

Effects of Provider Characteristics on Care Coordination Under Comanagement

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BACKGROUND: Care coordination is critical in settings characterized by high levels of uncertainty, time constraints, and interdependent work processes. The effects of provider characteristics on coordination in comanaged teams has never been examined.

OBJECTIVE: To characterize individual providers based on their contribution to team coordination.

PARTICIPANTS: Hospitalists, nonphysician providers, hepatologists, and fellows on a comanaged liver service of an academic hospital.

DESIGN: Between April 2008 and October 2008, participants were surveyed at baseline and repeatedly at the completion of physician rotations to assess their preferred and actual comanagement structures. In addition, they repeatedly rated their comanagers' contributions to overall coordination using an instrument that assessed relational coordination (RC). Providers were categorized into tertiles of RC. Their management preferences and the frequency of a "composite bad outcome" (intensive care unit [ICU] transfer or inpatient death) in each tertile were evaluated.

RESULTS: All (100%) Baseline Surveys and 177/224 (79%) Repeated Surveys were completed by 32 providers. RC was shown to be a stable attribute of providers and not of adverse patient outcomes. Higher coordinators were characterized by their "ownership of patients" (higher 86% vs. lowest 20%, $P < 0.01$). High compared to low coordinator hepatologists demonstrated leadership through a broader delegation of tasks as well as self-assignment of responsibilities. A trend toward more frequent "composite bad outcomes" was seen for low tertile physicians: hospitalists (low 8.6% vs. high 1.1%, $P < 0.01$), hepatologists (low 5.2% vs. high 2.0%, $P = 0.22$), fellows (low 5.8% vs. high 1.8%, $P = 0.08$).

CONCLUSION: Individual provider's teamwork-related disposition affects perceived coordination on comanaged team and may influence patient outcomes. *Journal of Hospital Medicine* 2010;5:508–513. © 2010 Society of Hospital Medicine.

KEYWORDS: communication, leadership, multi-disciplinary care, outcomes measurement, teamwork.

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Technological advances drive medical providers to specialize through the need for proficiency around increasingly focused areas of expertise.¹ But the benefits of specialization are attained only by balancing the advantages of increasing expertise and the costs of coordinating care that must be borne as specialization increases.² Integrating experts into modern medical delivery systems requires attention to the coordinating mechanisms that govern team-based care.³

Coordination, defined as the management of task interdependencies,⁴ is a central component and a useful measure of teamwork.⁵ Several studies demonstrate the patient-level impact of coordination among providers.^{6–9} Gittel et al.⁸ demonstrated that orthopedic hospitals whose staff

had better relational coordination (RC) measures had shorter lengths of stay and better post-operative pain control for patients undergoing surgery. In medical intensive care units (ICUs), Wheelan et al.⁹ showed that staff members of units with lower mortality rates perceived their teams as functioning at higher stages of group development and perceived their team members as less dependent and more trusting.

Communication is the cornerstone of effective team coordination.^{10,11} As such, practice model interventions that facilitate frequent communication of higher quality are associated with lower error rates¹⁰ and better teamwork.¹¹ The use of hospitalists, for example, is shown to capitalize

on this advantage by improving coordination through physician availability that facilitates communication and relational interactions among hospital-based staff.¹² While system-level interventions such as this have received significant attention from experts in organizations, empirical studies that explore the contribution of team member characteristics to overall coordination are lacking.¹³

Inpatient comanagement services offer a unique model for studying teamwork. While the label is used to describe a variety of arrangements,^{14–16} comanagement broadly describes a practice model wherein providers of various specialties deliver direct care to patients, in contrast to the traditional generalist-consultant model in which specialists lend expertise.¹⁷ Many recent comanagement practices involve hospitalists in partnership with surgeons in the care of patients with concurrent medical and surgical needs,¹⁸ but similar arrangements between hospitalists and medical subspecialists are being adopted in some medical centers for the care of complex patients with conditions such as heart failure, cancer, stroke, and solid organ transplantations. Coordination among providers has not been studied in this context.

The goals of this study are: (1) to measure the input of individual providers to the overall coordination of care on a highly interdependent medical comanagement service, (2) to characterize high and low coordinators, and (3) to explore the relationship between coordination and patient outcomes. The main hypothesis is that the quality of team coordination is determined partly by the attributes of its members such that their individual contributions to the coordination of care affect the outcomes of vulnerable hospitalized patients.

