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Comanagement of hospitalized surgical patients by medicine physicians in the United States

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Abstract

Background—Comanagement of surgical patients by medicine physicians has been shown to improve efficiency and reduce adverse outcomes. We examined the extent to which comanagement is employed during hospitalizations for common surgical procedures in the United States.

Methods—A retrospective cohort study of Medicare fee-for-service beneficiaries hospitalized for one of 15 inpatient surgical procedures in 1996 through 2006 (n=694,806). Proportion of Medicare beneficiaries comanaged by medicine physicians (generalist physicians or internal medicine subspecialists) during hospitalization.

Results—Between 1996 and 2006, 35.2% of patients hospitalized for a common surgical procedure were comanaged by a medicine physician: 23.7% by a generalist physician and 14% by an internal medicine subspecialist (2.5% were comanaged by both). The percentage of patients experiencing comanagement was relatively unchanged from 1996–2000, then increased sharply. The increase was entirely due to an increase in comanagement by generalist physicians. In a multivariable multilevel analysis, comanagement by generalist physicians increased 11.5% per year during 2001 to 2006. Patients with advanced age, more comorbidities, or receiving care in non-teaching, mid-size (200–499 beds) or for profit hospitals were more likely to receive comanagement. All of the growth in comanagement was attributed to increased comanagement by hospitalist physicians.

Conclusions—Medical comanagement of Medicare beneficiaries hospitalized for a surgical procedure is increasing because of the increasing role of hospitalists. To meet this growing need for comanagement, training in internal medicine should include medical management of surgical patients.

Introduction

Comanagement of surgical patients refers to patient care in which the medicine physician daily assesses acute issues, addresses medical comorbidities, communicates with surgeons, and facilitates patient care transition from the acute care hospital setting[1].

Benefits of comanagement include: increased prescribing of evidence-based treatments[2]; reduced time to surgery[3]; fewer transfers to an ICU for acute medical deterioration[4]; lower

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post-operative complications[4–6]; increased likelihood of discharge to home[4]; reduced length of stay[7]; improved nurse and surgeon satisfaction[5]; and a lower 6-month readmission rate[2].

Using a 5% national Medicare sample, we examined the rate of comanagement of surgical patients by generalist physicians or internal medicine subspecialists in US hospitals from 1996 through 2006. We also examined how comanagement by medicine physicians varied by type of surgery, and by patient and hospital characteristics.

Methods

The study cohort consisted of 694,806 hospital admissions in the 5% Medicare sample who had inpatient surgery between 1996 and 2006 and were discharged with a surgical *Diagnosis Related Group* (DRG) associated with at least one of the following procedures: cholecystectomy (DRG 493, 195, 196, 197, 198); resection for colorectal cancer (DRG 148, 149); abdominal aortic aneurysm repair (DRG 110); lower extremity revascularization (DRG 553, 554, 478); major leg amputation (DRG 113, 213, 285); coronary artery bypass grafting surgery (DRG 105, 547, 548, 549, 550); aortic/mitral valve replacement (DRG 104, 105); lung resection for cancer (DRG 75); radical prostatectomy (DRG 334); transurethral resection of the prostate for BPH (DRG 476, 306); radical nephrectomy for renal cancer (DRG 303); back surgery (DRG 496, 497, 498, 499); knee replacement (DRG 544); hip replacement (DRG 544); and repair of hip fracture (DRG 210, 211, 544). Surgical DRGs selected were those used by the *Dartmouth Atlas of Healthcare*[7] for benchmarking US hospitals and associated with a mean length of stay >3 days.

We identified two types of comanagement: that by a generalist physician (i.e., general internist, geriatrician, family practitioner or general practitioner) and that by an internal medicine subspecialist.

Comanagement was defined by the relevant physician (generalist or internal medicine subspecialist) submitting a claim for evaluation and management services on ≥70% of the days the patient was hospitalized, including partial days (i.e., admission and discharge days).

Inpatient physician claims were identified using AMA-CPT E&M codes 99221–99223 (initial hospital visit), 99251–99255 (inpatient consultation) and 99231–99233 (subsequent hospital visit). We also analyzed the effect of various cutpoints for minimum percent of total hospital days for which a medicine physician provided care.

