

EMPLOYEE INVOLVEMENT IN THE DEPLOYMENT OF HEALTH INFORMATION TECHNOLOGY

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ABSTRACT

This paper uses employee and patient survey data from a large, integrated healthcare provider to assess the mediating role that employment relations plays in the effective deployment of an electronic health record (EHR) system. The author finds that while a new scheduling module facilitated the appointment-making process, its effects were greater in those buildings that engaged workers in the development and deployment of the system. This study presents the first empirical evidence of human resource (HR) complementarities with respect to EHRs, findings that should inform policymakers and sectoral actors as they allocate substantial resources towards the healthcare industry's transition from paper-based to electronic recordkeeping. It advances the employment relations and management literatures by demonstrating how HR practices complement workplace IT.

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The US healthcare sector's reluctance to transform from paper-based recordkeeping to so-called electronic health records (EHRs) has caught the attention of those tasked with reforming the industry. Both the previous and current administrations have suggested that new efficiencies rest on the adoption of health information technology (IT), a statement backed-up by the allocation of \$19.2 billion dollars in the 2009 stimulus package and assertions that the effective use of this technology could reduce healthcare spending by \$80 billion annually.

Policymakers may be right to infer a causal link between low levels of health IT investment, on the one hand, and soaring costs, high levels of medical errors, and low rates of "best practice" compliance on the other. Solid evidence links IT investment to productivity gains across much of the economy (e.g., Brynjolfsson and Hitt 2003; Oliner and Sichel 2000). However, reform efforts to date pay little attention to another finding suggested by this line of research—that the IT-performance link hinges on the employment relations and human resources (HR) contexts in which the technology is deployed (Bartel, Ichniowski, and Shaw 2007; e.g., Batt 1999; Brynjolfsson, Hitt, and Yang 2002). This raises the question of how aspects of the employment relationship influence the effectiveness of new technologies—the generation of so-called "complementarities."

This paper provides the first answer to this question by examining the rollout of one piece of an EHR system across a single region of Kaiser Permanente, the nation's largest, not-for-profit health plan. I first draw on qualitative, observational data to theorize the process by which the scheduling module facilitates the work of regional support staff. This stage of data-gathering also allows me to identify performance measures most directly tied to the effective use of this particular module, outcomes that are of interest to the organization itself and that are measured reliably across clinics over time. Furthermore, I determine the ways in which workers could be engaged in the development, deployment, and use of the technology, particularly those forms of employee involvement that improve the effectiveness of the scheduling module. This careful examination of the design and use of the technology paves the way for a longitudinal analysis of clinic-level performance carried out on a dataset that crosses archival, patient satisfaction data with responses to a newly-administered survey of healthcare support staff. This multi-method design enables me to isolate the effects of the technology itself from the additional gains arising from its use in clinics with higher levels of worker engagement.

The study offers a number of advantages over existing ones. It allows us to hold constant many of the unobservable contextual factors that remain unaccounted for in national, cross-industry studies of complementarities (e.g., Brynjolfsson, Hitt, and Yang 2002; Caroli and van Reenan 2001). Likewise, rather than relying on measures of revenue or profit, it relies on a contextually-appropriate, homogenous performance measure as suggested by Ichniowski, Shaw, and Prenzushi (1997) and MacDuffie (1995). The paper also supplements more-grounded examinations of complementarities developed largely in manufacturing rather than in the service sector (Bartel, Ichniowski, and Shaw 2007; cf. Batt 1999). Aside from bridging the findings between large- n and case-type analyses, it uses qualitative and observational data to establish an understanding of the paths by which workers' active engagement in an IT initiative boosts the performance of the new technology.

Given the industry and the technology being examined, the findings also inform the very active policy debate now brewing in the US over the slow diffusion of health IT. That debate focuses largely on the technology itself rather than the workforce that will be expected to employ the health IT to better serve patients and increase the efficiency of the industry. The results of this study suggest that this oversight will dampen the performance returns on the massive public and private sector investment in health IT and EHR systems now taking place.

Partnering Around EHRs at Kaiser Permanente

Kaiser Permanente is an integrated health insurer and healthcare provider, comprised of a non-profit health plan and hospital arm as well as for-profit, physician-owned medical groups. With its roughly 8.7 million members, 32 hospitals, 421 medical office buildings, 160,000 employees, and 13,000 physicians blanketed through much of the country, Kaiser serves as the largest managed care network in the US. Kaiser's EHR system, KP HealthConnect, is an amalgam of software modules developed that once fully-deployed will include a full complement of interoperable, administrative and clinical health IT applications. One of these, the scheduling module, is used for scheduling office visits, procedures, and lab tests in each region's outpatient or "ambulatory" clinics—doctors' offices.

By some estimates, Kaiser's investment in KP HealthConnect has now exceeded \$4 billion. The organization justifies these outlays not on the technology's ability to facilitate existing processes. Rather, CEO George Halvorson intended the technology to occasion a wholesale transformation in the way all healthcare is delivered in the US, one for which EHRs

were an indispensable prerequisite and that Kaiser is poised to lead. He and a coauthor articulated this vision in a critique of the healthcare industry just as Halvorson assumed his role at Kaiser.

Real improvement in the quality and consistency of care will require the use of automated medical records that give doctors and patients full information about care and care systems right in the exam room...Every other profession makes use of computers to perform these kinds of services. Medicine will soon follow.
(Halvorson and Isham 2003: 166)

Halvorson, like many reformers, believes that the runaway costs and declining care quality stem from the industry's office-visit or "encounter" orientation, where individual problems are disposed of individually. Following this approach, clinicians generally cannot access most historical information on a patient or information gathered by other providers, let alone data on other patients reporting similar symptoms and the success and failure rates of different treatment options. With fully-integrated and interoperable EHRs, providers could deliver consistent, evidence-based care by managing the overall, long-term health of the patient population. This approach, often labeled "population health management," prioritizes prevention over treatment. In situations in which prevention is not possible, it emphasizes a coordinated, active, and once again, evidence-based protocol for managing patients with chronic conditions such as diabetes or heart disease. It is through these mechanisms, replicated across the entire US healthcare delivery system, that Hillestad et al. (2005) estimate their \$81 billion annual savings figure.