Materials and Methods

Setting

The study was conducted at the University of Chicago Medical Center, Chicago, IL, an urban 572-bed tertiary care hospital. The comanaged multidisciplinary inpatient service serves hospitalized patients with complex medical needs. This study focused on providers and patients from a subset of the comanaged multidisciplinary inpatient service that involved the collaboration of medical hepatologists with hospitalists. A hepatology team, composed of an attending hepatologist and a fellow, comanaged with 2 hospitalist teams, each composed of an attending hospitalist and 1 or 2 nonphysician providers (NPPs). Attending physicians rotated on the service in 1-week to 3-week rotations, while fellows rotated in 4-week stretches. NPPs worked nonuniform 3-day or 4-day weeks excluding weekends and holidays. The hepatology team was responsible for arranging admissions, developing a care plan with a specialty focus, coordinating care with transplant surgeons when necessary, and managing post-discharge care. The hospitalist teams were responsible for admitting patients, managing routine and emergent inpatient issues, coordinating care with ancil-

lary and consultative staff, and discharging patients. Dedicated evening and night hospitalists, who were not part of the comanaging day-time teams, provided after-hours care. Outside of these areas, there was no instruction or education about how responsibilities should be shared among providers on the service.

Subjects and Study Design

Baseline Survey of Providers

All hospitalists, NPPs, hepatologists, and fellows scheduled to rotate on the comanaged multidisciplinary inpatient service signed a written consent to participate. In April 2008 a nonanonymous baseline 17-item paper survey was administered.

Items of the Baseline Survey (supporting information Appendix A) were generated from a consideration of the most salient issues around the management structure of comanagement models from a comprehensive review the literature. Two items addressed the respondents' experience and intent to leave their role. Twelve items addressed their preferences about the provider management structure of an ideally comanaged inpatient service, specifically soliciting their preferences about a single physician leader, consensus seeking, and their preferred degree of information, participation, and decision making under the model. Included in this set of items was a single item assessment of the provider's sense of "patient ownership" on an ideally comanaged service. The final 3 items addressed the perceived assignment of responsibilities. Each of these items presented a clinical objective followed by up to 7 contingent tasks on whose completion the successful execution of the objective depended. Each respondent was asked to indicate one or more of the 4 provider types that should be responsible for completing each task.

Repeated Survey of Providers

From April to October 2008, providers who rotated on the comanaged liver service were surveyed repeatedly to give information about the actual management structure and coordination within teams, which consisted of combinations of randomly assigned providers. Physicians were surveyed on the day when any 1 of the 3 physician types ended his or her rotation. NPPs were surveyed every Wednesday except on the weeks when none of the physicians had changed since the previous survey. One investigator (KH) hand-delivered the surveys, usually during the first minutes of the joint daily rounds and collected them immediately upon completion. Surveys that could not be completed immediately were collected on daily rounds on subsequent days within 1 week. The primary reason for nonresponse was lost surveys that were not immediately completed.

The 14-item Repeated Survey (supporting information Appendix B) consisted of 2 parts. The first 7 items reprised items from the Baseline Survey that addressed management structures, but were rephrased to allow respondents to

TABLE 1. Survey Response Rates and Characteristics by Provider Type

	Baseline Survey (%)	Repeated Surveys (%)	% Female	Years Experience Median (range)	# RC Evaluations of Each Provider Median (range)	RC Mean (range)
Hospitalists	15/15 (100)	36/43 (84)	42	1 (0-10)	6 (3-21)	4.71 (4.33-4.94)
NPPs	5/5 (100)	92/97 (95)	100	4 (2-15)	30 (23-34)	4.60 (4.48-4.71)
Hepatologists	6/6 (100)	26/42 (62)	33	7 (1-25)	16 (5-51)	4.37 (4.03-4.59)
GI fellows	6/6 (100)	23/42 (55)	48	1 (0-1)	19 (8-37)	4.28 (3.88-4.53)
Total	32/32 (100)	177/223 (79)	55	2 (0-25)	12.5 (3-51)	4.57 (3.88-4.94)

Abbreviations: GI, gastrointestinal; NPP, non-physician provider; RC, individual provider Relational Coordination score.

report their experiences on their immediate rotation. The second part of the Repeated Survey addressed RC, which is described below.