In some analyses we examined comanagement of surgical patients by hospitalist physicians, as previously defined.[8]

Statistical Analyses

The proportion of admissions comanaged by any medicine physician was calculated, then stratified by patient and hospital characteristics. Linear trend in percentage of patients comanaged from 1996 to 2006 was tested using likelihood ratio test. Two trends were identified: during 1996–2000 and during 2001–2006. Hierarchical generalized linear models with a logistic link, adjusting for clustering of admissions (level 1) within hospitals (level 2), were constructed to evaluate comanagement during 2001–2006 with any medicine physician or generalist physician.

Analyses were performed with SAS version 9.1 (SAS Inc., Cary, NC). GLIMMIX was used to conduct multilevel analyses.

Results

Between 1996 and 2006, 35.2% of patients hospitalized for a common surgical procedure were comanaged by medicine physicians: 23.7% by a generalist physician and 14% by an internal medicine subspecialist (2.5% were comanaged by both).

Comanagement by any medicine physician for patients hospitalized for a surgical procedure increased from 33.3% in 1996 to 40.8% in 2006 ($p<0.001$). A likelihood ratio test showed two distinct time trends ($p<0.001$). The percentage of surgical patients receiving comanagement changed little during the late 1990s, then increased in 2001(Figure1). The increase in comanagement was limited to comanagement by generalist physicians. Comanagement by generalist physicians increased from 20.5% in 1996 to 31.3% in 2006 ($p<0.001$). This increase was entirely due to an increase in comanagement by generalist physicians who were hospitalists. Comanagement by hospitalists increased from 1.7% of patients in 1996 to 12.5% in 2006.

The percent of patients comanaged by a medicine physician varied by type of surgery (Figure 2). For example, comanagement by a medicine physician increased from 28.6% in 1996 to 41.7% in 2006 ($p<0.001$) for patients hospitalized for orthopedic surgery but actually decreased for patients hospitalized for cardiothoracic surgery, from 43.0% in 1996 to 39.9% in 2006 ($p<0.001$).

Table 1 shows how comanagement varied by patient and hospital characteristics. Older adults, females, those with low socioeconomic status and those with more comorbidities were more likely to receive comanagement. Most comanaged patients were seen by a generalist physician, except for those undergoing cardiothoracic surgery, who were more likely to be comanaged by internal medicine subspecialists (almost entirely cardiologists or pulmonologists). Surgical patients cared for in non-teaching, mid-size and for-profit hospitals were more likely to receive medical comanagement.

After adjusting for other variables, comanagement by a generalist physician increased at 11.4% per year and overall comanagement by any medicine physician increased 7.8% per year during 2001–2006 (Table 2). Advanced age, emergency admissions and increasing comorbidities were all strong predictors of comanagement. Patients cared for in major teaching hospitals were substantially less likely to receive comanagement. Comanagement varied widely by region, with patients in New England much less likely than others to be comanaged.

In these analyses, we defined comanagement as participation of a medical physician on ≥70% of total hospital days. Using different cutpoints (e.g ≥50%, or ≥80% of hospital days) changed the estimates of percentage of patients receiving comanagement. However, the pattern of increase in comanagement over time, and the association of comanagement with patient and hospital characteristics did not change appreciably by cutpoint.

Conclusion

We found a rapid rise in the percentage of hospitalized surgical patients comanaged by a medicine physician. The increase, begun in 2001, was caused by more comanagement by generalist hospitalist physicians. The percentage of patients comanaged by internal medicine subspecialists or non-hospitalist generalist physicians was essentially unchanged from 1996 through 2006.

Orthopedic surgery patients experienced the fastest growth in medical comanagement, and the greatest overall use of comanagement by generalist physicians. Almost all studies of

comanagement are in orthopedic patients[2–6, 9]. Indeed, the rapid growth in medical comanagement coincided with the first randomized controlled trials published in 2001, showing benefits of comanagement in orthopedic patients[9]. Clearly, prospective trials of medical comanagement are needed in other surgical disciplines.

