Decisions about Knowledge in Medical Practice: The Effect of Temporal Features of a Task[1]

Daniel A. Menchik
Michigan State University

A classic question of social science is how knowledge informs practice. Research on physicians' decisions about medical knowledge has focused on doctors' personal capabilities and features of the knowledge corpus, producing divergent findings. This study asks, instead, How is decision making about the use of knowledge influenced by features of work? From observations of one team's decisions in multiple clinical and administrative contexts, the author argues that making decisions is contingent upon temporal features of physicians' tasks. Physicians receive feedback at different speeds, and they must account for these speeds when judging what they can prioritize. This finding explains doctors' perceived uncertainty in other studies as a product of the long feedback loop in tasks, and their certainty or pragmatism as a product of shorter feedback loops. In these latter scenarios, physicians consider and deploy scientific knowledge after—and not before, as is usually assumed—determining a fruitful plan of action.

How do experts make decisions about using their specialized knowledge? One recurring and consequential subject taken up by sociologists is that of decisions made by physicians about their work and, more particularly, how physicians use their specialized knowledge. Up to this point, studies of physicians' use of knowledge have paid considerable attention to the knowledge corpus: what their knowledge is and what parts of the knowledge corpus

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physicians select for different purposes. We have developed a working picture of the vast corpus of knowledge available to physicians. We have focused on what information doctors acquired from their training and from the scholarly literature. We have studied how social movements and the state approve certain parts of the knowledge corpus for regular use and disapprove of other parts. In addition, we have especially examined what happens when doctors are confronted with the vastness of knowledge, and we have found that they feel uncertain.[2]

This work on the knowledge corpus has made important contributions to our understanding of doctors' relationship to the knowledge they use, including decision making. In the early days of the sociology of medicine, scholars sought a consistent image of doctors' relationship with the expansive knowledge corpus of medicine (Parsons 1951). Since then, there has been much commentary among academic physicians on whether certain kinds of knowledge, such as that developed in the study of population health, are evidentially sound for use with individual patients (Cohen, Stavri, and Hersh 2004).[3]

But the question remains: How do doctors go about making decisions about what knowledge to use and when to use it? To begin to investigate what organizes physicians' decisions about using knowledge, I propose that we move to the site where decisions are made: the task. Specifically, I argue that we must consider temporal horizons, a major difference between tasks of work.[4] Compare, for instance, scholars and doctors. Scholars may be said

[2] Although any list of this scholarship inevitably will be incomplete, a survey of relatively recent work would include research on knowledge in psychiatry, on the standards in the Diagnostic and Statistical Manual of Mental Disorders (Lakoff 2005; Whooley and Horwitz 2013); clinical trials and creation of knowledge (Epstein 1996); oncology, on improvising treatment practices (Livingston 2012); alternative medicine and state sponsorship (Adams 2002); talk therapy and individual responsibility (Carr 2010); abortion services and the state (Halfmann 2011); disease categories and pharmaceutical companies (Greene 2007); scientific and other forms as well as the organizational venues in which each type improves one's reputation (Menchik and Meltzer 2010); neonatal intensive care decisions and institutional preferences of doctors' knowledge over nurses' (Anspach 1993); and neonatal screening processes and strains on parents (Timmermans and Buchbinder 2012). Literature on training and uncertainty is addressed below.

[3] More recent work has expanded how we understand the relationship between the corpus and its everyday use. Along with anthropologists, we have profitably begun to study doctors with a different kind of salient knowledge, those who manage the embodied role in surgical practice of tactile knowledge (Pope 2002; Prentice 2012). Because embodied knowledge is acquired through practice, this work suggests a different way to think about the relationship between experts and knowledge (see also Fourcade 2010): that we should look at how doctors actually get their work done, rather than at the knowledge corpus itself.

[4] Timmermans and Angell (2001) observe that trainees differ in how they use the corpus, but the authors' excellent study also raises the question—one perhaps difficult to answer with their study design—of how such doctors go about deciding how to use it.

to have the luxury of deferring decisions about using knowledge in the task of writing an article; they can *decide not to decide* how to use their knowledge and set aside a draft article. Doctors may be said to be under pressure to make decisions about using knowledge immediately in many cases, such as emergency cases, because the task requires a rapid response. But compare other tasks undertaken by scholars and doctors. On occasion, scholars engaged in writing must make decisions about knowledge more rapidly, for instance, if the task is writing comments on papers or writing a grant application as a deadline approaches. Doctors too may in some cases have more time in which to make decisions about using their knowledge, for instance, when a patient is stable and under observation or can be scheduled to return for a follow-up visit before a treatment is recommended.

These preliminary observations about the temporal horizons of tasks requiring use of knowledge raise another key question: How do we capture the range of situations in which doctors decide how to use their knowledge? We have not yet focused on this situational variation in part because the ethnographic tools available to study work and interactions usually focus our attention on one location or one group. If we can follow physicians across different tasks then we can consider how they adjust their decision making to different time constraints. To theorize decision making in the context of a time-specific task, I turn to the work of Shackle (1942, 1955, 1966), who argues that decision makers project the consequences of their choices about using knowledge using a blueprint configured by the temporal characteristics of the task. Because Shackle is concerned with how people make decisions differently according to the period for which their knowledge must be relevant, he illustrates vividly that the problem of decision making is situated firmly in the domain of the sociology of knowledge (see Merton 1949, chap. 14). However, Shackle's theory has a limitation when applied to the multiple tasks performed by doctors. It does not in its original formulation apply to decision making in response to the demands of a range of tasks calling on different types of knowledge, from managing patient finances to developing clinical knowledge and navigating bureaucratic rules and, under different pressures, from moment to moment, task to task, and place to place. Physicians must continuously adjust to different tasks and time constraints. I suggest how the blueprint concept can be made dynamic, to account for the multiple interests that physicians have, so that we can better understand decisions about using knowledge according to the social context in which that knowledge is being deployed.

As we sociologists move to look at future-oriented behavior (Mische 2009, 2014; Frye 2012; Beckert 2013; Tavory and Eliasoph 2013), in the study of

decision making there are several benefits of turning from the knowledge corpus to the task's circumstances. For studies of work, in particular, we will gain the capacity to account for the different actions individuals pursue on the basis of their projections of the relevance and usefulness of knowledge for accomplishing concrete tasks. Three consequences can follow from examining the time horizon of the task. First, we can reconsider the place of uncertainty in decisions using knowledge. Scholars focused on the subject of professional socialization differ about whether doctors, when confronted with medicine's knowledge corpus, adopt a perspective of uncertainty (Fox 1957) or simply one that is more pragmatic (Becker et al. 1961; Hafferty 1991). Second, studying time allows us to consider the merits of the Bayesian perspective for accounting for how knowledge is processed in what has been called "evidence-based" decision making. This perspective describes doctors as considering prior information from the published literature on the benefits of a treatment, combining this with an estimate of their uncertainty level, and updating their estimate of their chances of success in pursuing the treatment. Although some accept this to be a meaningful characterization of medical decisions (Parmigiani 2002; Felder and Mayerhofer 2011), others object (Phelps and Levitt 2004). Finally, a focus on time will allow us to understand another important component of the "how" of decision making about expert knowledge: the interplay between the task and the decision maker's interests. Specifically, we can understand how doctors' many potential interests—ranging from cost concerns, to organizational citizenship, to stress relief, and to status with colleagues, subordinates, and superiors—are prioritized in practice.

Practically speaking, without this processual understanding of how doctors make decisions using what can be thought of as a more dynamic blueprint concept—modifying Shackle (and reflecting current work in architectural theory)—we may fail to notice the flaws in our system of medical education, and we may develop and implement "decision aids" that miss truly germane features of decisions. Most significantly, by not accounting for this dynamic interpretive process, we risk overlooking links between the study of medical decision making and more general sociological processes centered around time, work, and knowledge.

As I will show, when we compare doctors' decision-making processes in the context of different tasks, we can understand that decision making about the use of knowledge is an iterative and calculated act of prioritization, dependent on the temporal horizon of work, an act meant to further one or more of an actor's interests. The speed of a task's feedback loops lets the actor apprehend which of these concerns can be more or less promisingly pursued in that time and place, and decisions occur as the actor dynamically interprets the task amid this feedback.

MEDICAL DECISIONS ABOUT USING KNOWLEDGE

Sociologists have frequently focused on physicians' and trainees' decisions in terms of engagement with medicine's knowledge base.[5] These studies were largely initiated by Parsons (1951, p. 448), who focused on how physicians' uncertainty arises when their knowledge advances to the point that they become aware of unfavorable factors in the situation that they did not previously appreciate and see the fruitlessness of control measures in which they previously had faith. Fox (1957, p. 208) followed this contribution with an emphasis on trainees' uncertainty about whether they can master available knowledge, whether knowledge for the problems they confront actually exists in the field, and whether they will be able to discern between these uncertainties involving medicine's vast knowledge corpus.

Yet some have questioned whether we should think about physicians' feelings of uncertainty toward knowledge, outside of the context of their other concerns and interests (Becker et al. 1961; Hafferty 1991). These studies have shown that incipient (and practicing) doctors are less concerned with the content and availability of knowledge than they are with practical matters such as saving face, reducing costs, and maintaining autonomy. Atkinson (1984, p. 949) points out the limitations of current work on uncertainty with regard to the relationship between knowledge and action in medicine, and he calls for a more compelling treatment. He closes his intervention by arguing that detailed ethnographic research is necessary in order to map contextual variations in decision-making processes. That task remains.

It is true that in the decades since Atkinson identified the need to work more on the relationships between knowledge and action, many statisticians and medical educators have proposed a second—and no less controversial—way of understanding how decisions using medical knowledge are and should be made. This recent approach too is largely focused on the knowledge corpus. In this approach, referred to as evidence-based medicine, doctors are called on to consult published research in decision making.[6] Evidence-based medicine focuses largely on the kinds of knowledge itself, describing a "hierarchy of evidence," with randomized trials considered the gold standard (e.g., Richardson et al. 1999). The idea that clinicians would benefit from consulting this knowledge is nothing new; what

[5] Although offering distinct accounts of decision making, this ethnographic literature also focused on a range of processes beyond decision making, including but not limited to issues of responsibility, morale, and professional socialization.

[6] There are other models of medical decision making, to be sure (e.g., Greenhalgh 1999), but I address this one because it is so confidently linked to the curricula taught in U.S. medical schools today.

seems new is the endorsement of immediate recourse to the results and meta-analyses of clinical trials as the optimal way to make decisions.

Underpinning the "how" of making evidence-based decisions using clinical trials is the Bayesian approach. This process is widely recognized as the basis of the evidence-based medicine taught in medical schools, endorsed in journals, and incorporated by academic physicians, psychologists, and economists in models of how doctors make decisions using medical knowledge (e.g., Ashby and Smith 2000, p. 3292; Parmigiani 2002; Felder and Mayerhofer 2011). In the textbook model of Bayesian decision making, the decision maker uses priors to ascribe probability to an event or proposition about which he or she is uncertain and incorporates this information into the process of strengthening inferences about the value of a parameter that describes population characteristics (such as the true mean efficacy of a certain medical treatment). In medicine, academic physicians have promoted the use of research articles as the ideal source of priors in evidence-based decisions about using knowledge. In the idealized case involving the Bayesian model, the oncologist needing to decide on a treatment for a cancer patient consults literature on clinical trials to calculate the benefits of surgical treatment or radiation therapy, having gotten the patient's assessment of each treatment's utility with respect to the trade-off between length of survival, side effects, or delay in completion of the treatment but not knowing the probability of each of these outcomes.

Many doctors and sociologists, however, have questioned not only whether doctors do and should base their priors on clinical research alone, thus challenging the Bayesian operationalization by academic physicians, but also the evidence-based medicine concept more generally (see Knaapen [2014] for a comprehensive review). This criticism questions whether population data are appropriate for decisions about patients and whether the definition of evidence excludes information important to the tasks clinicians actually perform (Cohen et al. 2004). The focus of research studies on a single relationship presents physicians with great challenges in measuring the influence of different combinations of diagnoses and treatments on patient outcomes (Naylor 2001). This criticism remains primarily focused on features of the knowledge corpus and the fact that the kind of information needed for the perfect application of evidence is lacking.

