p>| Table 3: Length of Stay, Intensive Care, Mortality, Readmission Rates, and Case Mix Index for Family Physicians (2003, 2012) and Hospitalists (2012) |
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<table>
<thead>
<tr>
<th></th>
<th>Family Medicine</th>
<th>Hospitalists</th>
<th>P Value</th>
</tr>
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<tr>
<td>Number of discharges</td>
<td>21,654</td>
<td>24,041</td>
<td>127,985</td>
</tr>
<tr>
<td>LOS observed mean days</td>
<td>4.5</td>
<td>4.5</td>
<td>5.5</td>
</tr>
<tr>
<td>LOS expected mean days</td>
<td>4.6</td>
<td>4.8</td>
<td>5.2</td>
</tr>
<tr>
<td>LOS index</td>
<td>0.98</td>
<td>0.94</td>
<td>1.06</td>
</tr>
<tr>
<td>Intensive care unit cases (%)</td>
<td>13.1%</td>
<td>12.6%</td>
<td>35.5%</td>
</tr>
<tr>
<td>Intensive care unit mean days</td>
<td>3.2</td>
<td>3.5</td>
<td>5.8</td>
</tr>
<tr>
<td>Observed deaths (%)</td>
<td>2.2%</td>
<td>1.1%</td>
<td>1.6%</td>
</tr>
<tr>
<td>Expected deaths (%)</td>
<td>2.6%</td>
<td>2.2%</td>
<td>3.1%</td>
</tr>
<tr>
<td>Mortality index</td>
<td>0.85</td>
<td>0.50</td>
<td>0.52</td>
</tr>
<tr>
<td>All readmits: 30 days (%)</td>
<td>15.1%</td>
<td>17.5%</td>
<td>16.0%</td>
</tr>
<tr>
<td>All readmits: 7 days (%)</td>
<td>6.9%</td>
<td>6.7%</td>
<td>6.2%</td>
</tr>
<tr>
<td>Related readmits: 30 days (%)</td>
<td>5.7%</td>
<td>6.8%</td>
<td>6.6%</td>
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<tr>
<td>Related readmits: 7 days (%)</td>
<td>2.6%</td>
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<tr>
<td>Case mix index</td>
<td>1.1</td>
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<td>1.3</td>
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LOS—length of stay
diagnoses reflect changes in disease treatment approaches and likely shifts between specialists other than family physicians. In summary, the hospitalist movement appears not to have had an impact on the types of patients cared for on family medicine adult inpatient services in these hospitals between 2003 and 2012.

Although the majority of diagnoses managed by family physicians and hospitalists in 2012 were similar, hospitalists cared for a larger percentage of intensive care unit patients. As expected, the unadjusted LOS and mortality rates for patients cared for by hospitalists were substantially higher than family physicians, but even when corrected for severity of illness some differences remain. Family physicians have a lower observed LOS (4.5 versus 5.5), a lower expected LOS (4.8 versus 5.2), and a lower LOS index (0.9 versus 1.0) than hospitalists. This finding is in contrast to that of Coffman and of Lindenauer. In a 2006 sample of Medicare patients, Coffman found a 0.36 day shorter LOS for hospitalists than non-hospitalists, although the non-hospitalist data was not further stratified by family medicine for a direct comparison. Lindenauer did compare LOS for hospitalists and family medicine among admissions in 45 hospitals included in the Perspective database in 2007 and found that hospitalists had a 0.4 day shorter stay. Though these studies are 6–7 years old, our finding of 1.0 day shorter LOS compared to hospitalists does not appear to be explained solely by trends over time. The LOS for family medicine increased only minimally from 2003 to 2012.

The mortality index dropped for family medicine in 2003 from 0.9 to 0.5 in 2012, which is nearly identical to the mortality index for hospital medicine in 2012 (0.52), despite the sicker patients that hospitalists care for. We hypothesized that the low mortality index and the improvement in the mortality index for family medicine might be due to an increase in the reliance on hospice. However, in a separate analysis, discharge to hospice did not have an impact on the index. It is possible that the low mortality indexes in 2012 may simply reflect the quality of care. Irrespective of the explanation, family physicians and hospitalists are comparable on this measure.

Differences in readmission rates were significant only for those readmitted for all diagnosis-related groups (DRGs), but there was no difference between family physicians and hospitalists for those patients readmitted for a related DRG. The only other similar analyses were by Carek and Lindenauer, who examined readmit rates between hospitalists and family medicine at 30 and 14 days, respectively, for any DRG. Neither study showed a difference.

One of the limitations of this study was that we included only academic and teaching hospitals, only had access to the specialty of the discharging physician, and did not have more detailed information on their practice styles. For example, we believe it is safe to assume that most of the patient discharges coded to hospitalists were cared for by general internists working on hospitalist services. However, we do not know the practice style of the family physicians in these hospitals, many, if not most, of whom include family medicine residency programs and dedicated residency facility who supervise family medicine inpatient teaching services. We assume that, most commonly, a cadre of teaching family physicians rotate on the inpatient service staffed by resident physicians. Alternatively, community-based family physicians may have admitted patients to the inpatient resident team and either attended on those patients personally or handed the patient over to the inpatient attending at the time. Therefore, this comparison is more accurately described as one between hospitalist services staffed by general internists and a variety of family medicine teaching services. These results therefore may not apply to family physicians and hospitalists practicing in non-teaching hospitals, which are the majority of hospitals in the United States.

Another limitation was the relatively recent and likely incomplete coding for hospitalist discharges. UHC only began coding separately for hospitalists in 2006, and not all hospitals code separately for hospitalists as the discharging physician even in 2012. The likely impact of this undercoding of hospitalist discharges in our view is an underestimation of the growth of hospitalist discharges as a proportion of the entire volume of discharges and an over-estimation of discharges by general internists, since most hospitalists are general internists. Because very few hospitalists are family physicians, we believe that the uncertainty as to whether family physician hospitalists are coded as family medicine or hospital medicine does not have any important impact on family physician discharge volume estimates in our study.

Readmission data were limited in this study by the inability to capture readmissions to non-UHC hospitals. We speculate that readmissions to non-UHC hospitals of patients cared for on family medicine services, which may focus more on continuity patients than hospitalist services, may be less likely to occur in the case of patients cared for on hospitalist services. If so, the more likely bias in our estimation is that the 30-day readmission rate for hospitalists could be underestimated. However, it is quite possible that this potential bias operates equally for hospitalist discharges and family physician discharges.

A final limitation is that this study was a non-randomized comparison. Although the diagnoses cared for are similar, and we applied appropriate risk adjustment methodology to account for case mix differences, there remains the possibility of unmeasured confounding variables that, if measured and included in our models, may have produced different findings.
Despite these potential limitations, to our knowledge, this is the first report describing the volume, scope of care, and outcomes comparing family medicine discharges over a 10-year interval and with hospitalist discharges.

Conclusions
Family physicians provided a stable proportion of adult inpatient discharges from UHC hospitals in 2003 and in 2012. When risk adjusted, length of stay was lower, and mortality rates were similar for family physicians and hospitalists in 2012. Readmission rates for related diagnoses were similar. Family physicians cared for much the same diagnostic mix of adult inpatients in 2003 as in 2012 and share the majority of frequent discharge diagnoses with hospitalists. Hospitalists tended to care for more complex and sicker patients, but the case mix index for family physicians actually increased slightly between 2003 and 2012. We conclude that the dramatic growth in the hospitalist movement has had little to no impact on the volume, quality, or content of adult inpatient care by family physicians in US academic and teaching hospitals.

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References