The growth in care of surgical patients by medical physicians raises the issue of appropriate training. A cross sectional survey of generalist physicians who devoted ≥25% time to inpatient care revealed perioperative management was underemphasized during their training[10]. The American Council of Graduate Medical Education currently does not list competencies in perioperative management as a core requirement for internal medicine training[11]

The growth in comanagement by medicine physicians in our study was attributed to increased care by hospitalist physicians. Hospitalists are well suited to respond quickly to changes in postoperative patients. A recent survey found that 91% of hospitalists have cared for surgical patients[12]. The Society of Hospital Medicine recognizes perioperative management as a key skill for hospitalists and lists competencies in perioperative medicine as core requirements[13]

Older adults and those with comorbidities are more likely to receive comanagement. These patients are at higher risk for complications of surgery, and will more likely benefit from comanagement. In a recent study of Medicare beneficiaries, among patients re-hospitalized within 30 days of a surgical discharge, 70.5% were re-hospitalized for a medical condition[14]. Closer attention to medical comorbidities during initial hospitalization might be expected to reduce this rate.

The increase in comanagement of surgical patients by hospitalists has implications for number of hospitalists needed. If we assume that 100% of Medicare patients hospitalized for surgical procedures are to be followed by hospitalists that would require an additional of 2500 to 3000 full time equivalent hospitalists given the current workload of hospitalist[15].

Our study has several limitations. First, we examined comanagement only in a fee-for-service Medicare population and findings may not be generalizable to non-Medicare patients. We studied fifteen common inpatient surgeries performed in this population, and results may not apply to other surgeries. These represent 39.1% of all surgical procedures in this population.

Our definition of comanagement — evaluation and management claims submitted on at least 70% of all hospital days by a medicine physician — is arbitrary. Using different cutpoints changed the proportion of patients comanaged but not the increasing trend. A further limitation is that we did not assess processes or outcomes of care and therefore cannot comment on any benefits of comanagement.

In summary, comanagement of surgical patients by medicine physicians is increasing. To meet this need, training in internal medicine should include medical management of surgical patients. Further prospective trials of comanagement in surgical patients in specialties other than orthopedic surgery are clearly needed.

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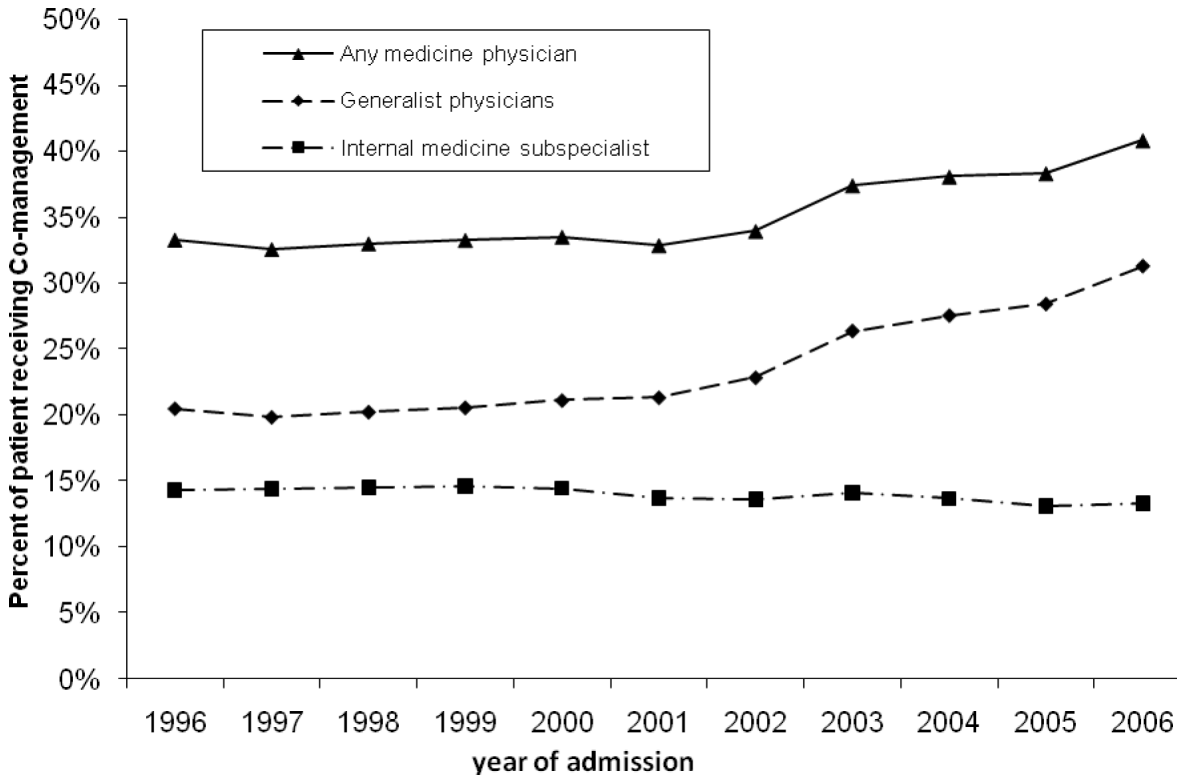