Yet we are not going to understand how doctors choose from the knowledge corpus until we understand how doctors go about making decisions. This more sociological problem stems from the fact that doctors are supposed to calculate their level of uncertainty about the probability that the literature is going to be relevant for this patient at this moment. Given that the Bayesian model is deemed by many to be inadequate for physicians' attempts to attain the ideal of evidence-based medicine, we need to understand decision making in a way that incorporates the influence of social

factors in doctors' actual decision-making context. The sociological problem, then, is centered around prioritization: how doctors prioritize not only what decisions get made (regarding cost reduction, length of hospital stay, etc.) but what information is potentially useful or necessary. If the Bayesian process underpinning evidence-based medicine is an idealized characterization to which many practicing physicians object, it makes sense to see how the process of making decisions about knowledge actually works. If the problem is less about qualities of the knowledge corpus and more about the context of actual practice, then the unit of analysis we really care about is the iterative series of prioritizations, projections, and their revisions that comprise the decision-making process. The question thus becomes how to explain the actions of doctors as they undertake entire decision-making processes, particularly those involving the pursuit of knowledge from the scientific literature, a patient, or another source. The answer, I show below, comes from a focus on the task.

DECISION MAKING IN SOCIAL CONTEXTS

To fully understand how tasks affect doctors' ability to predict outcomes and register whether they are on the right track, we need a way of accounting for how doctors come to interpret data and deploy knowledge in so many different ways. The question is, How do people engage objective tasks while considering a set of interests, experiences, and expectations? A dynamic model is necessary, and we will find it in a dynamic systematization of interest-based responses to feedback loops that I base on the model of Shackle (1942) and his concept of the blueprint.[7] For Shackle, a blueprint mediates our understanding of a process. Blueprints organize interpretations in a nonbehavioristic way; people use them to read and act on signals in a way that reflects their interests, past successes, and predictions of a set of potential consequences and risks.[8]

[7] When Hannan and Freeman (1977) specify that an "organizational form is a blueprint for organizational action, for transforming inputs into outputs" (pp. 934–35), they describe a model similar to that organizing Bayesian approaches to decision making. This input-output model made sense in the context of late-1970s organization theory's focus on relations between organizations and their environments. But it is less helpful for understanding the more situationally contingent decisions of individuals within organizations, as they act on interests, and are affected by interactions, in performing tasks. My use of the blueprint, informed by Shackle, shares more with its use in recent theory on entrepreneurship (e.g., Aldrich and Yang 2012).

[8] It is instructive to consider the concept of the blueprint relative to that of the schema. We usually think of a schema as a shared cultural model that guides interpretations (e.g., Blair-Loy 2003). The concept of the blueprint is meant to incorporate an action's projected outcomes based on a task. When considered in the dynamic terms I sketch here, blueprints are continuously updated, and in a way that is more specific than are schema to a particular individual's interaction with a task.

A sociological theory of medical decision making requires us to find a way to account for how interpretations are shaped by social contexts. Therefore, we should start with the concept of the blueprint itself and the way a person considers whether and how a decision will further his or her interests. The blueprint mediates one's situational understandings of useful pathways toward goal-oriented behavior as a socially constructed understanding of what is doable, appropriate, effective, and promising. Shackle's blueprint (1942) represents how investors seek to project the consequences of decisions emerging in circumstantial pressures. This process, he argues, is parallel to how a planner uses a blueprint of a plant built to produce a product. Beyond attributes such as the nature of a product and its technical design, the blueprint implicitly reflects a specific period of future time in which it is intended to be relevant. Periods that are more distant bring a wider range of potential values of important variables such as prices, orders, size of inventories, rates of taxation, and relative strength of national air forces or fleets, so a blueprint relevant to a distant period requires more from its reader because he must adjust features affected by a shift in one or more of those variables. According to Shackle, the more distant the period considered in decision making, the less light an actor's present knowledge will seem to throw on it. This interpretive distance indexes the level of certainty or uncertainty the actor feels in his or her ability to predict the consequences of pursuing key interests.

There are two potential criticisms that might be leveled toward a turn to Shackle's concept of blueprint to inform how we understand decisions in medicine. First, because he uses the blueprint as a model to understand investors making decisions about money, it may not initially seem to be the same situation. Yet there are key parallels, because medicine, like investing, involves path dependence; in the same way one cannot decide to build a plant and expect to sell it for the same or more at the moment when a better site becomes available, a doctor cannot remove a prostate and then decide radiation therapy would have been a better cancer treatment after the patient dislikes the side effects. But side effects are not the only concern of the patient and physician. It is possible to work with Shackle's concept of the blueprint as long as it is updated to account for the range of physicians' interests—a range that might be wider than that of investors. The second criticism is that Shackle's account is static (Lachmann 1959, p. 68). Certainly Shackle's concept does involve one decision at one moment, and decisions in the real world are seldom isolated. But the concept can be applicable to the iterative nature of patient-physician interaction as well as other human elements in the social context of the task that develop over time. For doctors, blueprints for decision making are incomplete, contingent, and dynamic, evolving in real time. By incorporating feedback loops into Shackle's model, we can see how decision makers interpret new in-

formation, respond, and update what they predict will be the consequences of the task given their interests.[9]

Bringing together Shackle's notion of the blueprint with feedback loops lets us account for both the interests and situation-imposed constraints that are established by tasks. For example, the people who decide to build a plant are interested in profit, but they must make a cost-benefit analysis to deal with the constraints of engineering decisions, the nature of a product, its technical design, and its location. Similarly, when doctors make decisions with a patient, they also need to project outcomes that may shift after a decision because of situation-imposed constraints, including the probability of the patient's compliance, the reaction of the body to intervention, the suitability of a specific intervention with a specific patient, and matters of cost. They must carry out these projections because, for instance, they do not want to perform heart surgery on a patient who they discover also has stomach cancer and thus a prognosis of six months to live. Feedback loops are important to physicians not only because they help doctors forecast outcomes but also because they allow doctors to identify what interests could profitably be pursued. These interests include diagnosing and treating a patient (either immediately or later), considering the published or practiced diagnostic or treatment techniques to use, or focusing on different tasks altogether.

Therefore, this article investigates a more socially contextualized decision-making process that is iterative and thus moves past the one-off abstracted notion of Shackle's blueprint.[10] The basic premise of a feedback loop involves providing people with information about their actions and giving them an opportunity to change those actions. The feedback loop begins with data, with a behavior measured, captured, and stored. This is the evidence stage. The information must then be relayed to the individual, not in the raw form in which it was captured but in a context that makes it emotionally resonant. This is the relevance stage, where one considers whether and how one's interests can be exercised. But even the most compelling information is useless if we do not know what to make of it. Thus we need a third stage: consequence. The information must illuminate one or more paths ahead, where one consults the blueprint for projected outcomes of an action. And finally, the fourth stage: action. There must be a clear moment when the in-

[9] Making Shackle's theory dynamic in this way also aligns it with more recent scholarship on blueprints and other study drawings. This work argues their role is one not of passive recording but of active participation in formulating the design (Herbert 1993, p. 2; Béguin 2003). Drawings serve not as completed objects but as part of a graphic thinking process.

[10] This approach is consistent with that of social psychologists, who have shown that identities can be conceptualized as feedback processes, comprising continuously operating loops of input meanings to output meanings and output meanings to input meanings (Blumer 1962; Burke 1991).

dividual can recalibrate a behavior, make a choice, and act. Then that action is measured, and the feedback loop can run once more with every action stimulating new behaviors inching the individual nearer to his or her goals.[11]

This description is incomplete without attention to doctors' interests, which must be accounted for because they may only partially overlap with those of the patient. In addition to incorporating a doctor's potential interest in diagnosing and treating a patient to the best of her abilities, a socially contextualized decision-making model may account for the doctor's desire to reduce her workload, to finish work fast enough to adhere to organizational or professional restrictions on work hours, to maintain a profitable practice, or to try a procedure for which there is no evidence.[12] To choose just one example of such so-called non-evidence-based motivations at work, the rate of Caesarean sections has been shown to vary according to time of day, drops in the fertility rate (and respective ob-gyn income levels), and changes in malpractice laws.[13] Physicians, then, have many everyday concerns that are urgent, important, and competing.

A simple example demonstrates the relationship between tasks, interests, and blueprint, showing how a short feedback loop makes the priorities of a doctor immediately evident. Consider the needs of a cardiac electrophysiologist, a cardiologist who ablates, or burns, a patient's heart to channel an abnormal rhythm. The actions of electrophysiologists and their associates are entrained with feedback in tasks. Preventing clotting, infection, and pain in an ablation requires a more-or-less precise schedule that ensures the patient is anticoagulated, sterilized, and sedated. In a routine case, the nurse will monitor the patient's blood pressure, the industry rep will test and program the patient's new defibrillator, the tech will ensure the computer tracks the catheter, and the fellow will apply constant pressure to the catheter site to prevent bleeding. Despite the great social distance, these negotiations among nurse, tech, and doctors will lead to a corrected heart rhythm. Doctors must think ahead, using their blueprint for the task to envision outcomes and ask-

[11] See both scholarly (Wiener 1961) and popular (Goetz 2011) accounts, as well as Parsons's (1967) feedback loops in the AGIL (adaptation, goal attainment, integration, latency) cybernetic control mechanism.

[12] See Fox and Swazey (1974, chap. 3), Mizrahi (1986), McKinlay, Potter, and Feldman (1996), and Szymczak et al. (2010). Another compelling way of describing many of these varied and sometimes-conflicting interests is Lutfey's (2005, p. 426) characterization of physicians' roles as "educators, detectives, negotiators, salesmen, cheerleaders, and policemen."

[13] See Burns, Geller, and Wholey (1995), Gruber and Owings (1996), Dubay, Kaestner, and Waidmann (1999), and Currie and MacLeod (2008). Jacobson et al. (2013) use a change in Medicare fees to show that doctors shifted chemotherapy treatments in response to increased profit margins—a shift that ultimately improved outcomes.

ing paraprofessionals to act accordingly. In the midst of a bleeding episode, the doctor will not consider what he knows about the cost of the equipment and assistance necessary to stabilize the patient. Nor will the doctor choose to embark on learning a new technique for the procedure. The doctor will prioritize bleeding cessation with reliable techniques while imagining a set of potentially negative legal, reputational, and time-consuming outcomes.

DATA AND METHOD

The sketch above of a situational theory of the process of making decisions about the use of knowledge demands a method that will account for the particulars of the social context. Furthermore, the challenge of any situational theory is to show its phenomena's replicability. To meet this challenge, I compare differences in the decision-making practices of a single group of trainees led by different types of medical authorities seeking to accomplish different types of tasks. I compare tasks also to consider an alternative hypothesis: to see whether the doctors' knowledge practices and experiences of certainty had to do with the way the organization incentivized trainees to pursue interests aligned with its own, rather than with the interaction of the trainees' interests, blueprints, and tasks. A study of how the same set of individuals performs different tasks resembles a "fixed effects" ethnographic approach, in that it will account for potential unobserved heterogeneity in the backgrounds of the specific doctors exposed to these tasks.

In this section I first identify the differences in the key tasks of trainees on the basis of my interviews and observations. Then I explain the rationale for comparing across tasks, showing how the approach allows me to isolate key influences on processes of decision making in response to feedback loops of different durations.

Four Contexts Organizing Medicine's Tasks, Decision-Making Processes, and Resource Constraints

Interns move across social contexts to learn or practice tasks, and in doing so they must deal with a range of actors, from surgeons, to pediatricians, to bureaucrats. During the periods they are on the wards, teams of interns must respond to tasks organized within two different kinds of contexts. The first kind is organized by the authority of the attending, who may be an "intensivist" or a "deliberator," in my categorization of normative regimes. Intensivists demand responsiveness and expect confident interventions. Deliberators demand sensitivity to multiple potential outcomes and expect thoughtful consideration. The second kind of context is organized by another type of authority: administrators. In this study, I follow interns as

they engage with authorities in four different tasks: cardiac electrophysiology (where the authorities are intensivists), general cardiology (where the authorities are deliberators), and the separate meetings about admission and discharge (where the authorities are administrators or physicians in administrative roles). In what follows I look more closely at the tasks undertaken in the two kinds of social context and how I picked the doctors I focus on in the study. In both this section and the analysis I show that the tasks involve feedback loops of different durations.