One aspect of Kaiser Permanente, exceptional even among large-scale providers, is the unique set of employment structures and processes governing support staff. Kaiser's Labor Management Partnership (LMP) is a cooperative arrangement between Kaiser Permanente and thirty union locals representing workers in seven of its eight regions (Kochan, Eaton, McKersie, and Adler 2009). As of 2008, the Coalition of Kaiser Permanente Unions (CKPU) and thus, the LMP, covers about 86,000 Kaiser employees. The configuration of the LMP replicates that of its management-side counterparts, creating labor-management "partners" at every level in every region in which the CKPU represents workers. At the apex of the LMP in its Oakland-based office sits a representative from Kaiser—a senior vice president reporting

directly to Kaiser’s COO—alongside the CKPU’s director. Similar dyads exist regionally and come about at the national and local levels or even across levels on an ad hoc basis.

LMP-engendered structures for channeling conflict and for facilitating communication between strategic- and workplace-level actors are credited for the success of a handful of Kaiser initiatives, including the opening of a new medical center in southern California and a program of non-trivial service improvements in the Fresno service area.¹ Though the parties may not have realized it at the time, the Partnership’s contributions to these strategic initiatives were small-scale “dress rehearsals” relative to what would be expected of it with respect to KP HealthConnect.

The KP HealthConnect initiative necessitated its own LMP sub-structure. The LMP funds a full-time KP HealthConnect union coordinator to represent the interests of the CKPU with respect to KP HealthConnect’s development, deployment, and ongoing use. It also developed and now administers a national-level KP HealthConnect “Effects Bargain” governing job and wage protections for workers as they relate to the KP HealthConnect initiative. It establishes the importance of labor to the KP HealthConnect initiative and that KP HealthConnect will advance the interests of the workforce as it advances Kaiser’s goals. It underlines the need for flexibility at all levels in processes and workflows and for the active engagement of labor in developing and implementing KP HealthConnect. In exchange, the document creates and funds regional-level KP HealthConnect union representatives to represent labor alongside IT and operations leads at the top of each region’s KP HealthConnect project team. Among other things, it makes guarantees with respect to training and preparation as well as a commitment to mitigating the effects of staffing challenges that would inevitably occur in the run-up to implementation.

Primary Care Appointment-Making in the Northwest Region

Headquartered in the suburbs of Portland, Oregon, Kaiser’s Northwest regional operation, Kaiser Permanente of the Northwest (KPNW), relies on 880 physicians and 8,900 employees to serve just over 480,000 members. The region spans the greater metropolitan Portland and Vancouver, Washington areas. The region offers “ambulatory” care through 27 outpatient medical office buildings, 15 of which serve as hubs for primary care—family practice,

¹ For more details on the LMP, see Kochan, Eaton, McKersie, and Adler (2009).

pediatrics, and internal medicine.² This paper focuses on these primary care clinics, in part, because so many of the performance outcomes of interest to Kaiser are shaped by the member's experience with his or her primary care physician (PCP). This is not surprising given that primary care is the backbone of the Kaiser system and of the managed care model more broadly. Bounding the sample in this way also allowed the researcher to spend time in all of the clinics examining the contextual mediators of the IT's effectiveness.

The challenges around which Kaiser leadership in Oakland have been strategizing manifest themselves very clearly in the Northwest region. Recall that Kaiser intended KP HealthConnect to occasion a complete reorientation of Kaiser's approach to healthcare delivery, quite typical of the way many organizations approach an IT investment (Brynjolfsson and Hitt 2000). Historically, the technology as well as the workflows and work structures supporting it were aligned to support an "encounter-orientation" in which each individual patient-presented issue is dealt with in isolation without much of a connection to the patient's history with other providers or other patients' experiences with the same set of symptoms. This contrasts with the more holistic approach to patient health that KP HealthConnect was intended to foster. Indeed, this message reached Portland undiluted. As one high-level regional manager explained, "KP HealthConnect is not just an IT project. All of the strategic vision is in how we use it." At the workplace level, this would have to translate into the reevaluation of workflows and work structures to reinforce the organization's grand strategy for the EHR system. The scheduling module was just one of the technological innovations introduced as part of this grand strategy.

KP HealthConnect's scheduling module was introduced under the umbrella of Kaiser's LMP. Therefore, all aspects of the initiative were guided by the KP HealthConnect Effects Bargain. The region rightly anticipated that the organizational side of the transition from an encounter-orientation to a more holistic approach to patient health would prove challenging. The patchwork of legacy systems—some IT and some paper-based—did not interface with one another cleanly. Among other challenges, those support staff charged with setting patient appointments using the legacy scheduling application frequently found themselves asking even long-term Kaiser members for data that should be permanently linked to a member's health records number (HRN), namely contact information. The system also made it difficult to

² The term "outpatient" is often used to describe those patients expected to check-in and out of the hospital on the same day. However, since this dissertation does not address anything related to "inpatients" or hospital care, I use the adjectives "ambulatory" and "outpatient" interchangeably.

schedule regularly, recurring appointments and often lacked up-to-date information on providers' availability vis-à-vis vacation scheduling, "panel support" time, or the use of planned or unplanned leave.

To understand how this would have a negative impact on economic performance, consider the process by which members make a primary care appointment by phone. They dial their clinic's appointments line. The call is received by a member intake specialist (MIS). The MIS opens the schedule corresponding to the member's PCP and searches for the first available appointment time or the first available time slot amenable to the member. According to one regional manager, this only disposed of about 40 percent of cases. More frequently, large sections of a provider's schedule would be blocked as unavailable for one of the reasons listed above. The MIS would then transfer the member to the medical assistant (MA) supporting the appropriate provider. If the MA picked up, he or she could override or correct the schedule. If instead the MA were unavailable or serving another patient in-person, the patient calling could leave a message. If the patient ever calls again, possibly returning a call from the MA, they would start all over again at the call center, where the MIS would again try to make an appointment and likely run into the same complication. The end result was that 75-80 percent of members initially denied an appointment would ultimately be given one within an acceptable time frame.

This chain of events came at the great expense of patient satisfaction with respect to accessing their providers as well as with the appointment-making process. Furthermore, appointment-setting required 4-5 "touches" from more highly-paid medical assistants (MAs) in addition to MISs, rather than the single touch of one MIS. Effective use of the new scheduling module was expected to address this issue. Success could be measured in two ways. First, could the patient schedule an appointment with the first person they spoke with? Second, how satisfied is the patient with the appointment-setting process?