Figure 1. Trends in comanagement[a] of patients hospitalized for a surgical procedure between 1996 and 2006 by a generalist physician[b], internal medicine sub-specialist[c] or any medicine physician[d]

[a]A patient is defined as "having comanagement" if any medicine physician submitted evaluation and management (E&M) claims for at least 70% of the days during the patients hospital stay for a surgical procedure.

[b]Any medicine physician: either a generalist physician or an internal medicine subspecialist

[c]Generalist physician includes: internal medicine physician, geriatrician, family practitioner or a general practitioner

[d]Internal medicine subspecialist includes: pulmonary, cardiology, gastroenterology, endocrinology, rheumatology, nephrology, infectious disease and hematology/oncology.

For all point estimates the 95% confidence interval are less than 0.5% and are not shown.

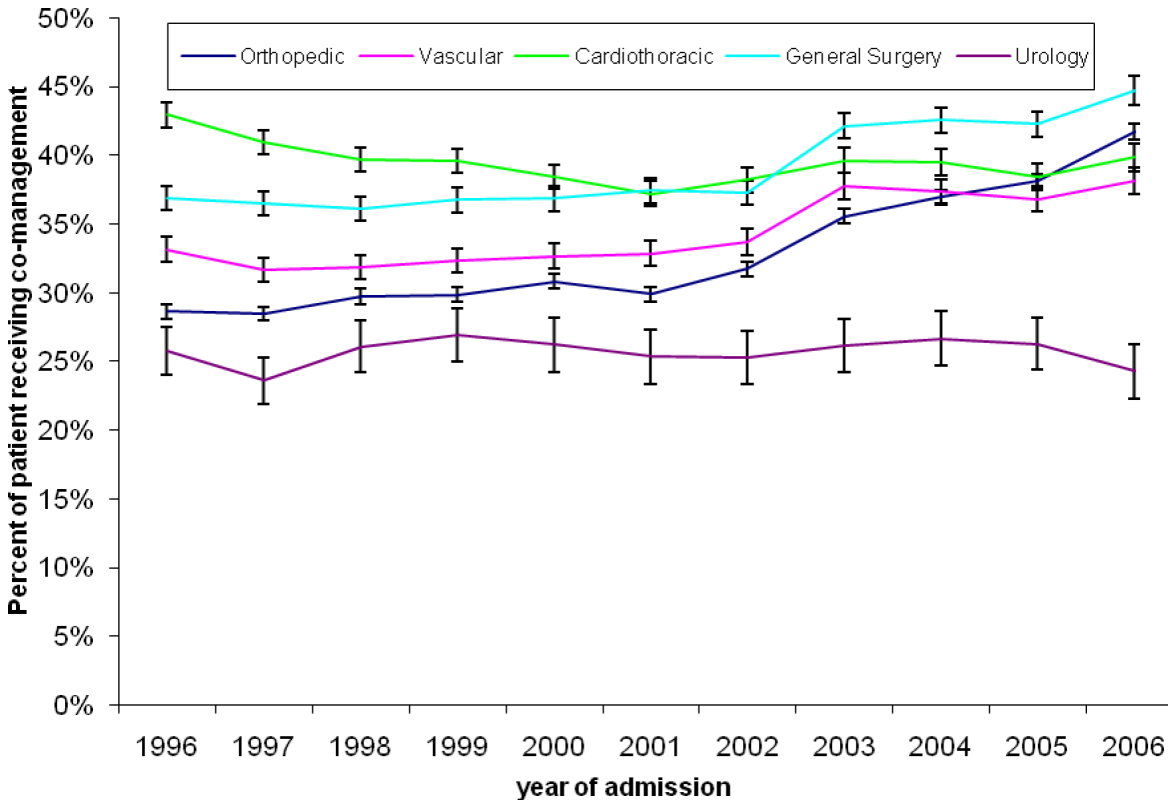

Figure 2. Trends in medical comanagement by type of surgery for patients hospitalized for a surgical procedure between 1996 and 2006

General surgery includes cholecystectomy (DRG 493, 195, 196, 197, 198) and resection for colorectal cancer (DRG 148, 149),

Vascular surgery includes abdominal aortic aneurysm repair (DRG 110), lower extremity revascularization (DRG 553, 554, 478) and major leg amputation (DRG 113, 213, 285)

Cardiothoracic surgery includes coronary artery bypass grafting (DRG 105, 547, 548, 549, 550), aortic/mitral valve replacement (DRG 104, 105) and lung resection for cancer (DRG 75)

Urology includes radical prostatectomy (DRG 334), transurethral resection of the prostrate for BPH (476, 306) and radical nephrectomy for renal cancer (DRG 303)

Orthopedic surgery includes back surgery (DRG 496, 497, 498, 499), knee replacement (DRG 544), hip replacement (DRG 544) and repair for hip fracture (DRG 210, 211, 544)

Table 1

Percent of surgical patients comanaged by any medicine physician[a] or a generalist physician[b] stratified by selected patient and hospital characteristics[c], 1996–2006 (n=694,806).