I inductively identified and then studied normative regimes in clinical practice whose tasks reflected the broadest range of tasks in medicine. Intensivist tasks involve very fast feedback loops in their work, focusing on problems instead of patients and conducting procedures. Deliberator tasks involve much slower feedback loops, focusing primarily on the patient as a whole and providing advice and dispensing drugs.[14] Rather than impose these categories, I created them by asking 15 doctors to sort different subspecialties into groups that reflected the "kinds" of physicians they encountered during training, and the subspecialties ended up varying primarily according to the duration and speed of the feedback loops in their work, whether their work was focused on a problem or patient, and whether procedures were conducted. Both the intensivist and deliberator regimes are well represented in the cardiology division I studied.

To best capture the nature of different tasks, I sought to report on attendings who best represented each normative regime, that is, those whose abilities to execute the functional requirements of their job made them consummate representatives of their subfields. Each month I observed inpatient cardiology teams led by two different attending physicians, each of whom presided over the team during half of a month. I chose specific physicians who were highly esteemed by asking their colleagues questions regarding network ties, specifically, whom they approached for work-related advice.[15] The intensivist regime is represented by the electrophysiologist Dr. Kellogg. The deliberator regime is exemplified by the general cardiologist Dr. Walker.[16] Regardless of normative regime, when leading a team the

[14] Types of doctors in the intensivist regime were cardiac electrophysiologist, anesthesiologist, urologist, surgeon, emergency medicine physician, radiation oncologist, and endoscopist. Included in the deliberator category were general cardiologist, internist, nephrologist, endocrinologist, rheumatologist, geriatrician, hematologist, gastroenterologist, and psychiatrist.

[15] For specific questions, see Menchik and Meltzer (2010).

[16] The names of the doctors and hospital are pseudonyms. The gender signaled by language on the page does not necessarily represent the gender of the individual. I have varied the gender composition of my teams at all levels in order to avoid the concerns around sex-based discrimination raised by Bosk ([1979] 2003, pp. 218–23), even al-

attendings foist their central tasks on trainees, in concert with attempts to teach and recruit promising students into their professional domains (see Merton 1957, pp. 22–33).

Data on these doctors were collected across four years of ethnographic fieldwork in "Superior Hospital." Superior is consistently ranked among the top hospitals in the country for its medical school and subspecialties. In addition to the attending, trainee teams at Superior consist of a resident, two interns (first-year residents), and one or two medical students. In each of the eight teams I studied in their month-long cardiology rotation, I compared what trainees did in response to different tasks demanded by attendings and administrators. To demonstrate how doctors interact with tasks over the course of their month on a cardiology service, I describe in detail the work of one team that provides a clear demonstration of the effects that I observed in other teams.

I was fully immersed in these eight teams, across six four-day call cycles a month, for a total observation time of about 3,840 hours on the wards. I conducted one-on-one interviews with the members of the team focused on here and also conducted follow-up interviews approximately one year after my initial observation. I followed all teams' four-day "call cycles," which comprised two days of 12-hour shifts followed by a 30- to 40-hour stretch of being "on call." During the night of call, team members admitted patients to the service, followed up on existing patients, responded to "codes" (the emergencies, usually fatal, occurring throughout the hospital), and attempted to steal a few hours of sleep. The team then received 12–16 hours off before returning to Superior and restarting the cycle.

Beyond my interest in reporting on a team led by well-respected physicians from distinct normative regimes, my interest in showing the independent effects of the way attendings reproduced the demands of their normative regimes' tasks led me to ensure that the patients treated by the team during each half of the month discussed here had similar conditions.[17] Approximately half were admitted with chest pain, one-quarter had heart failure, and the rest suffered from arrhythmias or needed a heart transplant.[18]

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though it is likely that these issues are more germane to surgical residents in the 1970s (when approximately 5% were female; O'Connell 2007) than to internists today (when the percentage is 45%; American Board of Internal Medicine, http://www.abim.org/about/examInfo/data-res/chart-02.aspx).

[17] I ensured that I observed each type of attending during the first half of a month to make certain that my findings could not be attributed to the sequence of team leadership. Such sequence effects would be revealed in the finding that patients of teams led by the same intensivist-deliberator sequence would have experiences in the hospital that were more similar than different. The appendix shows that this is not the case.

[18] This composition is consistent with other months. Data available upon request.

The hospital is organized across several administrative tasks that are designed to move patients into and through the hospital within the number of days for which it will be reimbursed by the state. These tasks are necessary in any health care organization; all share the need to match patients with organizational needs and capabilities and to constrain physicians enamored of the idea that "everyone is entitled to the best possible care." Administrators perform the discharge task under the authority of others who want them to send patients home or to other medical institutions as quickly as possible. In the same way that physicians in independent practice must respond to nonpatients to meet federal mandates (e.g., the digitization of patients' health records), trainees in the residency program must also respond to nonpatients who seek to control their practices. In the first administrative task that these trainees must confront, the admissions meeting, they must manage organizational protocol used at the beginning of a call cycle to sort patients into a quadrant of the hospital. In my observations physicians in administrative roles, seeking fast movement out of the emergency department, initially directed each admission to a particular team. In a second task, the discharge meeting, administrators, social workers, and case managers were aware of patients' insurance status and required estimated discharge times and constant updates. Since insurance companies will often reimburse hospitals at a limited level beyond an allocated number of days, rapid discharge is a concern. Together with the two attending-led clinical tasks, then, these administrative tasks constituted the range of tasks the team members collectively encountered during their four-day call cycles. I observed two years' worth of these events.

Within all four of these sites, I documented the features of trainees' case presentations because they allow us to observe how doctors make decisions about knowledge to construct performances important to acting on various tasks with different feedback loops. In Superior Hospital, as patients arrive through the emergency room or are transferred from clinics and different hospitals, teams of trainees and attendings justify decisions about what they will complete now or allocate for later. The trainees are in constant action, each seeking to evaluate the likelihood of outcomes in their blueprint for the task by managing the test results and differential diagnoses comprising a patient's medical condition. In providing feedback on trainees' presentations, attendings sought to reproduce normative models for managing patients while observing and evaluating the progress of subordinates (see Anspach 1988, p. 351). In contrast, feedback for administrative tasks, which involve triage and discharge decisions, was more oriented toward matters of a patient's placement in the hospital or readiness for discharge. The admissions meeting had many of the features of ward-based case presentations yet might emphasize more centrally a patient's traits that made him or her

appropriate for a particular kind of care. At the discharge meeting the postcase presentation discussion might revolve around the extent that tests were complete and the family available to assist the patient after discharge.

In order to analyze these various feedback loops, it was important to confirm my claims about how the doctors pursued and acted on knowledge. Because my accounts of these strategies might be flawed, when analyzing notes from my fieldwork I showed them to both the attendings and the trainees. However, this inductive method of studying decision making may be defective because it assumes I can always distinguish between decisions about knowledge that are made strategically from those underpinned by less instrumental motivations. Unfortunately, there are no valid grounds for distinguishing a genuinely inconsistent response to a task from a "deviant case" whose features must be scrutinized in order to modify the description of the trainee's tactics. By not distinguishing inconsistent cases, I might not properly describe responses to tasks, which also suggests the possibility that my account of the interests underpinning doctors' decisions about knowledge may simply be an observer's construct. To attempt to confirm my descriptions, I asked the doctors I observed how far my accounts corresponded with their own impressions of their clinic practice. Where they found discrepancies in my accounts, these were thoroughly discussed and, where necessary, the data were reanalyzed in light of the discussion.

Using a "Fixed Effects" Small-*N* Approach to Studying the Relevant Social Context through Tasks

To develop a dynamic theory we need to identify how feedback loops of different durations affect decisions about knowledge. For this, it is necessary to study physicians confronting varying tasks. This means we must move beyond the approach in which we study one case in detail as a way to identify mechanisms or that of comparing two cases of similar groups from different institutions to understand how differences in one variable influence decisions. The former approach makes it difficult to disentangle particular phenomena from general phenomena, and the latter approach makes it hard to ensure the groups are comparable. In contrast, all four of the tasks I address involve identifiable time pressures at the level of the team, and the durations of their feedback loops could plausibly influence how the doctors pursue interests with their blueprints and use medical knowledge in decisions. Because I examine the effects of feedback using one group of individuals, I use what can be thought of as a fixed effects approach with a small-*n* design.

The small-*n* approach I use, an application of Mill's method of differences, is relatively unique for ethnographic data and is more common to comparative historical work than ethnography (e.g., Skocpol 1979). Yet, it

enables me to compare explanations of ethnographic phenomena of which there are inherently only a few cases (see Nagel 1950, bk. 3, chap 8). In most cases, the small-*n* approach has the analytic payoff of retaining the detail of case studies while separating the particular aspects of particular cases from more general processes (Abbott 2004, pp. 58–59). And because I hold constant the backgrounds and experiences of individual team members in trying to understand how they use knowledge, feel certain, and make decisions, I can overcome the usual problem of comparability in small-*n* studies.

ANALYSIS

Each section below describes the tasks, how different authorities engaged the trainees in these tasks, and how feedback from these authorities dynamically interacted with trainees' interests to influence work in the tasks. To identify the dynamic relationships between the actor interpreting interests and the requirements of the task, I examine how feedback loops in the two clinical and two administrative tasks leached back into how trainees understood and performed decisions. I begin by describing the two tasks enacted respectively by the intensivist and deliberator physicians leading the team (Dr. Kellogg and Dr. Walker, respectively). I then consider these tasks alongside the two tasks performed in administrative settings, to explain how interns perceived and responded to the admissions and discharge demands in their call cycle. In each of these normative regimes, the germane tasks usually involved practices with patients, practices with trainees, and modeling communication practices. These different normative regimes all involved feedback loops of different speeds, and the speed of each feedback loop regulated the extent and nature of doctors' interactions with their blueprints. Thus, by examining this process of decision making to accomplish tasks, we can explain not only how blueprints operate but also how doctors end up performing in predictable ways.

PART 1: IDENTIFYING THE INTERACTION OF TASK AND BLUEPRINT IN CLINICAL CONTEXTS

In this section we see that the team's likelihood of drawing on knowledge was conditioned by whether they could receive feedback that would allow them to project that this knowledge would help them pursue interests. Different communication patterns play a role in decision making, and I look at them because they index the interrelatedness of key features of social context. In the clinical sites, the tasks allow us to consider both a feedback loop that is fast (that of intensivists, such as Dr. Kellogg), and one that is slow (that of deliberators, such as Dr. Walker). In particular, trainees who learn from

Dr. Kellogg to associate fast feedback loops with certainty chose knowledge that would suggest certainty in order to save face. The slower feedback loops of Dr. Walker's tasks left trainees time to consider what knowledge to use, and they were less decisive (more uncertain) because they were unable to predict the benefits of deploying knowledge for patient care, leading them to pursue other preoccupations. As the above examples attest, the attendings' normative regimes make them enact feedback loops of different speeds, thereby causing their trainees to develop different relationships with knowledge.

Confidently Projecting Outcomes from the Rapid Feedback Loops of the Intensivist's Tasks

We begin with the intensivist tasks, which, as I mentioned above, involve rapid responses to fast feedback loops. Tasks for intensivists require them to act intuitively and intentionally, and so they need their peers to be predictable. Thus, the intensivists provide positive feedback if they get reliable information and negative feedback if they do not get it. To trainees, these tasks most closely resemble what they learn in medical school—that is, amassing and deploying knowledge in reliable and predictable ways for authority figures. But in the actual practice of medicine, the nature of the tasks is different in significant ways, so previously learned approaches did not entirely suffice for the trainees I observed. The demands of the clinical tasks elicited an interrogation from intensivists that led subordinates to draw from clinical research they projected would allow them to confidently respond. They could do so when functioning as a social unit that let them identify deployable knowledge. Because the fast feedback loop of the task intensivists enacted let team members visualize outcomes of deploying knowledge, they did so with certainty. It quickly allowed trainees to use their blueprint to interpret whether the task would benefit from drawing on skills developed in their preclinical medical training (a period focused on memorization and recall of matters such as anatomy), the process of what Becker et al. (1961) describe as becoming "test wise." It also made them realize they needed not only to choose scientific knowledge but also to deliver decisive statements in a form that would reassure both patients and interdependent professionals of their competence. In so doing, they became able to project confidence in their interactions within the constraints of the blueprint but also to feel more confident about future tasks resembling this one.