Employment Relations and Technological Change

Employment relations scholars in the US have long speculated that industrial relations variables mediate the effectiveness of new technologies. Slichter (1941) and his colleagues (Slichter, Healy, and Livernash 1960) draw on case study evidence to consider the ways that trade unions affect the pace, nature, and effectiveness of new technologies in the workplace. They develop a typology of stylized policies, including "willing acceptance," opposition, and

encouragement that unions enact in response to impending technological advances, dispensing the less-nuanced view that workers would universally block innovations in production.

Though these same studies cover the topic of union-management cooperation in depth, they make little more than passing mention of the specific ways that workers' active engagement in a technology-related initiative could improve its likelihood of success. These authors fail to recognize a fundamental set of assumptions about work and organizations held by most organizational theorists and management practitioners alike throughout much of the twentieth century. This view holds that management leaders craft the organization's strategy, structure, culture, and performance potential, allowing the workforce to enter the analysis only after technological choices and organizational design had been firmly-established (Kochan, Orlikowski, and Cutcher-Gershenfeld 2003). Indeed, this is the essence of the model that McGregor (1960) labels "Theory X." Though neither he nor his "Theory Y" speak directly to the topic of technology in the workplace, others extend his treatment. Kochan, Orlikowski, and Cutcher-Gershenfeld (2003) argue that an enlightened, Theory Y approach integrates technology with social and work systems to increase the productivity of human capital. This stands in stark contrast to the idea that managers and engineers fashion technology with an eye towards controlling work and minimizing opportunities for human error, which these authors associate with Theory X.

This enlightened take on employment relations informs the literature examining so-called high-performance work systems (HPWS). This research finds that carefully-crafted bundles of employment practices, inclusive of opportunities for workers to inject their specialized knowledge into the production process, drive performance outcomes at the firm (e.g., Huselid 1995), plant (e.g., MacDuffie 1995; Youndt, Snell, Dean, and Lepak 1996), and even sub-unit levels within the organization (e.g., Cutcher-Gershenfeld 1991; Ichniowski, Shaw, and Prennushi 1997). Much of this research treats technology merely as a source of unobserved heterogeneity capable of explaining inconsistencies in empirical findings (e.g., Cappelli and Neumark 2001) while some such as Ichniowski, Shaw, and Prennushi's (1997) analysis of steel minimill finishing lines instead carefully "partial out" the direct effects of new technologies.

Other studies to emerge from the HPWO research stream focus more squarely on complementarities between human and technological capital. MacDuffie (1995), for example, looks explicitly at the ways that employment practices interact with new technologies to drive

productivity. He finds that these constructs complement one another in automobile manufacturing. Kelley (1996), focusing more specifically on workforce participation and IT, but still in a manufacturing context, also shows an increased effectiveness of production innovations where employees are involved in decision-making around new technologies and work structures, including opportunities for training on the new IT. More recently, Bartel, Ichniowski, and Shaw's (2007) rich analysis of a valve manufacturer illustrates the specific paths by which IT benefits production. Among the conclusions they reach is that IT enables business strategies like flexible manufacturing that are especially conducive to the modern economy, and that the adoption of these production innovations necessitates increased engagement of the workforce in training as well as in problem-solving.

While manufacturing lends itself more readily to empirical examination of complementarities, a few service-sector studies have also been able to shed light on the ways that employment relations mediates the effectiveness of IT. Batt's (1999) call center study revealed that the deployment of new IT increased sales of new phone plans and phone plan features. However, the sales effect was larger where workers reported that they had the autonomy to draw on their tacit organizational and production knowledge to work together to identify and address problems across the production process. Along similar lines, one study of retail banks shows that IT adoption is more highly-correlated with wages—a signal of productivity—where workers are privy to high-involvement work practices (Hunter and Lafkas 2003).

This methodologically-mixed batch of empirical studies from multiple industries helps explain complementarities that obtain in large-*n*, nationwide, cross-industry studies. This stream of research not only manages to generalize much of what emerged from the earlier work—that innovative employment practices seeking to involve and empower workers to make optimal use of IT—prove as important as the technology itself in generating productivity increases (e.g., Brynjolfsson, Hitt, and Yang 2002; Brynjolfsson and Hitt 2003). It also disposes of what has been labeled a statistically “elusive connection” (Kelley 1994) between IT investment and economic performance. Moreover, it does so with a focus on employment relations portended by the theoretical contributions of some of the earliest pluralist scholars of work and employment in the US.

Empirical Strategy

The overarching research questions guiding this work are whether or not EHR systems can improve organizational outcomes and whether or not these improvements are larger where workers are engaged in the deployment and use of these systems. The early state of research on organizational issues surrounding EHRs begs for careful analyses that allow us to build understanding of the how the technology can improve performance and why these improvements would be more pronounced where workers are engaged in the project.

With that in mind, I interviewed management and labor leaders throughout the Northwest region as well as in Kaiser's national headquarters with the goal of isolating a single piece of the EHR system that would lend itself to detailed, reliable study. Through these interviews, I learned that the scheduling module addressed a very concrete set of organizational challenges—inefficiencies and patient dissatisfaction with the appointment-setting process. More specifically, the module was intended to provide workers with more accurate and up-to-date patient data and scheduling information in order to streamline the process by which patients call to make an appointment.

By focusing on a single region's deployment and use of the module in primary care, I could zero-in on 15 clinics within a constrained geographic and functional space. I observed production processes associated with the technology, spoke with numerous frontline staff, and familiarized myself with the employment relations structures and processes intended to integrate workers and workforce issues into the EHR initiative broadly as well as into the planning focused specifically on the scheduling module. Information gleaned from this work allowed me to take careful measures of the right "inputs" (e.g., when the technology went "live," the nature and extent of employee engagement in support of the system) and to collect time series of organizationally-identified "outputs" (e.g., data from patients describing the appointment-setting process). I could then marry archival patient data to the responses from a newly-developed, study-specific employee survey to examine clinic-level, month-to-month performance changes.