		Comanagement	
Variables	**N**	**% with generalist physician**	**% with any medicine physician**
All admissions	694806	23.7%	35.2%
Age			
< 65	63232	16.5%	27.2%
65 – 74	255558	18.3%	30.7%
75 – 84	269365	24.9%	37.0%
85 +	106651	37.5%	46.2%
Gender			
Male	305573	20.1%	34.0%
Female	389233	26.4%	36.1%
Ethnicity			
White	613990	23.7%	35.3%
Black	54090	23.4%	33.7%
Others	26726	22.5%	35.4%
Low Socioeconomic status			
No	582807	23.0%	34.8%
Yes	111999	26.8%	37.4%
Emergency admission			
No	497618	18.0%	29.5%
Yes	197188	37.9%	49.7%
Type of surgery			
Orthopedic	321502	27.9%	33.2%
Vascular	113029	20.6%	34.4%
Cardiothoracic	118661	10.6%	39.5%
General Surgery	119392	29.3%	38.9%
Urology	22222	17.5%	25.7%
Comorbidity Score			
0	147483	19.7%	28.6%
1	166208	21.6%	31.8%
2	131771	23.8%	35.8%
>=3	249344	27.2%	41.1%
Census Regions			
Middle Atlantic	93539	25.5%	41.3%
New England	35228	10.2%	16.3%
East North Central	126090	25.8%	34.8%
West North Central	61938	29.1%	36.9%
South Atlantic	145081	21.2%	32.7%
East South Central	54762	26.7%	38.9%

		Comanagement	
Variables	**N**	**% with generalist physician**	**% with any medicine physician**
West South Central	75671	28.3%	43.7%
Mountain	35021	20.9%	30.4%
Pacific	62860	18.2%	31.9%
Teaching affiliation			
Non	350442	26.6%	37.4%
Minor	170911	24.2%	36.6%
Major	173453	17.2%	29.4%
Hospital size			
< 200 beds	154895	27.7%	33.6%
200 – 349	184456	26.0%	37.4%
350 – 499	147312	23.1%	37.4%
>=500	208143	19.0%	32.9%
Type of hospital			
Non-profit	539144	23.5%	35.3%
For profit	75076	27.1%	40.2%
Public	80586	21.6%	29.7%
Received hospitalist care			
No	624259	20.5%	32.5%
Yes	70547	51.8%	58.9%

[a] Any medicine physician: either a generalist physician or an internal medicine subspecialist

[b] Generalist physician includes: general internal medicine physician, geriatrician, family practitioner or a general practitioner

[c] All percents across either patient or hospital characteristics were statistically significantly different at p<0.001 level.