The month of observation reported here began as structured by tasks usually encountered by Dr. Kellogg, a specialist in cardiac electrophysiology and exemplar of the intensivist model. Intensivists' tasks require that

they respond spontaneously to a constant cycle of fast feedback loops, in response to often unexpected events and new information provided during the hands-on execution of a case in their laboratories. In these laboratory settings outside the residency team, Dr. Kellogg's usual decision-making processes resemble those she models for the trainees in rapid-fire interactions that allow her to assess how well residency team members are capable of responding to tasks resembling her own. She and her colleagues in the electrophysiology laboratory implant pacemakers or defibrillators, extract electronic leads and other device components if they deliver excessive shocks or fail to work when appropriate, and ablate the heart in an effort to correct electrical signals forming abnormal cardiac rhythms. Intensivist work demands a high level of coordination and permits only a low margin of error once the patient is on the operating table, so that physicians must make quick and confident decisions about both scientific and embodied knowledge.

When responding to feedback loops, the intensivist makes decisions based on several sources of information. Intensivists must constantly monitor the jagged tracings of an electrocardiogram that at any moment might reveal excessively fast or slow beats. Intensivists must also observe the movement of a catheter through the patient's arteries and heart through fluoroscopy (x-ray), as well as direct the nurse to deliver sedation if the patient expresses pain. The behavior of intensivists is event centered, and they must quickly interpret patient changes in front of a team composed of a doctor completing a fellowship, a nurse, and several assisting technicians. Intensivists keep deploying knowledge because they can see results amid the fast feedback loop organizing their task interactions.

As an intensivist, Dr. Kellogg demands predictability in these interactions because she depends on the immediate availability of good information. For example, she must evaluate the device recommendation from the industry representative at the bedside who assists with the procedure by clarifying the features of the technology. Intensivists must ensure both that the device is suitable for the patient's anatomy and also that it does not include unnecessary features. Intensivists have a deep understanding of a limited range of tasks and, given the risk they recognize in these tasks, want as much predictability as possible. Like her colleagues in this command structure, Dr. Kellogg demands responsiveness and is highly sensitive to whether she gets it. Only if intensivists can rely on predictability from their associates around the operating table are their movements intuitive and deliberate. When outside of the laboratory and in the residency teams, Dr. Kellogg and her colleagues reenact their own tasks with the goal of preparing trainees to make decisions in rapidly responding to feedback loops with an eye toward potential outcomes in a blueprint.

To accomplish the task of managing patients in electrophysiology, the doctors must ensure that these patients adhere to recommendations for managing their health after a procedure. Unfortunately, patients do not always listen, so in order to meet the needs of the task, attendings try to teach trainees how to persuade patients to behave in a way that will achieve patient compliance in the longer term, and they also teach them how to use knowledge they collect from an initial assessment of a patient to anticipate outcomes about a patient's prognosis.

In order to improve trainees' abilities to influence patients' behaviors and project treatment outcomes, Dr. Kellogg serves as a model for how to interact with patients. First, she presumes patient compliance as a default condition, rather than offering up options: "We're going to do X, and we are more likely to be more successful if we do it." She may then briefly hedge, saying, "If you're adamant about not doing this, we're going to respect your wishes," but will go on to indicate to the patient that a test result suggests that the knowledge underpinning her initial recommendation would be immediately beneficial for achieving a particular outcome. Second, she uses stark metaphors to recommend health behaviors to patients. A favorite: "By eating all of this canned food, it's like you're screwing off the top of a salt shaker and pouring it down your throat." With these tactics, intensivists intend to send a clear message about the benefits of future changes in habit, while smoothing any potential resistance by the patient to treatment.

While the central tasks of an intensivist are to gain patient compliance and perform procedures correctly, the most essential underlying task that is affected by the feedback loop is communication. Trainees are expected to know how to communicate effectively with their attendings, their peers, and their patients. To make good decisions, trainees who interact with patients must learn to adopt an authoritative stature and hold their composure even in tough circumstances, answer questions about a device or procedure without stuttering, and communicate to patients that they know the process and consequences of an operation. Learning these interactive styles gives trainees tools to make decisions about how to communicate in different contexts. The doctor has successfully executed the task if the patient knows what to expect and will comply even if the process is painful, which ultimately makes the procedure easier and probably more successful. In these procedures, especially, intensivists must be ready to change strategies after interpreting new information by consulting the blueprint. As one of Dr. Kellogg's colleagues put it:

> You need to make sure they have an understanding of the case before they go in, and if a fellow can't articulate as to what his plan is, then they get a response

> from me, asking, "How do you expect to go into a room and operate on a patient when you don't even have a plan, you have no understanding of the case?" This isn't play time, and I tell them that. They go in and cut and sew and slam a device in and whatnot. This is a patient; you have to have an understanding of that patient's history and be able to anticipate what kinds of complications this particular patient might have, and in anticipating those potential complications, now you have a plan set in place that demonstrates that you're aware that those complications exist and how you're going to circumvent them in approaching the case.

One of the demands of the social context of the task, then, is that the trainees be able to make good decisions about relevant knowledge so that they can communicate rapidly and effectively with the attending. On the wards, too, Dr. Kellogg seeks to expose students to potential complications so they can use their blueprints to personally anticipate outcomes and rapidly adjust course. The teaching philosophy of intensivists resembles that of a piano teacher; correct procedure has to be learned through repetition. And if a procedure does not work, intensivists can reassure themselves that they executed it correctly without second-guessing their decisions.

Dr. Kellogg suggested that trainees need to respond decisively and perform a resolute and highly polished case presentation if they are to gain the buy in of both the patient and fellow colleagues and make themselves confident their experience is sufficient for action.

> In your verbal interactions with people, it's important to know what you're talking about, but it's also very important to convey to the other person that you know what you're talking about. That you're confident about what you're saying, and not hemming, hawing, saying, "I don't know, I don't know." Just make a guess and put your stake in the ground. . . . And there's this expression, "Be strong and be wrong." It's funny because it's a little bit backwards, but the hyperbole is meant to emphasize the importance of being confident in what you say. And also feeling like you've done enough research and that you have gone through the rationalization in your mind so thoroughly that you are convinced that what you're saying is correct.[19]

For an intensivist, when a trainee uses the verbal tic of "hemming and hawing," the trainee undercuts the enterprise of ensuring he or she responds appropriately in a situation with built-in fast feedback loops.

To simulate the pressures of their tasks' fast feedback loops, intensivists engage in the practice of "pimping" trainees in their case presentations,

[19] Kellogg (2011, pp. 70, 78) describes the pervasiveness of the "strong and wrong" philosophy among surgeons. The fact that her task structure shares much with surgeons makes it unsurprising that Dr. Kellogg's teaching resembles that of Dr. Arthur in Bosk (2003).

forcing them to learn to decode information very quickly midprocedure.[20] In exposing trainees to new information in a fashion analogous to electrophysiologists' interactions with the patient, Dr. Kellogg seeks to prepare trainees to communicate effectively, while also preparing them to change strategies and further ensure they realize projected outcomes. Accordingly, her pedagogical strategy involves interrupting their case presentations. While the following example is relatively tame, Dr. Kellogg's strategy creates pressure on residents to concisely infer from tests to deductively arrive at a diagnosis.

Dr. K So, I think a useful format is to start with the problem, and then, your assessment of that problem. In your presentation yesterday, all of those elements were mixed together. So, she's a new dilated cardiomyopathy. Based on her history and the test we got yesterday, including a negative stress test and a negative TSH [thyroid-stimulating hormone score], she is most likely a pericardiomyopathy. From a symptoms standpoint, what do you think her volume status is?
Intern I don't think . . .
Dr. K (interrupting) So your options are euvolaemic, hypervolaemic.
Intern Well . . .
Dr. K (interrupting) So, do you think she's hypervolaemic, euvolaemic?
Intern Euvolaemic.
Dr. K Well, based on what you're telling me, she didn't diurese, and was not euvolaemic yesterday, so she's unlikely to be euvolaemic today. So, assessing people's volume status is a skill for you to work on.

Another teaching sequence also frequently used by intensivists involves a point-blank question such as "what do you see in this EKG?" that is followed by multiple queries of "anything else?" Through these sequences intensivists reenact the challenge of gathering data, evaluating their relevance, considering their consequences for blueprint-projected outcomes, and taking action.

In my observations, the new doctors' interactions with the intensivists' tasks clearly showed them that they could prevent embarrassment only by gathering published knowledge and confidently deploying it. The fast feedback loops of pimping allowed them to predict that deploying scientific knowledge would help them save face. Consequently, they saw the need to

[20] "Pimping" is a process interns dread due to the interrogation's persistence (see also Anspach 1988, p. 361; Kellogg 2011, pp. 78, 117; Prentice 2012, p. 154). Its traumatic and anxiety-producing nature makes pimping a common target of satire in medicine (Bennett 1985; Detsky 2009). The analogue in the United Kingdom is "bollocking" (Pringle 1998, p. 192). Its efficacy for learning surgical tasks is periodically reinforced in the medical literature (Antonoff and D'Cunha 2011).

respond with an urgency demonstrated in many other studies of intensivist medical education (e.g., Bosk 2003; Prentice 2012). As the resident said in describing her motivation for preparing for presentations with Dr. Kellogg, "The times that you feel like an idiot on rounds, I can tell you, you go and you read because you just don't want to be an idiot again." Interests and goals were unambiguous: prepare knowledge and delivery for the next day's pimping.

Trainees' discomfort with the fast feedback loops in intensivists' tasks made them collectively prepare in advance when engaging in decisions about knowledge. The immediate feedback in pimping led trainees to formulate "strong and wrong" responses and a specific case presentation format demanded by the intensivist's tasks. She frequently goaded her residents to prepare, to "put it in your head before you blurt it out." A medical student indicated he was highly conscious of Dr. Kellogg's expectations for how he should consider the relevance and consequences of patient data, given how often he had been sanctioned on his oral presentations. "She told me, 'Don't think out loud, don't say what you're thinking. It is more professional to not say anything.' She says it's more professional if I process things first before I say them. And if it's not relevant, don't say it. She said, 'Make yourself look good and not bad.'" The medical student anticipated that his concern for saving face would be achieved by working with teammates. Consequently, he and the resident habitually crammed for case presentations late into the evening, and he opted to eschew the policies of Superior's medical school by staying overnight at the hospital during the first half of the month.

When working with the intensivists, the trainees' interest in saving face and the fast feedback loops in their tasks led them to confirm their blueprint-mediated projection that they would be successful only if they responded to the tasks with familiar strategies of information collection that are formed in medical school. In the face of intensivists' pimping, trainees found the most effective strategy for proposing next steps was to unhesitatingly deploy scientific findings in case presentations (see also Detsky 2009). Once they decided what they wanted to do, trainees would first look to databases with summaries of expert opinion, such as UpToDate, which then might lead them to scientific studies published in the Medline database. Ultimately, their goal was to locate articles based on the longitudinal, multicenter, prospective, so-called landmark clinical trials constituting cardiology's knowledge base. The trainees would subsequently deploy these findings in support of their plans, engaging in a practice I refer to below as "Bayesian performances." This decision was familiar because medical and premedical training frequently requires students to seek out, memorize, and deploy their findings for authorities. Consulting this blueprint allowed them to foresee that they would be able to save face in interactions with Dr. Kellogg.