The study protocols, consents, and data collection mechanisms were approved by the institutional review board of the University of Chicago Medical Center. Collection of patient information was designed to comply with the Health Insurance Portability and Accountability Act of 1996.

Patients

Patients were admitted to 1 of the 2 hospitalist teams on the comanaged service on alternating days, which allowed patients to be assigned to providers pseudo-randomly. Consent to use clinical data was obtained during their stay or by telephone after discharge. If patients were unable to provide consent due to cognitive impairment, consent was sought through designated proxies.¹⁹

Main Measurements

Relational Care Coordination

The survey instrument used to measure individual contributions to overall coordination was adapted from the Relational Coordination tool developed by Gittel.²⁰ This instrument was chosen because it has already been validated in various clinical contexts^{8,12,21} and the theoretical assumptions about the independent relational and communication components of coordination are applicable to our context. RC is characterized by the 7 domains of frequent, timely, accurate, and problem-solving communications; shared goals, shared knowledge, and mutual respect. Respondents rated, on a 5-point scale (1 = negative, 5 = positive), team members of the other 3 provider types during each rotation on all of the 7 domains. The mean across the domains yielded the RC score. Although the instrument was originally developed to measure the coordination in groups of individuals, the RC for a single provider was calculated by taking the mean of all the RC directed at that individual across team members who worked with him or her during the study period. Because some providers worked more rotations than others, a nonuniform number of observations contributed to the calculation of individual RC (Table 1). For each provider type, individuals were ranked on their RC

and categorized in tertiles representing high, middle, and low coordinators.

Statistical Analysis

The discriminating ability of the RC for individuals was assessed by comparing the highest and lowest RC of each provider type using the 2-tailed *t*-test. The difference in responses to items from the Baseline and Repeated Surveys by individual RC tertiles was assessed with the Chi-squared test for categorical data and the 2-tailed *t*-test for comparing means. For each physician type, the frequency of the composite bad outcomes between the highest and lowest RC tertile categories were compared using a 2-sample Wilcoxon rank-sum (Mann-Whitney) test for nonparametric data.

Results

All 32 providers (100%) completed the Baseline Survey and participated in the Repeated Surveys of which 177/224 (79%) were completed. The median number of surveys that contributed to the calculation of individual RC and the mean RC by provider type are summarized in Table 1.

Of the 119 patients managed on the service, the mean age (standard deviation [SD]) was 55 (14) years and 48% were women. Of the 201 hospitalizations, there were 13 floor-to-ICU transfers and 5 in-hospital deaths, however, we excluded from the analysis 1 death of a patient who was admitted under inpatient hospice status.

RC Measures

Individual provider RC ranges were 4.33 to 4.94 ($p = 0.05$) for hospitalists; 4.48 to 4.71 ($p = 0.10$) for NP/PAs; 4.03 to 4.59 ($p < 0.01$) for hepatologists; and 3.88 to 4.52 ($p = 0.02$) for fellows. The high, middle, and low coordinator categories for each provider type were shown to be durable through time by demonstrating that the coordination ranking of individuals was essentially preserved even when using partial data from each half of the study period. Thus, RC appears to reflect a stable attribute of the provider as opposed to specific circumstances of the rotation. The categories were shown to be durable to the influences of bad outcomes (inpatient deaths and ICU transfers) by demonstrating that the placement of individuals into 1 of the 3 coordination categories were preserved even when data from rotations involving a bad

TABLE 2. Response Pattern by All Respondents to the Patient Ownership Item From the Baseline Survey by Coordination Tertiles

	Agree	Somewhat Agree	Somewhat Disagree	Disagree
High	4	6	0	1
Middle	5	4	0	2
Low	2	0	4	4
	<i>p</i> < 0.01			

outcome were removed. Nonetheless, in order to address the possibility of bad outcomes negatively affecting perception of coordination, all analysis involving RC used the values that excluded data from these rotations.

Characteristics of Good and Poor Coordinators Patient Ownership

The single-item measure of patient ownership in the Baseline Survey reads: “I have as much a sense of ownership of my patients on the comanaged service as on a non-comanaged service.” The majority of providers of every type in the high and middle coordinator categories agreed, while providers in the low coordinator category generally disagreed with the statement. The aggregated responses of all the provider types are shown in Table 2.