Data Collection

All of the quantitative data analyzed in this paper were collected in and around Portland, Oregon, the center of Kaiser Permanente's Northwest regional operations. Kaiser's history of regional autonomy created an enormous amount of inter-regional heterogeneity in terms of technologies, workflows, and recordkeeping. Therefore, any attempt to collect or

gather reliable data required limiting the scope of statistical analyses to a single region of manageable size and to a subset of the entire EHR system whose performance impact could be understood, modeled, and estimated credibly with respect to the organizational and employment relations context. The resulting dataset was constructed by drawing from a mix of self-collected and archival sources. It includes employee data provided directly to me as well as data collected by Kaiser from support staff and patients in the 15 ambulatory clinics that offer primary care. These clinics are typically named for their location though they are de-identified and relabeled here.

Survey of Support Staff

A questionnaire was developed and distributed electronically to all regional support staff. Names and email addresses were provided by Kaiser management with the permission of union leaders. Before the final instrument was made available to respondents, it was tested for clarity and understanding with a “working group” of building-level staff representatives—themselves members of the target sample—as well as clinic-level managers. Only where a staff member could be clearly identified as someone who worked solely in the inpatient setting were they excluded from the original sample frame.

This decision to “cast the net” so widely yielded a subset of the sample that could not meaningfully respond to the survey. Their responses do not contaminate the data, because respondents had the opportunity to declare themselves non-users of the scheduling module. The presence of these respondents in the sample, however, does bias the response rate downward. Even so, after three email reminders to non-responders, 1,655 completed responses were received of the 2,612 surveys sent out, yielding an overall response rate of approximately 63 percent. Responses from all respondents were used to standardize survey items where appropriate. However, the analysis undertaken here necessitates only the responses of the region’s 481 MAs (56 percent response rate) and 309 MISs (51 percent response rate). Analyses confirm that those MISs who responded had about the same average age and job tenure as those who did not. The MA responders had the same average tenures as their non-responding colleagues. However, those MAs who responded were marginally older than those that did not respond—41.8 years vs. 39.3 years ($t = 2.44, p < .01$).³

³ I could not test for randomness with respect to sex. However, nearly all of the MAs and MISs in the original sample frame were women.

Patient Satisfaction Survey

Kaiser contracts its own patient satisfaction survey in order to evaluate patients' most recent visit to a medical office. The survey is conducted by mail and has historically averaged a response rate of around 35 percent. Over the relevant sample period, the survey yielded 52,372 responses. I aggregate these individual responses by clinic and by the month in which the appointment took place. This study relies on survey items relating to the patient's experience making their appointment if they did so by phone.

Qualitative Findings

History assured that the Northwest's LMP apparatus would be tightly woven into the KP HealthConnect initiative, and consequently into the development and deployment of the EHR system's scheduling module. On its own, the Northwest began migrating away from paper-based health records in the mid-1990s, long before the foundation was set for a Kaiser-wide EHR strategy. At that time, the vendor landscape was sparse, prompting other regions to experiment with untested systems linked to well-branded technology and consulting practices or, in the case of the Colorado region, to begin the arduous process of developing a system in-house. The Northwest, on the other hand, was impressed with a small, Madison, Wisconsin-based software startup, Epic Systems Corporation. According to those active in the region's health IT strategizing at that time, Epic's product appeared especially "patient-centered." This, coupled with a malleable configuration and assurances of quality service, put regional managers at ease. Regional leaders, less concerned about scalability, agreed on the fundamental database design employed by Epic and developed an open-ended and comfortable working relationship with Epic's founder and CEO.

Though KPNW had only adopted a small fraction of the Epic Systems products that would eventually be integrated into KP HealthConnect, Oakland saw fit to draw on the experience and expertise of regional managers in the 2003 selection of Epic's product as Kaiser's national EHR "solution." Shortly thereafter, when the union Coalition, the CKPU, sought labor involvement in the baseline configuration of the system, Oakland drafted a Northwest-based RN to work fulltime as the frontline staff representative in the "national build." One of the first tasks of that representative was to work with the national LMP

coordinator for KP HealthConnect to select and appoint regional labor coordinators and to assist their efforts to engage workers in the regional configuration processes.

Over the next two years, the role of these coordinators and, more broadly, the enactment of partnership with respect to KP HealthConnect, became the subject of the special bargaining talks that eventually yielded the KP HealthConnect Effects Bargain. As noted above, these talks and the resulting agreement essentially detailed the ways that the tenets of partnership already agreed to under the national agreement would be operationalized and applied in the context of KP HealthConnect. This solidified strategic- and functional-level components of a comprehensive employee involvement apparatus. For starters, management detailed the ways its provision of employment security would work for those potentially displaced by KP HealthConnect IT applications. However, technological displacement was much less of an issue in the Northwest than in other regions since KPNW had pared down its medical records staff years earlier with its regional transition from paper-based to electronic record-keeping. More germane to the Northwest was the list of KP HealthConnect-related matters over which the parties agreed would be subject to KP HealthConnect effects bargaining. Included were the addition and removal of responsibilities or increases in skill requirements for current positions, the moving of work from one classification to another, design and workflow decisions that impact contractual language, and changes in production standards or work volume.

The Effects Bargain also established the creation for each region of at least one, full-time, KP HealthConnect labor coordinator to serve on their regional KP HealthConnect leadership team. Since the labor coordinator was charged with monitoring KP HealthConnect-related production process and workflow change experiments and pilots, they also took on the job of identifying and responding to demands for frontline worker engagement arising in the course of the initiative. Labor and management also agreed to joint planning around two other key issues arising from KP HealthConnect. First, the parties agreed that effective engagement of the workforce depended on workers' temporary relief from their regular responsibilities. Therefore, management agreed to fund the "backfill" required to maintain operations and quality, the demands of which would be determined by labor and management. KP HealthConnect training would be the primary driver of these backfill demands. Its adequacy and composition—training to use new applications, training to perform new tasks emerging from workflow redesign, etc.—would also be determined jointly. In the aggregate, Kaiser

expected labor's active engagement in configuring, implementing, and eventually, using KP HealthConnect as effectively as possible. More broadly, the workforce was expected to support the overarching business strategy, namely, improved service to members and a reorientation towards preventive care. For this reason, management and labor leaders alike adopted the rhetoric that KP HealthConnect was "just a tool" for providing frontline staff the information they need to reorient their approach to patient care.