When trainees carried out intensivist tasks modeled by Dr. Kellogg, they sought to draw on knowledge to perform in a way that gave patients confidence and allowed them to more reasonably project positive outcomes. Their performances were underpinned by the prediction that, whatever else the faculty demanded, a "passing grade" on the test would surely require knowledge of immediately accessible well-established facts (see also Becker et al. 1961). They had a general ignorance of the long-term consequences of deploying these facts, to be sure, but the feedback loop showed them that deploying scientific findings in immediate response to "pimping" was more important and could achieve the outcome of saving face. When confronted with feedback loops demanding their fast response, and a task showing them that they would be rewarded by enacting confidence for both patient and team, they could project that deploying scientific knowledge would be considered appropriate by Dr. Kellogg. In contrast to what was demanded by intensivists' tasks, as I show in the next section, the temporal features of the deliberator's tasks did not allow the same level of reliance on familiar short-term strategies.

Projecting Provisional Outcomes from the Slow Feedback Loops of the Deliberator's Tasks

Tasks for deliberators often require that they develop innovative ways to manage patient conditions, and so they need team members to collaborate in a way that might shake loose a new idea. Consequently, they expect team members to be open to a range of possible directions for treating and securing the compliance of a patient. The slow feedback loop of the deliberator stems from the fact that many things can happen to patients between office visits: they can be noncompliant, they can have a different problem that is more acute, they can improve on their own. Furthermore, the deliberator's task involves goals that can be quite ambiguous, ranging from an interest in preventing procedures for those with limited capacity to give informed consent to a focus on improving quality of life. Because of all these factors that slow the speed of the feedback loop, the team members I followed could not easily envision outcomes using blueprints for deliberators' tasks with patients, and so they could not immediately identify what they must do and how they should do it. So, rather than being "strong and wrong," when with the deliberator trainees opted to include hedges when they proposed next steps in patient care, they were uncertain about what kind of knowledge would help them respond to Dr. Walker and manage the patient. This enabled them to pursue their interest in preserving energy amid their many responsibilities.

Deliberators must make decisions about using knowledge to accomplish a task that differs from that of the intensivist in multiple ways: it is not to

provide a quick answer but to over time find the best answer, it is not to be in control of the patient but to maintain the confidence of the patient, and it is not to visualize the right solution but to adjust in converging on a pragmatic solution. To make these decisions about knowledge, general cardiologists like Dr. Walker foreground a range of individualized quality-of-life and disability-related concerns as they develop over time. Deliberators frame problems broadly and rely on patient feedback for making decisions about care. Fitting the folk notion of the "good doctor," the primary tasks of Dr. Walker, along with other deliberators, involve few procedures; he largely provides his patients with medication to treat their cardiac concerns. He is concerned about not only the immediate outcomes of invasive valvular surgery but also longer-term ones. Thus he experiences a different level of ambiguity in decision making than Dr. Kellogg, as his patients might have a whole range of cardiological issues, if indeed their problems turn out to be related to the heart at all. General cardiologists work more independently than cardiologists who conduct procedures, and when working within training settings they may emphasize that trainees must anticipate more possible outcomes into the longer term. For instance, if they are working with an elderly patient who might get a valve replacement, they have to consider the side effects on the patient's long-term mental capacities. Because the deliberators have longer time horizons, they expect trainees to examine patient symptoms other than simply those revealed in the cardiac tests.

Dr. Walker is not looking for short-term solutions and quick fixes, and since many endpoints might be relevant in his eyes, there is no clear best way to execute a treatment. Dr. Walker indicated in interviews that a goal underpinning his interactions with subordinates was to push them to interact with patients to gather information and develop provisional, adjustable plans at different points that rest on interview-based knowledge about patients. Treatment trajectories for deliberators ultimately differ considerably between patients because deliberators are more likely to consider each patient's condition unique. To reduce the amount he has to speculate about outcomes, Dr. Walker might even suggest that some measures be delayed in response to a patient's objections, often with the intention of reaching a compromise based on a longer-term goal. For example, when a resident proposed a new treatment regimen, the patient protested, even though the new treatment regimen would accomplish the task more quickly. While Dr. Walker did agree with the resident's proposal, he was concerned that the patient would not adhere to the new regimen over time.

> Dr. W Well, I tell you, if the patient's so focused on the Lasix and Zeroxolyn, I would be happy to sorta make a deal with him. Sometimes it's the medication, and sometimes it's the physiology—it's such a moving target with these people.

Intern The only reason we stopped Zeroxolyn in the first place was to help the natremia, after all.

Dr. W So we could say, "OK you can get Zeroxolyn if you do a right heart cath, that would be a gain for us." I think using this drug would be relatively neutral from a medical standpoint.

As evidenced above, deliberators want interns and residents to consider the whole picture of a patient, to consider not only knowledge about a drug but why it was prescribed for this patient and to make a decision about what part of that knowledge to use so that they can make decisions about how to use other knowledge (about drugs, physiology) to act toward healing.

For Dr. Walker, then, effective decision making about the use of knowledge involves collaboration and an inclusive discursive approach. Because of the slower feedback loop involved in anticipating outcomes, he allows, if not expects, interns to experiment with knowledge of different varieties without predetermined plans or extensive justification. As Dr. Walker explained,

> I generally take the approach in the training environment that my job is to watch the overall care, make sure it is going in the right direction. So if somebody feels they want to get an additional test here, an additional test there, I let them explore that a little bit. Provided it's not something that's dangerous, I let them go there and find out where they end up with that test, even if I've been there and know it's not going to help us. . . . The times you run into trouble with residents is frequently with the brightest ones who are overreaching or are more confident than their level of training would suggest they should be.

Contrasting his job to that of the intensivist cardiologists, he continued, "So it's sort of different urgency, in a sense, a different level of risk that comes into the equation. If I'm reading an echo, and it looks like the fellow didn't read it correctly, we have a few hours to teach him why that isn't correct."

The first quote indicates how Dr. Walker feels his tasks require making decisions about the overall care. He wants trainees to articulate how they make the decisions to use a certain type of knowledge. In doing so he seeks to develop the kind of discursive space described by Habermas (2006), one that legitimates interaction between the lower-status trainee and the elite attending. In saying he lets people explore whether to get an additional test, he is saying that he wants them to articulate how they are making a decision about using knowledge to order a test. He also lets them do the test and expects them to check whether the knowledge they used to order the test was correct. To ensure that interns can act iteratively in this way, Dr. Walker consistently asks his interns to work together as a group. To

begin to envision outcomes, he feels the team should float a range of diagnoses and approaches to management. This pedagogy is consistent with the recognition by deliberators that not all solutions are immediately at hand. It also suggests his intention to observe how subordinates tolerate the uncertainty of making a decision and to teach them how a range of considerations can emerge through informal conversation that might be obscured by unambiguous delivery.

Interns in Dr. Walker's team cannot rely on a knowledge corpus exclusively based on the professional literature and have to develop their own understandings of patients. To help them begin to cultivate the relevant interactional skills, in case presentations he does not "pimp" but rather probes. As one intern noted, "[Dr. Kellogg] had a particular order for the case presentation and expected all the previous patient information we had; whereas with [Dr. Walker] it was like 'oh great, you have the echo report!' With her if you don't have the echo report, that would be inconceivable. With him if you had it, it was like a bonus." They reported feeling Dr. Walker had few demands in terms of specific information he consistently expected and was prepared to use whatever patient knowledge the team could find to work with them in assembling a picture of the patient and inductively deciding on next steps. In interviews, Dr. Walker emphasized the value of recognizing uncertainty and exploring multiple potential solutions. This was revealed in the way he responded to trainees during case presentations.

> Dr. W You know, this is one where you get nine different attendings that will have a slightly different opinion on this. None of them are right or wrong. The way I always think about it, if you're perioperative and you go to cath somebody, I'm not sure if putting someone who is demented on the cath table and asking them to cooperate is a safe bet.
>
> Resident So medical management is right, in this situation?
>
> Dr. W I'm just giving you my opinion. Part of the process is for you guys to make decisions, and do what you want, and if I think any of it's dangerous—like, if you order a stress test with someone with a thrombus—then I'll let you know. But short of that, there's not either a right way or wrong way to do this, so do what you want to do.

Dr. Walker rarely interrupted or corrected his subordinates during their case presentations. The way he sought to teach doctors to confront tasks required that he model reflection and direct trainees to propose individualized treatment directions and to be aware of the relationship between their judgment in the moment and their judgment a minute later, after consideration of other information. The team never received, nor were they ex-

pected to provide, an unambiguous indication of what constituted proper treatment.

While using the blueprint tied to the deliberator's tasks, the young doctors had to develop their own discursive strategy in response to their discomfort with using knowledge to pursue patient outcomes. This discursive strategy affected the knowledge residents used in decisions. Rather than using the "strong and wrong" strategy endorsed by Dr. Kellogg, they used two types of hedges: shields and approximators. This discursive strategy was particularly pronounced when a trainee was communicating his or her own lack of commitment to a particular treatment path. Having previously discussed the patient with team members, the resident presented:

> Abdominal pain. Unclear etiology. Seems chronic. She's had it for over a year. It had been getting worse over the last month and that's why she came in. Abdominal film was normal. UA [urinalysis] had been unremarkable. *But, um, it's kinda supra-pubic in location, so there's the possibility of some sort of, maybe, a pelvic issue*. We talked about maybe a pelvic ultrasound—but her pain seems to be better today. *So, I think as long as it's not a huge complaint it's probably a minor issue.* So we'll see how it goes after her diuresis.

In this example, the resident's discursive strategy involved hedging, and it was chosen because it includes a number of ideal-typical features. A hedge is a word or phrase "whose job it is to make things fuzzier" (Lakoff 1973, p. 471). Through studying physicians who stated that they felt uncertain at the moment of their use, hedges were analyzed by Prince, Frader, and Bosk (1982) into subclasses called approximators and shields. The development of this linguistic category in the medical context makes it valuable for showing certainty versus uncertainty when a task requires a doctor to interact with a blueprint. In the passage above, the sentence beginning with "But, um" is an approximator.[21] Doctors' use of approximators indexes an unwillingness to deliver a "strong and wrong" claim to establish the solid facts of "what is going on." They are adopting this discursive strategy because of their own interest in using knowledge in a way that accommodates others' perspectives and showing their readiness to compromise. In contrast, the sentence beginning with "So, I think" represents a shield.[22] The use of shields demonstrates that the doctor is personally unready to be considered as having committed to a claim at a particular point in time. The conse-

[21] Approximators adapt a term to a nonprototypical situation, representing fuzziness within the propositional content proper.

[22] Shields affect the degree and type of speaker commitment that is inferred. They represent fuzziness between the propositional content and the speaker, that is, in the speaker's commitment to the truth of the proposition conveyed. Shields do not affect the truth condition.

quence of the long feedback loop involved in this task was that trainees were uncertain about the benefits of using their knowledge in immediately intervening with the potential pelvic issue or increase in pain.

These hedges were appreciably more prominent in the language of the team when working with Dr. Walker, suggesting that deliberators have a different relationship to the research literature than intensivists. The hedges suggest that the differences between the intensivist's and deliberator's tasks were in the ability of the young doctors to easily envision outcomes of having deployed knowledge to treat the patient. The deliberator's trainees consulted academic literature one-third less than when they worked with Dr. Kellogg. Further, their interest in clinical research with the deliberator was not linked to the task. Only one team member claimed that she continued to pore through the literature at the rate she had previously maintained. Yet she indicated her motivation for reading had changed; it was now driven by a concern for reducing general uncertainty about cardiology. "I still looked up papers with [Dr. Walker], but it was more for my own edification than for patient care issues." When this trainee worked with Dr. Kellogg, she was involved in a conscious process of becoming "test wise" (Becker and Geer 1958; Becker et al. 1961) through a search for material she anticipated would prevent embarrassment if deployed in interrogation. When she worked with Dr. Walker, she developed an ad hoc relationship with the literature, which resembled an attempt to understand the knowledge of the field independently of the structure imposed in previous formal training settings (see Fox 1957, p. 223). Under the deliberator, the intern sought to expand her knowledge in more general ways, because the time horizon was too distant and there were too many directions for decision making to allow her to predict what specific information would be most relevant.