Leadership

Hepatologists are the potential leader of the comanaged team because of their content expertise in liver diseases. Their responses to the 3 items in the Baseline Survey that addressed perceived assignment of responsibilities are shown in Table 3. The high compared to the low coordinator hepatologists delegated the responsibility of completing necessary tasks to more providers, overall, such that an average of 3 providers were redundantly held responsible for the completion of each task by the high coordinators while only 1 provider was held responsible by the low coordinators. Furthermore, the high coordinators delegated the responsibility of completing more tasks to themselves compared to the low coordinators.

According to responses to the management structure items of the Repeated Surveys, more providers of every type indicated that a single physician leader directed the overall management of every patient when a high or middle coordinator hospitalist was on service as opposed to a service with a low coordinator hospitalist (high 76% vs. middle 73% vs. low 58%, *P* = 0.06). Furthermore, a low coordinator hospitalist on service was more likely to indicate a desire for greater influence in directing the management of patients (desire influence 93% vs. not 7%, *P* < 0.01). This pattern was also seen with low coordinator NPPs, who more often indicated a desire for greater influence in directing patient management (desire influence 100% vs. not 0%, *P* < 0.01).

TABLE 3. Response Pattern by Hepatologists to the Perceived Assignment of Responsibility Items From the Baseline Survey by Coordination Tertiles

Hepatologists	Mean # of Tasks Delegated Overall, n (SD)	Mean # of Providers Delegated to Each Task, n (SD)	Mean # of Tasks Delegated to Self, n (SD)
High (n = 2)	56 (0.0)	2.9 (0.0)	11.5 (2.1)
Middle (n = 2)	35 (2.8)	1.8 (0.2)	9.5 (3.5)
Low (n = 2)	19 (1.4)	1.0 (0.1)	4.5 (2.1)
<i>p</i> value(high vs. low)	<0.01	<0.01	0.08

Abbreviation: SD, standard deviation.

Experience

Age, years in practice, years at the institution, and time spent on the comanaged service were not associated with RC in our small sample of providers.

Outcomes by Provider Coordination

The unit of analysis in this section is the “team-patient encounter,” which is the consecutive days during which a unique assortment of physicians managed a patient’s hospitalization. NPPs could not be associated with any single team due to their nonuniform work patterns. The 201 hospitalizations in this study were composed of 351 “team-patient encounters.” Table 4 displays the unadjusted frequency of inpatient deaths and ICU transfers that occurred during these encounters by RC tertiles. In each of the 3 physician types, composite bad outcomes are most frequent among the lowest coordinators. The pattern is statistically significant for hospitalists.

Another interesting observation is the largest number of encounters in the lowest coordination tertile of each physician type. While the reason for this finding is not clear, associations between work-load and poor coordination evoke issues related to “burnout.” In order to address the possibility of an artifactually elevated probability of a bad outcome among providers who rotated through the service more often, we calculated the correlation between the number of encounter-days and the frequency of bad outcomes for the 15 providers who were associated with at least one such event. If these events occurred by chance, we should find a positive correlation between its frequency and the number of encounters. The Pearson’s correlation coefficient of -0.38 suggests that bad outcomes do not occur more frequently with providers who work more rotations by chance alone.

Discussion

By adapting Gittel’s RC instrument to focus on individual providers, we found that their characteristic attributes such as preference for particular management styles, leadership quality, and “patient ownership” are associated with their

TABLE 4. Frequency of Bad Outcomes by Physician Provider Coordination Tertiles

	Team-Patient Encounters, n	Mean Length of Encounter, n (days)	ICU Transfer, n (%)	Hospital Death, n (%)	Bad Outcome, n (%)
Hospitalists					
High (n = 5)	92	3.1	1 (1.1)	1 (1.1)	1 (1.1)
Middle (n = 5)	119	3.2	1 (0.8)	1 (0.8)	1 (0.8)
Low (n = 5)	140	3.2	11 (7.9)	2 (1.4)	12 (8.6)
<i>p</i> value (high vs. low)	NA	0.70	0.02	0.82	0.02
Hepatologists					
High (n = 2)	99	3.2	(2.0)	0 (0.0)	2 (2.0)
Middle (n = 2)	79	3.4	3 (3.0)	1 (1.3)	3 (3.0)
Low (n = 2)	173	3.0	8 (4.6)	3 (1.7)	9 (5.2)
<i>p</i> value (high vs. low)	NA	0.52	0.27	0.19	0.20
GI fellows					
High (n = 2)	111	3.1	2 (1.8)	0 (0.0)	2 (1.8)
Middle (n = 2)	67	3.3	2 (3.0)	1 (1.5)	2 (3.0)
Low (n = 2)	173	3.2	9 (5.2)	3 (1.7)	10 (5.8)
<i>p</i> value (high vs. low)	NA	0.74	0.15	0.16	0.10

Abbreviations: GI, gastrointestinal; ICU, intensive care unit; NA, not applicable.

externally perceived contributions to the overall coordination of care. In an unadjusted analysis, we also observed an intriguing trend towards more frequent major hospital complications when the worst coordinators of each physician type were on service.