Back in Portland, the Northwest first signaled its commitment to both the Partnership and to KP HealthConnect by funding two FTEs to serve as KP HealthConnect labor coordinators—one from the Oregon Federation of Nurses and Health Professionals (OFN) Local 5017, representing RNs and other professional staff, and one from the Service Employees International Union (SEIU) Local 49, representing members of the clinical support staff including MAs and MISs. With most of KP HealthConnect's outpatient clinical records functionality already comfortably in place, the region turned to one of KP HealthConnect's non-clinical applications, the scheduling module. As noted above, this application was intended to streamline appointment scheduling. The coordinators immediately assumed their positions on the local configuration team, alongside IT and operations leaders as well as programmers and application specialists. They also began assembling a cadre of bargaining unit members to serve as "super-users." Super-users were support staff end-users—mainly RNs, MAs, and MISs—drawn from throughout the region. These 15-20 workers (membership was fluid) were the first to learn how to use the scheduling module and served as liaisons between frontline support staff and the regional configuration team. As the region grew closer to implementing the system in the spring and summer of 2005, super users were temporarily transferred on a full-time basis from their regular roles on the front lines, allowing them to travel the region answering questions and facilitating the training of other bargaining unit members. Union and management leadership were also looking ahead to the post-deployment period when these experts would return to their jobs able to serve as their workplace's de facto leaders and "go-to" people for all matters technological and work-related pertaining to the KP HealthConnect scheduling module.

The organization of work at Kaiser posed a unique set of challenges for the transition from the legacy technology to the new administrative module. Aside from carrying pagers and serving as troubleshooters in the months before and weeks after go-live, super-users supplied information that proved vital to the configuration and implementation of the system. It was

the super-users who pointed out that the transition between scheduling systems could not be done in waves—by clinic, by department, or by any way other than what would eventually be labeled a “big bang.” This is because Kaiser patients, while assigned to a specific provider in a specific clinic, draw on services from many departments and often multiple clinics. If a patient needs to schedule a lab or specialty visit while seeing their primary care physician, support staff in their home clinic must be able to access and modify appointment schedules from across the region. Aside from communicating this up to management through their labor coordinators, the team also made a related case with respect to training, also voiced at the strategic level by the regional labor coordinators: all end-users must be trained—something that had not occurred in the other regions that had already implemented this module—and, in fact, trained before go-live.

Management’s recognition of this increased demand for training reinforced the need for backfill as well as for some flexibility from the rank-and-file. The short time frame meant that some training would have to occur in the evenings and on weekends, a decision that would not be welcomed by the workforce. Overall, the decision to go with a “big bang” made the planning and preparation undertaken during the configuration stage even more imperative, as the region could not wait for the first returns from pilot testing to identify and solve problems. In fact, it was also a super-user that pointed out to regional management through his KP HealthConnect labor coordinator that even the very limited plan for testing—appointments at just two clinics in the region—could not take place until nearly the entire region had been trained, since anyone in the system making appointments for these clinics would have to be comfortable using the scheduling module at the start of the short pilot period. An additional lesson conveyed by the super-users group that stemmed from the pilot portion of the deployment was the need to temporarily reduce appointment loads and to allow MAs extra time for checking-in and “rooming” patients around the go-live date. They also pointed out the need for small changes in security access settings, allowing MAs “write” rather than “read-only” access to certain parts of the patient record.

Super-users played just as vital a role in the initiative when they returned fulltime to their regular positions. Managers and frontline staff report their being in-demand as KP HealthConnect resource people in their clinics, providing co-workers with quick answers to the sorts of “just-in-time” questions that arose as those who were already formally-trained became everyday users. Though those workers joining Kaiser after go-live received formal KP

HealthConnect training during orientation, they also called on their clinic's super-users for follow-up questions as they "climbed the learning curve." Reports from super-users returned to their permanent roles reached the region's two KP HealthConnect labor coordinators—still fulltime on the project—revealing a consensus on the need for follow-up training in the system. Frontline staff had by-and-large mastered the basics, but were not taking advantage of the system's more advanced features that could facilitate routine tasks and improve performance. This led to the development of follow-up "optimization" training to take place during the ongoing-use of the system. Included in these sessions were opportunities for workers to learn how design and implement tools and keyboard shortcuts for regularly-recurring workflows unique to their module, clinic, department, or even to themselves. Even today, super-users still accept and communicate requests and suggestions for system improvements to the labor coordinators as well as to regional IT staff. One recent change to come about this way was the addition of a check-box on the scheduling interface to denote whether or not a member has cleared any parties for the release of confidential health information, something that has become especially critical since the passage of the Health Insurance Portability and Accountability Act (HIPAA). Though the KP HealthConnect super-users team was effectively dissolved a few months after the deployment of the scheduling module, it has since been reconstituted, including a few of its original members, to facilitate the development and deployment of other KP HealthConnect modules.

In the net, the qualitative investigation of the Northwest's experience with the scheduling module provides initial evidence that this IT application benefited from its inclusion under the KP HealthConnect umbrella. Employee involvement structures enabled information gleaned from support staff to influence fundamental decisions regarding how the technology was rolled out as well as changes in the technology's configuration intended to make the module more useful to workers. The labor coordinators also served as a bridge between the strategic and workplace-level interests, as one management leader argued, helping frontline staff understand the "rationale" for the system. They communicated largely via the super-users the transformative goals served by the scheduling module and that the union judged the workforce to have a real stake in the technology's success. Furthermore, the Effects Bargain instituted flexibility and installed functional-level structures for disposing of matters that might otherwise limit the applications of workers' ideas, e.g., asking workers to undertake training during non-working hours. Therefore, we should expect the new technology to

generate improvements in the organization's targeted outcomes. Furthermore, we should expect these improvements to be even larger in those clinics achieving higher levels on employee engagement measures.