Using their blueprint for this task, the young doctors could safely project that their non-work-related interests could be exercised, and they made the decision not to consult the published knowledge corpus. Dr. Walker's inability to envision clear outcomes for a patient led him to organize their tasks in a way that emphasized discussion and negotiation over fear. Not able to project the benefits that might come from, for example, collecting more knowledge about the patient in advance, they slept more and spent less time gathering knowledge and preparing for case presentations during call nights. One intern used his time at night to watch hockey games on the Internet. Other team members searched for attendings' profiles on the Internet and laughed at their outdated pictures. They felt that what would be valued in the task enacted by Dr. Walker was less their perfected delivery than a capacity and willingness to adjust; because deliberators rely on pattern recognition, interns did not feel the need to prepare by consulting the published literature.

I have shown that the team did not decide to consult the professional literature in their interactions with the task structure imposed by the deliberator. This feeling came from not having feedback loops fast enough to demonstrate how knowledge from a patient or scientific study might help them predict outcomes of a decision. To be sure, they had less experience than Dr. Walker, so the range of outcomes they could project was smaller. But even Dr. Walker could not entirely envision outcomes; information from previous tasks was only marginally useful. Having been forced into this decision-making situation by the task's feedback loop, in addition to not drawing on information on abstracted patients described in the scientific research, trainees—like deliberators—were uncertain about what kinds of information to collect that might help them. They could, however, project that the time could be spent conserving their energy.

PART 2: IDENTIFYING THE INTERACTION OF TASK AND BLUEPRINT IN ADMINISTRATIVE SETTINGS

At the same time that they were working with Drs. Kellogg and Walker in their inpatient teams, the young doctors also had to respond to administrative tasks established by the hospital and imposed in two other sites. It is important to study these other tasks to establish whether and how situational features are germane—specifically, those involving feedback loop speed—in decision making about the use of knowledge. It turns out that the link is supported. Because the administrative tasks with fast feedback loops allowed the young doctors to use their blueprints to see that the authorities in these areas would potentially impinge on their concern for controlling their time and managing their relationships with their patients and fellow doctors, they confidently deployed knowledge from clinical research using language that defended them in that time and place.

In comparison to the tasks performed by the team under Drs. Kellogg and Walker, the administrative tasks organized by the hospital and performed by the team happened in two settings, the triage and discharge meetings, that are created to move patients into and out of the hospital as rapidly as possible. In both of these contexts, the interests of the administrators and of the doctors do not always converge. The triage meetings involve the residents and the emergency room (ER) physicians. Here the usual process for admission is that ER administrators and physicians will use a standardized protocol to initially sort incoming patients onto residency teams. The ER doctor is charged with speedily emptying beds so new patients can be admitted. If these patients are not moved from the crowded ER, then the hospital is unable to accept new patients that are potentially more interesting or lucrative. In the discharge meetings, the relevant authorities are paraprofessionals whose task is to place treated patients into outside organiza-

tions such as nursing homes and kidney dialysis centers. These cost-sensitive administrators, nurses, and case managers are charged with taking control and expediting decisions about patient management, in part, because many patients in Superior are uninsured or dependent on government aid.[23]

These two tasks, triage and discharge, provide an excellent opportunity for examining the effect of feedback loops on how interests are exercised because trainees bring to these tasks a set of goals and project a set of outcomes that in many ways conflict with those of administrators. In the triage meeting, the ER doctor (in an administrative role) expects the team to accept those patients the hospital has deemed appropriate for their service. At the same time, trainees have an interest in minimizing the number of patients on their censuses because they can foresee that doing so will briefly lighten their workload (see also Mizrahi 1986). Since they see the administrators' efforts as hindering their ability to manage a reasonable number of patients, they are motivated to try to convince the ER doctor expecting a quick decision that certain patients would be more appropriately placed on a different specialty's service.

In spite of these conflicts, the trainees I followed found their interests could be pursued because administrators recognized the value of the knowledge they deployed to support their arguments. In the same way that they were able to do so with Dr. Kellogg, the young doctors were able to use their incipient blueprints for this task to project potential outcomes of following administrators' lead, in particular, whether doing so would negatively affect their control over their own time or their relationships with their attendings. In ER triage meetings, administrators interpret the task to involve sorting patients into hospital areas with human and physical capital that can serve them, while trainees interpret the task as sorting patients into an area other than their own, a process referred to as "turfing" or "dumping." Trainees focus on turfing primarily those patients who are so-called social admits—those admitted for administrative reasons (e.g., authorization into a nursing home or dialysis center) and whose admission lowers morale because team members can anticipate, usually accurately, that social admits may stay for weeks without offering new learning experiences.[24] Social admits are thus avoided at all costs.

In the ER triage meetings I observed, the team was able to project outcomes of using scientific knowledge because the pressure from ER ad-

[23] A similar model for reviewing whether a patient has occupied a bed beyond the period reimbursed by insurers exists in the United Kingdom, where the state mandates that clinicians record reasons for noncompliance with National Service Frameworks (see Harrison 2002).

[24] Becker et al. (1961) report that doctors call these disfavored patients "crocks."

ministrators inflicted fast feedback loops. The team's exchanges in ER triage were not unlike Dr. Kellogg's approach of pimping; they were governed by tasks involving the need to convince another of their confidence and competence in decision making. Trainees knew the time costs of caring for more patients than those they must already treat (Leiderman and Grisso 1985). And while the feedback loops were rapid, they were more interactive and indeed gave the trainees a chance to pimp others using skills developed in medical school and with the intensivists' tasks. Here, the resident on the Kellogg/Walker team, Dr. N, was asked to follow a rule stating that all patients with the symptom of "syncope," or fainting, must be admitted to the cardiology service. The ER administrator had just told her she was to be given a new patient.

ER doc I got a syncope that I can't do anything with.
Dr. N A dump of a syncope? How can you do that?
ER doc I think it's kinda fishy.
Dr. N Did he syncopize?
ER doc Do you know him?
Dr. N I just saw him half dressed, tipping over.
ER doc Did he pull the Foley [catheter] out?
Dr. N I don't know what he was doing. Is he demented?
ER doc He's demented. And he lives on his own. . . . I've been trying to throw him out to GENS [General Medicine], where he belongs, but . . .
Dr. N And how demented is he?
ER doc Oriented to self, hospital, 1928 or '56, depending on when you ask him.
Dr. N And his syncope story is "got light-headed, dizzy, fell down"?
ER doc Was on the toilet, stood up, slumped down.
Dr. N So it's vagal.
ER doc Maybe.
Dr. N Why wouldn't it be?
ER doc Well, I think . . .
Dr. N 'Cause syncope, by definition, is defined best by clinical history.
ER doc So maybe it should go to general medicine.
Dr. N Yes, I'm going to appeal this.

This back-and-forth dynamic demanding an instant decision was common to admissions meetings.[25] The administrators did not necessarily share the pedagogical interests of the attendings. However, as shown above, in order to accomplish their own tasks they sought to convey the importance of rapid action. That trainees were able to effectively block patients from their services via pimping administrators suggests their capacity for using fast feed-

[25] Maynard (1991) shows that this pattern of concessions and assertions also organizes how physicians maintain authority in other sites.

back loops to forecast with their blueprints the possibility of instrumentally using scientific knowledge to enable them to maintain control in the team.

The resident came to dominate the ER's triage decisions by drawing on a store of clinical research whose effect she could project would let them block patients. The resident would come to triage meetings with a clear view of how her patient should be managed. She and other team members regularly used deductive tactics to quickly respond to the ER doctor, blocking attempts to allocate patients to their cardiology service. For instance, with a level of force similar to that expressed in the passage above, they learned to place patients diagnosed with syncope into the internal medicine service, claiming that the problem was "vasovagal" (related to the nervous system, not the heart). After an initial diagnosis of syncope by ER doctors, the trainees would order and review EKGs and make a case for sending the patient home or to another service, strategically deploying the cardiology literature with which they had familiarized themselves on the best approaches to interpreting and acting on these sketches. For example, one resident described her approach thusly: "We invoke clinical research to support our transfers all the time. We have to be able to say, 'These are studies that show this.' Oftentimes, if the resident is savvy enough . . . we can argue that even though there are certain arguments that there are markers for cardiac damage, that this [particular case] is an old event, or is not active enough to warrant action at this time."

To block patients to other services, the trainees frequently deployed criteria for treatment for select cases that leaders of the residency program had printed on laminated cards to try to standardize the sorting of admitted patients. These cards are based on evidence in the field, specifically classic presentations, and they ground specific decisions. When trainees use knowledge from their field represented in this set of cars, they decisively offered documentation and the impression that they were engaging in decision-making processes described in writings on evidence-based medicine. The feedback loops in ER interactions let the doctors project potential obstacles to transferring patients, which, on the basis of their training in "test-like" scenarios, they could project could be overcome if they identified compelling relationships between the patient's features and clinical research. These performances were a familiar strategy involving a combination of swagger and evidence expected in the tasks confronted by intensivists.

Now we turn to the discharge meeting, which also involves a well-defined task with fast feedback loops, one constructed by administrators looking to increase the speed of discharge by pressuring doctors to make decisions in a way that is consistent with the goals of the hospital. The trainees are strategically ensuring that control of decisions about the patient remains with the team, in part because they have been trained to discount opinions of paraprofessionals and to be only marginally concerned

about cost. In addition, this month they are working with cardiologists, whose dependence on referrals makes them concerned about relinquishing control of admissions and discharges to those unconcerned with cardiologists' reputations.

These administrators and other nonphysicians expect team members to actively participate and provide information that will inform their preparation for discharging a patient, yet the trainees use their blueprints to anticipate that attendings want them to maintain control over the team. As a senior physician executive who developed the system described, "We intended to put the heat on [trainees] early in the morning, and have them do something during that day—or the next day if [a patient] was still in and not going. And they had to report to [the discharge] group so that we could hear about it." These administrators know that the hospital's reimbursement level is pegged to the number of days the patient spends in the hospital. When physicians delay discharges, costs rise and revenues fall. Yet on the basis of blueprints for discharge tasks, interns do not want decisions to be governed by the financial imperatives of nonphysicians, nor do they want them to happen independently of the full team. Because others can help visualize outcomes of decisions, the team has an interest in supporting its members—recall that it collaborated with Dr. Kellogg to construct plans for patients. Administrators and others at the meeting, such as the group's social worker, get frustrated with trainees when they have to prod for information that will help place a patient outside of the hospital. After I watched him interrogate an intern in a meeting, Mike, the social worker, shaking his head, said, "They have to be part of the discharge planning." He wanted information from interns early in an admission. If they offered up such details, he could begin the paperwork necessary for convincing a nursing home or dialysis center to accept the patient. Yet using their blueprint the members of the team could project the potential hazard of allowing these outsiders to influence their team's decision: the attending would be angry.

The resident recognized the challenges that discharge meetings posed for the interest of her team members in making independent decisions. Because of this, the resident became an expert in achieving the teams' goals with the hospital by rapidly and confidently invoking knowledge developed outside of the team. As she did in response to tasks expected by Dr. Kellogg, the resident would prepare for these events until she was sure of her position's merits; she saw this site as a proving ground for being seen as an autonomous practitioner. For instance, in the elevator ride down to these meetings she would say to her team, "Watch this, I'm not going to have to use 'Dr. Kellogg says we should do such and such.'" She predicted that this tactic would be as ineffective with the committee as with intensivist attendings, as the regular "hospitalist" physician in the meeting would simply follow up with senior

doctors and thus force her to further defend the team's decision. Yet she projected that if she confidently invoked scientific research she would not be challenged by the nonphysicians in the meeting. The resident's practices were familiar because of her experiences with deploying useful knowledge, but also she could foresee the outcomes of deploying knowledge in support of her team. This instrumental use of evidence let her support claims that fast discharge decisions "are not in the patient's best interest." As they did with Dr. Kellogg and in admissions, then, for the discharge meetings the team worked together to be able to confidently respond to pressure from administrators by grounding their authority in their field's knowledge.

In contrast to the admissions meetings, where both ER doctors and team members benefited from the team's rapid decision making with clinical knowledge, the team's efforts in the discharge meetings were counterproductive to the hospital's goals. Over the two years in which I observed the interdisciplinary cardiology discharge meetings, the cardiology section showed no progress in its efforts to reduce discharge times. It eventually eliminated the requirement that residents attend these discharge meetings.