Table 2

Multilevel analyses of odds of comanagement with a generalist physician[a] and with any medicine physician[b] for a patient hospitalized for a surgical procedure between 2001 and 2006.

Variable	With generalist physician[c] Odds Ratio (95% CI)	With any medicine physician[c] Odds Ratio (95% CI)
Year of admission	1.114 (1.109–1.119)	1.078 (1.073–1.082)
Age		
<65	1.000	1.000
65–74	1.281 (1.241–1.323)	1.264 (1.228–1.300)
75–84	1.621 (1.570–1.673)	1.573 (1.529–1.618)
85+	2.135 (2.063–2.211)	2.033 (1.969–2.099)
Sex		
Female	1.000	1.000
Male	0.946 (0.930–0.962)	1.007 (0.992–1.023)
Race		
White	1.000	1.000
Black	1.117 (1.081–1.153)	0.955 (0.927–0.984)
Others	0.990 (0.948–1.033)	0.938 (0.902–0.976)
Low Socioeconomic status	1.148 (1.121–1.174)	1.098 (1.074–1.122)
Emergency admission	2.714 (2.666–2.762)	2.625 (2.581–2.670)
Type of surgery		
General Surgery	1.000	1.000
Orthopedic	1.090 (1.067–1.113)	0.890 (0.871–0.908)
Vascular	0.680 (0.661–0.699)	0.848 (0.826–0.871)
Cardiothoracic	0.390 (0.377–0.403)	1.341 (1.306–1.377)
Urology	0.672 (0.637–0.710)	0.682 (0.649–0.716)
Co-morbidity score		
0	1.000	1.000
1	1.131 (1.103–1.160)	1.161 (1.135–1.189)
2	1.288 (1.255–1.322)	1.352 (1.320–1.385)
>=3	1.607 (1.569–1.645)	1.753 (1.715–1.792)
Census Regions		
New England	1.000	1.000
Middle Atlantic	2.539 (2.193–2.939)	3.112 (2.687–3.605)
East North Central	2.935 (2.551–3.376)	2.854 (2.479–3.286)
West North Central	3.332 (2.856–3.889)	3.108 (2.660–3.630)
South Atlantic	2.134 (1.851–2.459)	2.386 (2.068–2.752)
East South Central	2.842 (2.417–3.343)	2.831 (2.404–3.332)
West South Central	2.914 (2.511–3.381)	3.266 (2.813–3.792)

Variable	With generalist physician[c] Odds Ratio (95% CI)	With any medicine physician[c] Odds Ratio (95% CI)
Mountain	1.926 (1.627–2.280)	1.971 (1.664–2.335)
Pacific	1.593 (1.373–1.849)	2.084 (1.796–2.420)
Teaching Hospital		
Non	1.642 (1.484–1.818)	1.725 (1.557–1.910)
Minor	1.572 (1.411–1.751)	1.627 (1.459–1.813)
Major	1.000	1.000
Hospital Size		
<200	1.000	1.000
200–349	1.126 (1.047–1.212)	1.321 (1.227–1.422)
350–499	0.994 (0.904–1.093)	1.298 (1.180–1.428)
>=500	0.796 (0.713–0.887)	1.027 (0.921–1.147)
Type of Hospital		
Non-Profit	1.000	1.000
For Profit	1.038 (0.954–1.129)	1.176 (1.080–1.279)
Public	0.820 (0.756–0.889)	0.758 (0.699–0.823)

[a] Generalist physician includes: general internal medicine physician, geriatrician, family practitioner or general practitioner

[b] Any medicine physician: includes a generalist physician or an internal medicine subspecialist

[c] Adjusted for patient characteristics (including age, sex, ethnicity, socioeconomic status, emergency admission, type of surgery, and comorbidity) and hospital characteristics (including region, medical school affiliation, type of hospital, and hospital size).