Description of Variables

Independent variables. Employee involvement measures come from the survey of support staff. Only once respondents answer that they are expected to use the scheduling module in the course of their everyday work are they offered the subsequent questions pertaining to it. These questions were items developed with information gleaned from the qualitative investigation already undertaken. Most questions were answered on a seven-point Likert-type scale. The engagement index was based on four survey items tailored specifically to the scheduling module initiative: 1.) My suggestions about how to design or improve it have been valued., 2.) My issues or complaints about it have been ignored.⁴, 3.) There is at least one bargaining unit member in my clinic who helps me a be a better user of the module., and 4.) Before it was rolled-out, the people whose work could be changed by it were asked for guidance. A scale formed by these questions proved somewhat reliable ($\alpha = .61$) by conventional standards. However, following Bidwell (2009), I take advantage of the single-site nature of the design to devise measures that are specific to the research setting. This serves to increase the accuracy of the measures by making them more concrete to respondents. Under these circumstances, we should not necessarily expect the items to be highly-correlated nor should we accept Cronbach's alpha as an effective assessment of their reliability (Jarvis, Mackenzie, Podsakoff, Mick, and Bearden 2003).

A principal components analysis revealed that the four items loaded onto a single principal component ($\lambda = 1.90$) that accounted for about half the variance represented by these items. That principal component was used to generate an engagement "score" for every worker-respondent in the dataset. Four other binary variables are constructed directly from items on the staff survey. Respondents answered yes or no to questions about whether or not a fellow member of the bargaining unit introduced them to the scheduling module, provided them with their follow-up training on the module, or otherwise served as an on-site expert or "super-user" for the scheduling module. Respondents also answered yes or no as to whether

⁴ This item is reverse-coded.

they provided any specific recommendations on additional ways that system could be used to meet its strategic goals.

Dependent variables. The dependent variables for the quantitative analysis come from a completely separate survey administered to an entirely disjoint sample—the patient satisfaction survey. This protects against common method bias—where “inputs” and “outputs” gathered with a single instrument or from the same source yield constructs with artificially-inflated correlations (Podsakoff, MacKenzie, Lee, and Podsakoff 2003). Recall that the scheduling module was intended to improve the appointment-making process by providing staff with more complete and more up-to-date information on provider availability. One question on the patient satisfaction survey asks, “Were you able to get the appointment scheduled by talking to just one person?”. Another asks respondents to rate on a nine-point Likert-type scale their satisfaction “with the length of time spent on the phone to schedule the appointment.” The former will be operationalized as a binary variable and the latter as a standardized, continuous variable.

Time-related control variables. Isolating the impact of the scheduling module and, in particular, the mediating effects of employee involvement on the effectiveness of the technology, requires controlling for trend changes in clinic-level performance. This is achieved first by including a standard linear time trend as an independent variable in the analyses, allowing us to see the “natural” progression of performance over the course of the sample period (October 2004 to June 2007), even before accounting for the other variables of interest. I will also incorporate a second linear time trend that begins with “go-live.” In addition to the two time trends, there are two additional binary variables of interest. The first is a “go-live” dummy set to equal one beginning in September 2005. In combination with the two time trends, it allows for a structural break in performance effects associated with the technology. I have also included a dummy to represent the “transition” months during which the technology and the organization were shifting from the legacy system to the scheduling module.

Results

Table 1 presents summary statistics from the survey of the Northwest’s support staff. Means are calculated using only responses from those MAs and MISs expected to use each system in the course of their work. The first set of variables represent the four items making up the engagement index. Notice how in all four cases, means hover near the neutral response

(4 = “neither agree nor disagree”)⁵, albeit with significant variation about the mean. Overall, only 11 percent of respondents claimed that they were first introduced to the technology by a fellow member of the bargaining unit (as opposed to a manager or an IT staffer), though 18 percent asserted that they had, in fact, received follow-up training from a co-worker. About 40 percent noted the importance of “super-users”—fellow members of the bargaining unit pulled from their regular, frontline positions to assist in the development and deployment of the system—to their successful use of the scheduling module. Interestingly, about 15 percent of respondents have made specific recommendations of ways that the system could be used more effectively. For example, some suggested the need for “write” privileges in addition to “read-only” privileges at certain screens. Others pointed out the need to make sure that a patient’s contact details remain on-screen throughout the appointment-setting process or the need to allow the home phone number field to be left empty for those patients having only a cell phone. Others had suggested the creation of shortcuts for frequently-used “bundles” of mouse clicks, like those required to make certain, regularly-occurring types of office visit appointments.

[—Insert Table 1 about here.—]

Table 2 breaks out the dependent variables by clinic. The first three columns focus on the binary dependent variable—whether or not the patient was able to make an appointment with the first person he or she spoke to on the telephone. In the Bruford clinic, for example, of 3,911 patient respondents to the question, 78 percent answered affirmatively. Note that most of the clinics average around 80 percent for this variable over the period of observation. The one exception appears to be Collins, which only managed to schedule appointments with one “touch” 73 percent of the time. The next three columns repeat the exercise for the continuous dependent variable—patient’s satisfaction with the length of the phone call required to make the appointment. In this case, the variable was standardized such that the mean was equal to zero and the standard deviation equal to one. Therefore, each clinic’s mean for the variable as reported in Table 2 is relative to the overall sample average. The Fleetwood clinic averaged .2 standard deviations above the sample mean, the highest of all the clinics. The clinic labeled Mullen achieved the lowest performance and the widest variation on this metric over the sample period.

⁵ Recall that one item is reverse-coded, so the 3.43 represents a 3.57 for comparative purposes here.

[—Insert Table 2 about here.—]

I first test the impact of engagement by analyzing the binary dependent variable. Ideally, I could run an “omnibus,” clinic fixed-effects (FE) logistic regression equation including a dummy variable for system go-live and a two-way interaction term between go-live and measures of employee engagement. The point estimate on the former could demonstrate an association between the deployment of the technology and the performance measure, while the point estimate on the two-way interaction would support the mediating effects of engagement. A number of complications arise with casting and interpreting estimates from an FE logit model (Chamberlain 1980), and the interpretation of interaction effects in binary models is also far from straightforward (Ai and Norton 2003). Aside from these issues with the model itself, the time-constant nature of the engagement measure precludes identifying its effects on performance in a FE context. The next best alternative is to run separate logits for each of the 14 clinics providing engagement scores and performance measures.⁶ Typically, this results in a loss of efficiency through sample attenuation. However, the large numbers of observations for each clinic mitigate that issue in this case.