We see from these two administrative tasks that the interests of trainees may conflict with those of the organization, and trainees pursue those interests according to their ability to predict ultimate outcomes. In response to these multiple possible outcomes, trainees formulate a plan for managing the fast feedback loops with an eye on their own goals, and they strategically select from the published evidence base to do so. They can anticipate the goals of the hospital and respond by pimping back with knowledge. A demonstration of how important projected outcomes are when making deductive decisions is as follows: a resident from a different month referenced the judicious care the residents used when deploying their knowledge of clinical evidence to reduce their workload. After I watched her deploy research findings in a discharge meeting, the resident reported: "[Invoking results from new clinical research is] always the means to the end. It's like, if we knew—if we could predict that a change would get them to be discharged earlier, we would do it. But if we thought there was a chance of complications that would lead to longer stay, we might not do it." She continues, laughing. "It sounds so twisted. But we would not do innovative management. . . . So that's the reason we don't do something new—there is definitely the aspect that we don't want to do something that leads to more work."

The preceding quote encapsulates the doctors' more general concerns when they deploy evidence. If confronted with the chance of receiving patients, especially social admits, they will often comb through the literature for practices that support their goals for discharge, rather than systematically evaluate the body of published research for the current "best practice." When considering arguments about evidence-based decision making, then,

it is true that trainees evaluate the literature. However, as these accounts of doctors' instrumental uses of knowledge indicate, they frequently do so after their goal for patient care is established, while expressing little uncertainty about the relevance of this knowledge and tactic for accomplishing the task at hand. The residents do not endorse new approaches when they cannot envision that they will reduce their workload.

In examining how feedback loops in tasks affect doctors' ability to pursue features of their blueprints, it is evident that tasks in administrative settings, like the clinical one with the intensivist, require trainees to make decisions authoritatively—that is, to act as if they are right and support themselves with knowledge and a confident delivery. The administrative tasks, then, demand short-term strategies of decision making with outcomes they feel well equipped to visualize. These tasks are facilitated through deploying medical knowledge on the basis of their ability to forecast whether it will help them attain everyday goals.

DISCUSSION

Doctors decide to use knowledge in different ways, depending on their ability to project its consequences for carrying out their interests. They are more or less able to update projections in their blueprint depending on the speed of their tasks' feedback loops. Across the sections below I describe how we can use this model by putting it into dialogue with other ways of understanding decision making. I show how it explains the data presented relative to the aligned incentives model, how it offers a way to understand the contingence of certainty and uncertainty, and how it specifies the place of scientific research in the decision-making process.

Doctors' Interactions with Feedback Loops Drive Decisions about Prioritizing Interests and Using Knowledge

As shown, doctors decide whether to pursue, and also how to select and deploy, knowledge on the basis of their interactive relationship with work itself, as structured by the blueprint and the feedback loops. Confirming the centrality of the task in these decisions in a small-*n* study requires that one consider and rule out confounding causes. One such potential and plausible cause is that the doctors were simply acting in ways consistent with the interests of the organization. Yet, when we examine the aligned incentives model more closely, we will see more clearly the importance of the interactions with the task and trainees' associated blueprints.

Testing the dynamic blueprint model against another model such as aligned incentives is important because of how I have used Mill's small-*n*

method of differences. In a small-*n* study such as this, we must establish a deterministic rather than a probabilistic link between feedback loops and the process of decision making, and to do so, we have to rule out key confounding causes. The biggest one, and one with measurable qualities (in contrast to most confounders that plague studies using Mill; cf. Lieberson 1991, p. 313), involves the organization's attempts to align the interests of the doctors with its own (Coleman 1990, pp. 43–56).

In a blueprint-oriented explanation, interests are prioritized through the interaction of an individual and task. In this model, feedback loops, and not the organization, account for the pain or pleasure trainees feel. As the doctor recognizes the task, in the particular context, the feedback loops calibrate how he or she turns to a blueprint for making decisions, which provides information on the feasibility of pursuing different concerns. Then, argues Shackle (1942), we see more clearly the role of the individual acting in a social context, "when we feel that we know for certain what will be the outcome of a given course of action, that outcome, if it is a desirable one, can be *enjoyed by anticipation* as soon as we have decided to take that course. This promised experience . . . is the real incentive for taking the decision" (pp. 78–79). The pleasure and pain that come from imagining the realization of interests organize how trainees think about the benefits of blocking the administrators and of watching hockey when on Dr. Walker's service and the embarrassment involved in Dr. Kellogg's pimping.

The specific training of team members also helps explain how interests inform decision making. Medical residents are prepared by many previous exams for elements of blueprints in which they must project outcomes of the knowledge they deploy.[26] Thus, their team's responses to tasks cannot be attributed to their having been put on the spot via sanctioning; after all, trainees are being continuously evaluated. Instead, the differences in the feedback loops of the tasks above show that the spot where they are put—that is, the characteristics of the particular interaction—encourages or discourages the exertion of effort according to their interests in that context. The specific context of a given task provides feedback that helps people understand how to act on the basis of whether, in the context and time available for a particular task, they can evaluate the consequences of acting on these concerns. When the feedback loop is fast, their blueprints clearly show what interests they should maximize and what consequences will follow their deployment of knowledge. In medical school, the physicians I studied had interacted with their previous tasks by collecting knowledge, storing it, and dumping these data (Antonoff and D'Cunha 2011; Tompkins

[26] Sociologists and academic physicians alike have shown that students in higher education learn to direct their attention according to the formats that organize how their progress is measured (Becker, Geer, and Hughes 1967; Tompkins 2011).

2011, p. 104). There, interpreting tasks in the context of the fast feedback of the Socratic method is considered by medical education scholars to be the best way to learn. In classes organized by semesters—and especially, evaluated with exams—students' tasks involved being evaluated on their ability to demonstrate short-term knowledge retention and to envision outcomes in the context of a test. Consequently, they knew immediately whether they had accomplished a certain goal.

In contrast, if we look at the problem from the perspective of the organization, especially in a medical profession concerned with evidence-based medicine, the key to explaining interests-based action would involve how doctors respond to aligned incentives that are managed by sanctions. This perspective would predict that, through sanctions by their superordinate physicians-as-managers, subordinates would respond to the sticks and carrots of the organization. Formal organizations can be seen as multiparty settings that create two-party social relations. Under the theory of aligned incentives, the hospital would incentivize trainees to constantly search for new scientific findings or patient information and also thus improve their confidence in decision making (both of which presumably would, in turn, improve care). This is because the teaching hospital, like other organizations, can be seen as having functional needs—to train doctors and cure patients.

It is easy to see why one might consider the aligned incentives perspective theoretically plausible. In common with other organizations, hospitals understand that members have more self-centered, local, and situationally specific interests and that the members may not even care whether the organization actually functions. So, the hospital tries hard to build in mechanisms to align the interests of the members with those of the organization (cf. Coleman 1990, pp. 43–56). One nearly universal tactic organizations use is to have novices compete for success by making decisions that further the cause of the organization. And it is indeed the case that this motivated mastery could be seen when Dr. Kellogg and the administrators organized tasks that predictably incentivized the subordinates to use field-valued knowledge to cram as if for tests and to justify their immediate activities.

Yet the proof of concept lies in the young doctors' interactions with other tasks. While the doctors could not imagine the possible outcomes of collecting knowledge for decisions with Dr. Walker's patients (but could project that they could pursue leisure), the feedback loops in administrative tasks allowed them to anticipate that they could achieve outcomes in blueprints they had constructed for the task and not those goals held by the organization. An aligned incentives model struggles to account for why interests propelling decisions varied; at times the doctors' germane concerns were to reduce embarrassment and shame, and at other times they involved watching a hockey game. By looking at the tasks, however, we can instead

see that the contrast between their leisure before encounters with Dr. Walker and their energetic preparation for Dr. Kellogg and the administrators was a function of how feedback loops in tasks led them to project whether they would be best served by collecting and deploying knowledge for patient care or by preserving energy.

Uncertainty and Certainty over Decisions about Using Knowledge Can Be Explained by Feedback Loop Speed

As this article has shown, the different speeds of feedback loops arbitrate how decision makers are returned to their blueprint for the task to assess whether accessible knowledge will help them carry out interests. We now have a way of accounting for uncertainty. Decision makers experience uncertainty or certainty depending on the length of feedback loops. In other words, uncertainty hinges less on trainees' relationships to knowledge per se and more on the existence or lack of feedback loops that enable them to predictably mobilize knowledge according to interests whose outcomes can be visualized with a given blueprint.

Regarding certainty, in the same way that Shackle (1966, p. 471) has argued there are limits to using probabilities to explain decision making, intensivists object to assertions they should simply draw from abstracted "evidence-based" findings in the heat of the surgical moment (Horton 1996). Rather than take the time to consider the applicability of knowledge from long-term clinical research to the specific circumstances of a task, intensivists are trained to confront the pressure of the immediate surgical moment, the need to be prepared and to sustain authority over a team of experts in response to the slightest complication. These time-sensitive task-driven demands for certainty are encapsulated in the attendings' expectation that the trainee could initially, as Dr. Kellogg put it, "anticipate what kinds of complications this particular patient might have" and at minimum have a provisional plan for circumventing those complications that occur in the fast-paced setting of the lab. The fast feedback loops of the administrative events also allowed the doctors to project the consequences of certainty in deploying knowledge. Interns, having previously succeeded in medical school using quick feedback loops, envisioned success in a way that ultimately enabled them to meet immediate demands with certainty.

In contrast, the slower feedback loops in the deliberator's tasks—and the respective increase in contingencies—make probabilistic logic less useful and uncertainty more likely. Because of the longer feedback loops and the number of variables involved in treatment, the deliberator entertains a wider variety of potential factors than are involved in the two other tasks above. Moreover, since they are less willing to simultaneously engage in multiple treatment modalities, deliberators wait for future events to as-

similate into their structure of expectations (Shackle 1942, p. 93). Given Dr. Walker's slow feedback loops, the trainees were unable to anticipate whether and how knowledge they might collect would help them manage the patient. Therefore, with the deliberator the trainees demonstrated a high level of uncertainty when they made decisions and turned to interests with which they could anticipate they would have success.

By analyzing the doctors' practices in terms of expectations tied to blueprints, it is possible to uncover an original way of explaining the organization of decision making while also explaining the contingence of uncertainty and certainty in both this study and its influential predecessors. The physicians I studied in the clinical and administrative tasks responded to tasks in ways consistent with both of the seemingly divergent findings of Fox and Becker and colleagues. The key to reconciling their findings is a matter of paying attention to doctors' interpretations of their blueprints amid different time constraints. The uncertain episodes that Fox (1957) describes in her model frequently involve the extended time horizon of deliberators. The physicians' contact with patients is described as continuous, and, especially in later years of training, they must manage the long-term doctor-patient relationship (pp. 228–35). According to Fox, the trainees are predominantly concerned with mastering available medical knowledge and struggling with the realization that the published knowledge base is incomplete. These concerns occur when, in the fourth year of medical school, they begin to have extended relationships with patients (p. 235). Thus, Fox's discovery that her trainees experienced uncertainty is predictable when we note that her subjects frequently engaged tasks with longer-term feedback loops.

Uncertainty's absence, in contrast, is a common theme in studies of trainees who face short-term demands. The findings of Becker et al. (1961) can be explained by the fact that trainees are considerably more motivated in carrying out tasks with short-term feedback loops that allow them to use blueprints to predict outcomes. Given the actual work of these trainees, it makes sense that the authors find they favor control and action in the moment over concern for longer-term consequences. In Becker et al.'s analysis, the tasks feature feedback loops of a much faster duration, and trainees are influenced most by tasks orienting them toward the "student culture," in which they seek to control the onslaught of responsibilities imposed on them daily. The trainees rely on practical reasoning to arrive at a modus vivendi that answers their immediate interests (such as passing required examinations), rather than expressing concern over unknown aspects of medicine. They celebrate when the "luck of the draw" provides them with patients who may have an acute condition like a myocardial infarct (p. 329). They especially relish tasks with fast-paced challenges, such as delivering a baby. Considering this time horizon, it is unsurprising that Becker et al.

report they did not find Fox's framework useful in analyzing their data (p. 420).