Existing evidence^{22,23} mostly summarized in a recent RAND Health report shows a weak association between clinical teamwork quality and patient mortality. While our data also support this association, it does so with limitations. Most importantly, the small sample size limited our ability to rigorously account for potential confounders that may have contributed to this apparent association. Further studies may better address whether or not bad outcomes are indeed associated with poor coordinators in highly interdependent clinical teams. In addition to confounding, the small sample size of providers makes the analysis vulnerable to type 1 errors. We addressed this issue by intensively surveying providers repeatedly to achieve a high resolution of the coordination and management structure measures from each comanaged team. The potential for omitted variables and reverse causality in that the coordination scores may be negatively influenced by particularly complex patients and bad outcomes remains a valid concern. We addressed this by confirming the stability of provider RC over time and excluding the RC data from rotations with a bad outcome, but the negative perception of an individual tied to past bad outcomes may persist beyond a particular rotation. Survey responses are subject to recall and hindsight biases, which we attempted to minimize by surveying respondents immediately after each team rotation. Finally, all of our findings may be not be generalizable to other comanagement settings. However, the important correlations between coordination and quality have been observed in other contexts.^{24,25}

In our study, in-hospital deaths and ICU transfers are treated as consequences of uncoordinated care. This interpretation may be problematic for circumstances when death is inevitable no matter how well coordinated the care, or when transfer to a higher level of care is appropriate. The rationale for grouping the 2 events into 1 “composite bad outcome” is based on the assumption that both death and the escalation of care can be delayed to an extent, if not wholly prevented, with the coordinated utilization of a modern hospital’s resources. The attribution of these events to poor coordinators may indicate the unraveling of coordination that normally must be maintained to help patients overcome decompensating events that are particularly common in the course of patients with severe liver diseases. Due to the exploratory nature of this analysis, additional studies are necessary to fully characterize the relationship between care coordination and care transfers.

An important implication of this study is that the communication skill and ethical disposition of each individual provider is relevant to the coordination that is sought in multi-provider teams. Training medical professionals to be better team members may have direct impact on the patients they serve. Our finding about patient ownership suggests that commitment to patients in the framework of care is not merely tradition but a characteristic of competent physicians. Moreover, physicians’ commitment to patients is a possible factor, not just in achieving patients’ satisfaction, but in securing better outcomes. To that end, the teaching of this and other humanistic principles must remain a vital part of medical education at all levels of training.

Several implications about team leadership and hierarchy are apparent from the data. Findings around the perceived assignment of responsibilities show that high coordinator

hepatologists acknowledge the advantages of overlapping task boundaries to prevent critical tasks from being missed and risking bad outcomes. High RC hepatologists in our study adopted a more participatory than supervisory role which presumably facilitated better coordination by transmitting organizational goals to other team members. The function of a comanaged team is likely to be enhanced by a fluid assignment of roles to better handle tasks with high uncertainty. Accordingly, comanagement models of care may not be appropriate in settings where tasks are not interdependent.²⁶ Inherent hierarchy appears to be a feature of well coordinated teams. One possible interpretation of our data is that hospitalists who yield the leadership role to the hepatologist are perceived to be better coordinators and that those who insist on exerting more influence in team decisions are perceived to be poor coordinators.

Existing evidence around care coordination predicts that comanagement designs improve provider coordination through stage-based and site-based specialization.¹² However, the mechanisms that mediate coordination and patient outcomes are not clear. Moreover, the mechanisms of coordinating multi-disciplinary teams may be specific to each clinical setting. The role of individual provider characteristics on coordination deserves more attention. Similarly, the impact of organizational culture under which favorable provider characteristics thrive is unknown. Finally, a detailed exposition of “patient ownership” and the role patients play in affecting the coordination of healthcare resources needs further exploration.

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