With that in mind, I ran 14 separate logistic regressions using responses to the patient satisfaction survey as the unit-of-observation. The regressions included just four independent variables—the two time trends and the two IT-related dummies. The first IT dummy captured the transformation period into the new system, and the second captured the performance impact of IT go-live. In Figure 1, I project the point estimates for IT go-live on a scatterplot against each clinic’s mean engagement score. First, notice that even accounting for trend and transition, none of the clinics witnessed a performance decrement arising from the technology, while four of them increased their performance by at least one standard deviation. Furthermore, the figure reveals a positive association between workers’ engagement in the effort and the size of performance improvements: those clinics whose workers reported being more engaged in the deployment saw greater performance improvements arising from the technology than those clinics with lower mean engagement scores.

⁶ While there are 16 clinics included in the descriptive statistics in Table 2, the regressions include only 14 or 15 clinics, depending on the particular model. This is because the Peterson clinic closed prior to the collection of quantitative measures of engagement, and the Ulrich clinic opened too late in the observation period to provide pre-“go-live” observations.

[—Insert Figure 1 about here.—]

Figures 2, 3, and 4 rely on the same, by-clinic logistic regression estimates. In each case, however, the performance effects are graphed against a different engagement measure gleaned from the workforce survey. Figure X shows a positive relationship between the size of the performance gain and the share of a clinic’s workers reporting the presence of a super-user—a lead user and ad hoc troubleshooter pulled from the frontlines. In this case, note the wide variation in the variable measured horizontally. Whereas 80 percent of respondents at Copeland reported the presence of a super-user, only 22 percent of respondents at the Bruford clinic answered the same question affirmatively, differences that appear to have had consequences for the size of the performance gain obtained from the scheduling module. Figures 3 and 4 offer analogous evidence with respect to training—the share of workers reporting that they received their initial training on the system from a fellow frontline staffer (Figure 3) and the share reporting that they received their follow-up training from a fellow frontline employee (Figure 4). Once again, those clinics in which a larger proportion of respondents reported having been trained by a fellow member of the bargaining unit appear to have obtained a larger performance benefit from the system.

[—Insert Figure 2 about here.—]

[—Insert Figure 3 about here.—]

[—Insert Figure 4 about here.—]

Additional support for both the effectiveness of the technology and the mediating impact of engagement comes from analyzing the continuous dependent variable. In this case, I employ a multilevel, random intercept model to account for clinic-level effects. It allows me to pull the observations into a single sample of clinic-months, because the continuous nature of the dependent variable allows for easy interpretation of point estimates on the two-way interaction between IT go-live and worker engagement. The time-constant nature of the engagement measure still precludes estimating of clinic-level fixed effects with these data,

though the qualitative investigation should boost confidence in the validity of these quantitative results.

Table 3 displays the models estimated, beginning with a simple model considering only the effects of trend. The first model shows a small, but statistically significant month-to-month increase in the dependent variable between October 2004 to June 2007. Once the post-implementation trend is added on the right-hand side (in the second model), the estimated partial slope on the original time trend turns negative and remains so for the rest of the models to be estimated. The go-live time trend, however, that first appears in the second model reveals a positive association between the use of the scheduling module and the performance measure it was intended to influence. Despite the negative, month-to-month effect of trend, the post-implementation time trend is actually positive and remains so for all subsequent estimates. Consistent with anecdotal accounts, customer service was suffering prior to the implementation of the administrative system, a trend that reversed itself at the same time as the transition to the new system. The next model adds the two dummy variables capturing transition to and deployment of the scheduling module. Both estimates are positive and statistically significant in this and the remaining models. Also note the point estimate on the post go-live time trend doubles. That means that once we account for a structural break in the time series, we can see evidence of a large (.44 standard deviations), one-time jump in performance as well as a steady, sizable (.06 standard deviations) month-to-month performance increase associated with the scheduling module, despite what would otherwise be a declining performance function (-.05 standard deviations each month) over time.

[—Insert Table 3 about here.—]

The last two models in Table 3 incorporate the effects of worker engagement on the effectiveness of the technology. Model 4 incorporates only a main effect for engagement. Interestingly, this predictor has an estimated performance effect that is insignificantly different from zero, suggesting that the impact of engagement already identified in Figures 1-4 comes not through an engaged workforce *per se*, but from the mediating impact of engagement with respect to the scheduling module initiative. It is also worth noting that the inclusion of the engagement variable in the fourth model does virtually nothing to the point estimates of all those variables carried over from the three versions of the equation estimated already. The

fifth and final model in Table 3 adds the two-way interaction to directly capture the incremental, mediating effect of engagement on the IT-performance link. Controlling for all of the other effects, a single standard deviation in the engagement index increases the effectiveness of the technology by .19. Interestingly, the estimate for the main engagement measure turns negative, further demonstrating that engagement's performance impact appears to come through its mediation of the scheduling module's effect on performance.

Discussion and Conclusions

This study of employee involvement in the deployment of an EHR system's scheduling module suggests not only that health IT can improve economic performance at the clinic level, but that IT-engendered gains are greater where staff are engaged in the development and deployment of the system. The argument is supported by a qualitative investigation of the organization, reinforced by statistical analyses linking two, separate measures of patient satisfaction to the use of the technology and to the employment relations context in which the technology was deployed.

One way to view these findings is as a generalization to health IT of findings from research on manufacturing automation. The US automobile industry provided employment relations researchers initial evidence that "high road" employment practices mediated the effectiveness of new production technologies. When domestic automakers sought to imitate their more-productive foreign competitors, they did so by matching high levels of investment in factory automation. American producers, however, did not seek to involve workers in the project or to leverage employee engagement to make the technology more effective. Only after investing billions of dollars into automation technology—\$650 million in one GM factory alone (Kochan 1988)—did domestic producers discover that the key to Japanese success—both at home and in their North American transplants—was a mix of new technologies and innovative employment practices that positioned shop floor workers to "give wisdom to the machine" (MacDuffie and Krafcik 1992).

This experience offers an important lesson to those believing that the deployment of EHRs will improve economic performance in America's healthcare sector. The findings of this study must inform the debate over healthcare reform now taking place in the US. The Obama administration shares Kaiser CEO Halvorson's view that EHR technology should be the lynchpin of any serious attempt to make the financing and delivery of healthcare more efficient.