One payoff of using a model involving dynamic interactions with blueprints to reconcile these two seemingly divergent perspectives is that it can also explain physicians' experiences beyond early stages of practice. For instance, according to Mumford (1970), residents in the community hospital—the site where they were given more responsibility and were more likely to confront emergencies—felt less that they were being "trained for uncertainty" than those in the university setting (p. 159). Further, the statistical data presented by Gerrity et al. (1992) on practicing attendings across specialties line up with this theory of uncertainty's presence or absence. The finding above that trainees lack uncertainty in decisive interventions helps explain these scholars' otherwise counterintuitive findings that less stress is experienced by physicians in the more high-risk fields. Uncertainty or certainty found in the work of Fox and Becker, then, is not simply a matter of pedagogy,[27] nor is it a sentiment associated with tasks specific to a stage of practice. The importance of context shown reinforces Atkinson's (1984, p. 954) proposition that both "uncertainty" and "certainty" should be seen as features of medical work equally. Specifically, I have shown that uncertainty and its antonym emerge and recede in a process tied to the speed of feedback loops presented in simulated and actual episodes of patient care.

Strategically Deploying Scientific Research: Doctors May Perform Evidence-Based Decision Making

Another key finding of this article is that doctors do not merely apply best practices for reviewing the scientific literature; they perform aspects of such evidence-based decision making through a process of interpretation. According to this process, when trainees execute tasks with fast feedback loops and use the literature to justify outcomes, they are performing the principles of evidence-based decision making to serve interests that may not be directly related to managing the patient.[28] Recognizing this process of interpretation accounts for important social, not simply logical, processes going on when an actor is making an inference.

It is not simply the case, then, that doctors routinely consult and passively follow research findings. They also, in response to a work task, may instru-

[27] This explanation was proposed by Fox (1989). Beyond evidence in this study, the limits of Fox's explanation are also represented in the finding of Timmermans and Angell (2001) that people in the same program can have different orientations toward the scientific literature.

[28] It is in this sense that such strategic deployments of evidence are similar to performances of trainees in attempting to impress attendings amid the latter's interrogations, as described by Becker et al. (1961, chap. 14). I thank a reviewer for pointing this out.

mentally pursue and deploy these findings as a credible warrant for pursuing goals whose outcomes they have projected. The findings will be read within a process of anticipation and action organized by feedback, a process involving interpretation from a standpoint or bias, as described by rhetoricians from Aristotle onward. (For instance, trainees faced with the constraints of their tasks will use evidence in the admissions meetings as a way to minimize the number of patients they must treat at one time.) This process of interpretation can be seen as the opposite of the process of using scientific findings detailed in writings on evidence-based medicine.

I call these instrumental deployments "Bayesian performances." We can see the performative value of scientific findings most clearly in the administrative contexts. As Strauss et al. (1963, p. 154) argued, in such settings, doctors and administrators turn to shared goals to overcome tensions between professional and bureaucratic influences on their decision making. Why, then, did the trainees I observed turn not to shared goals but specifically to scientific findings in order to address these same tensions? Although this study offers no unambiguous answer, several suggest themselves. First, it is possible that residents had been trained to internalize the importance of evidence-based medicine, given the value often placed on it. Second, they may have felt they were following organizational protocol; the academic hospital recognizes scientific findings as important and, as we have seen, integrates them into cards supporting the protocol for allocating patients. Third, and perhaps most important, as a resident said, these performances are "what work." These Bayesian performances are compelling to the individual doctors because deploying this form of knowledge allows them to reach projections using blueprints, formed around all of the tasks they must confront and have confronted successfully in the past. At the same time, they are compelling to others in their social context; presenting scientific knowledge in an academic hospital inevitably brings credibility, which allows trainees to practically accomplish what is necessary to serve concerns of their own and of the team. Moreover, since clinical research findings form the backbone of the doctors' accounts during decision making, the doctors' very claim to authority rests on their ability to translate science. Their ability to decode published studies also gives doctors an institutional and social advantage relative to stakeholders who must be convinced of that decision (e.g., insurers, administrators, patients).

These Bayesian performances publicly justify doctors' decisions under the constraints of time, and seeing how doctors "perform certainty" suggests a way to understand the bridge between organizational and individual levels of analysis that differs from the aligned incentives model. From Goffman, we know that in some situations it is more important to look knowledgeable than to be knowledgeable. Consistent with Goffman's observations, Dr. Kellogg prized the appearance of certainty in the concrete

present, whether or not that certainty was justified. The young doctors were rewarded similarly in both types of fast-paced administrative meetings. Generally speaking, doctors can draw on clinical experience or scientific expertise. They usually prefer the former kind of knowledge because it is more individualistic and embodied, hence noble, and less subject to external control and rationalization (see Freidson 1970, pp. 347–49). Yet the team members knew they needed to quickly appear knowledgeable in the agonistic scenarios developed by Dr. Kellogg and the administrators. As they were inexperienced in the task at hand, and were comfortable working within the test-intensive blueprints of medical school's tasks, they projected certain resources—scientific findings—as the only ones available that satisfied their need for an immediate, justified, and credible response.

These instrumental and performative deployments may be counterintuitive, but for four reasons they should not be surprising. First, medical knowledge itself, because it must recognize the infinite diversity of patient conditions, must be compatible with a range of tangible circumstances. Second, doctors know that they must actually use knowledge in response to this infinite diversity of patient conditions. Third, in medical studies, doctors cannot always find straightforward instructions for practice. Fourth, doctors have multiple interests, some of which give them both a need and set of compelling reasons to sidestep compounding responsibilities.

In fact, doctors' performative use of clinical research findings is recognized by hospital officials; it is an open secret among administrators that trainees have other interests in mind than those of the hospital, concerns they will find it hard to pursue because they have so little time. Administrators therefore take for granted that doctors will play these games; as shown above, they will use this knowledge to justify, in their terms, when they "put the heat on." When doctors "do" certainty in a way that is medically accountable, then, they are giving administrators a way to justify their own actions; they are using evidence-based medicine to make their behavior consistent with the organization's informal order; and they are providing their practices with stability, sensibility, and factual properties (see also Wieder 1974, pp. 131, 156, 182).

CONCLUSION

Sociologists have long found, from analyses as varied as those by Marx, Hughes, and Wilson, that work transforms individuals and their social contexts. This study has similarly zeroed in on the organization of work, showing how doctors use and update blueprints for tasks when interpreting whether they can pursue certain interests and showing the importance of feedback loop speed in facilitating this process of projection. It argues for

the benefits of focusing on the task instead of simply the corpus in understanding how doctors decide to use knowledge.

One implication of this study is that the way doctors use scientific findings can lead to opposite-than-intended processes in attempts to improve decision making in an organization. First, even though some sectors of medicine strive toward standardization in the form of tools such as checklists (Bosk et al. 2009), the role of interpretation makes standardization more difficult because in everyday settings, scientific findings are as important for serving interests that are interactional as for those that are substantive. Showing the importance of incipient physicians' different abilities in projecting actions according to different time horizons, these findings reinforce how people predict outcomes and use resources such as scientific findings to accomplish work but also leisure. In fact, if we expect homogeneous processes of deploying evidence, we may also find what might be called "standard errors," the appearance of errors in outcome that emerge when physicians make decisions on the basis of their own interests in addition to those of the institution and patient.

Second, this study has shown that some of the features of evidence-based medicine thought to improve hospital efficiency may not necessarily improve the speed at which the organization processes patients and might even make the hospital less efficient. The process of searching for information and preparing a confident delivery in response to tasks set by Dr. Kellogg was time intensive. Consequently, as the appendix shows, patients were held in the hospital, on average, more than one full day longer during the half of the month in which teams were led by an intensivist versus a deliberator (3.76 vs. 2.61 days respectively).[29] We also saw that the team's deployment of scientific knowledge in the discharge meetings was counterproductive to the hospital's goals. These findings suggest that notwithstanding the assumptions behind recent medical school training initiatives, the use of clinical research in practicing evidence-based medicine may not correlate directly with the efficient use of resources (contra Rosenbaum and Lamas 2012). Therefore, as health services research continues its pursuit of factors shaping the experience of health care beyond attributes of the organization (e.g., Wright and Perry 2010), it may benefit from accounting for elements such as task structure.

The study shows that when doctors face unfamiliar tasks and unfamiliar blueprints, doctors will appropriate and expand familiar blueprints. There

[29] Although one might expect that each patient's length of hospitalization would be influenced by the number of patients a team had to juggle, months such as September and January demonstrate that the reason for the increased length of stay is, in fact, unrelated to the number of patients treated in a particular month.

will always be old knowledge and new circumstances. The best students in medical school can already ace tests but they may still struggle with tying a knot. The best diagnostician may be able to identify a tropical disease but may not be able to interact with the administration. People will rely on strengths and have to cope with weaknesses resulting from previous training and personal experiences and will be more or less able to confront new tasks and exploit new resources that are available.

The sequence of steps referred to as "evidence-based medicine" is institutionalized; it is taught in medical school and endorsed by the field's journals. But, as shown above, the process of making decisions is in fact often reversed: doctors frequently pursue and deploy the results of scientific research not before determining a plan of action, as is usually assumed and expected, but after. As this process involves responding to feedback informing them of what interests they may reasonably pursue, it suggests a more general point for the sociological study of decisions about the practice of knowledge: the benefit of focusing not simply on the matter of "what" knowledge may or may not inform decisions but also on the circumstantial "where" of its interpretation.

APPENDIX

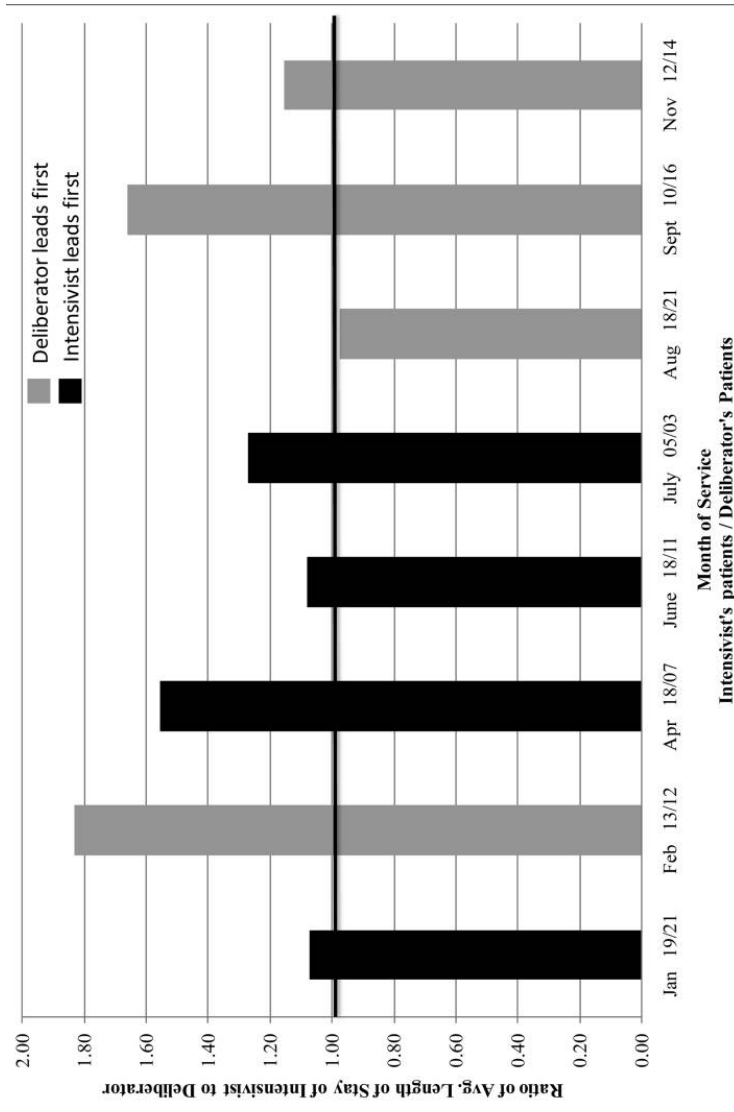

FIG. A1.—No sequence effects, and teams led by intensivists take longer to discharge patients

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