It has backed its rhetoric with the inclusion of \$25 billion in the recent stimulus package, most of which has been set aside as “incentive payments” for physicians. In the immediate term, this money is allocated toward those physicians choosing to purchase EHR systems. In later years, those physicians wishing to tap these funds must do more than just buy the technology. Rather, they must demonstrate “meaningful use” of their EHR systems. While the regulatory standard for “meaningful use” remains to be written, there has been no indication that organizational and workforce issues will influence policy. Consequently, there will be no requirement for adopting physicians to engage their staff in any aspects of system configuration, deployment, or ongoing use. The results of the present study imply that failure to invest in employee involvement structures and processes alongside the investments in hardware and software could lead the healthcare industry to repeat the mistakes of the auto industry. The key difference here is that the stakes are much greater. With respect to health IT, billions of dollars in public and private funds and an industry whose inefficiencies ripple across the entire economy all rest in the balance.

Aside from its policy implications, this research contributes to our understanding of the complementarities that come about between innovative employment practices and innovative workplace technologies, IT in particular. It picks up on some of the earliest work in pluralist industrial relations (e.g., McGregor 1960; Slichter 1941; Slichter, Healy, and Livernash 1960) that separated workers’ responses to new workplace technologies from the endogenous impact that workforce variables can have on the performance effects of new technologies. The results here also build on broad findings of employee involvement’s performance effects (e.g., Cutchers-Gershenfeld 1991; Huselid 1995). This study provides evidence that in the “information age”, the returns to “high-road” employment practices may be largely channeled through new technologies, a theory that has been considered thus far only in a manufacturing context (Bartel, Ichniowski, and Shaw 2007). At Kaiser, it is certainly true that new IT in the form of the scheduling module enabled a particular business strategy. However, much like Bartel, Ichniowski, and Shaw’s valve manufacturer (2007), high levels of workforce engagement created an environment in which this new technology could be used more effectively. This suggests that in the healthcare context, new business strategies and the technologies that facilitate them beg for a “high road” approach to employment involvement.

This implication—bolstered by this study’s homogenous, contextualized performance measure—suggests a way of reconciling conflicting results regarding the existence of

performance complementarities in large- n analyses. While Bresnahan, Brynjolfsson, and Hitt (2002), for example, find that IT investment and innovative employment practices interact positively in regression estimates of log value-added, others have been unable to conclusively identify these complementarities (e.g., Caroli and van Reenan 2001). Kaiser’s experience suggests that employee involvement in these projects should be expansive, involving workers in the planning of workforce reforms rather than simply assigning them new roles in a new system of production. It is true that employee involvement can, in fact, boost performance even when it is rather limited in nature, even in the service sector (Batt 1999). However, a number of earlier empirical studies suggest that wider, deeper forms of employee involvement—completely aside from the performance effects that stem from more effective use of new technologies—are more instrumental than programs that provide only minimal opportunities for worker engagement (e.g., Black and Lynch 2001; Cutcher-Gershenfeld 1991; Ichniowski, Shaw, and Prennushi 1997; Katz, Kochan, and Gobeille 1983). The results of this study extend these findings to the complementarities that can obtain between human and technological capital.

Ideally, this study might also reignite the technology “conversation” amongst employment researchers, the one began (at least in the US) with Slichter and his colleagues (Slichter 1941; Slichter, Healy, and Livernash 1960). Just as the field contemplates the continued relevance of traditional studies in collective bargaining, we have the opportunity and, in fact, the obligation to inform those more-focused on technological capital of the importance of employment relations and HR to the performance impact of IT.

This study has a number of limitations. The quantitative analyses do not explicitly control for confounding factors at the clinic level. Had there been more time-variant measures of clinic characteristics, I could have employed a fixed-effects (FE) specification to “tease out” the performance impact of the technology and of the employment relations context. In this case, however, an FE framework would have precluded estimation of the two-way interaction supporting the notion of engagement’s mediating role on the technology’s effectiveness. A related set of issues associated with the estimates—those supporting Figures 1 – 4 as well as those displayed in Table 3—is that of endogeneity or omitted variable bias. In particular, one might argue that those clinics that were “ready” for the technology based on observed measures of engagement or some other unobserved factors, not surprisingly, were able to use the technology more effectively.

With respect to these issues, reliance on qualitative findings in addition to the statistical estimates offers some assurance of the findings' overall validity. For example, it was through the deliberative, pre-statistical investigative process that I determined that the "go-live" date was set at the regional level and was not chosen clinic-by-clinic based on each clinic's readiness. Moreover, these issues would be of greater concern had I collected the performance measure from workers themselves, particularly had I used the same instrument to measure technology and employment relations "inputs." However, the performance measures come not from workers, but from patients, using an instrument that had been developed prior to this study and for more general purposes than to evaluate the effectiveness of new technologies. It is also the case that the employment relations measures were specific to the IT initiative as opposed to being indicative of the larger employment relations context. Finally, it is also worth noting that the main effect of engagement in the IT initiative turns negative in the final regression estimate in Table 3, the one that includes the critical, two-way interaction between engagement and the use of the scheduling module. That implies that after controlling for trend and for the use of the technology, those clinics with more-engaged workforces performed relatively poorly over the observation period, counter to the idea that solid performance led workers to evaluate the employment relations climate more positively than they would have otherwise. In the final estimate, the positive effects of engagement are channeled entirely through the use of the new system, an effect that would be difficult to explain as the product of endogeneity.

Nonetheless, it would be wrong to assume that Kaiser's experience with the scheduling module can be easily generalized. Given the lack of employment relations research on IT initiatives, particularly with respect to health IT and EHRs, this study prioritized internal validity by developing a rich understanding of a single piece of an EHR system in the context of one regional operation of a unique, large-scale healthcare organization. This facilitated my holding constant key organizational and employment relations variables that would be difficult to observe and control for in multi-organizational studies or studies encompassing the full complement of modules comprising an EHR system. Even aside from Kaiser's size and scope, its relationship with its employees is governed by the unique partnership arrangement, described above, that assured that the variability in workplace-level measures of engagement was matched by more stable measures of employment security and of business strategy than can be assumed across the entire healthcare industry. Indeed, this study can only begin the conversation about the important role of employment relations with respect to EHR

technologies. This area begs for greater study from scholars of work and employment. Future studies should aim to fill the gaps in and build-upon this study—conducted during what are clearly “early days” for a critical industry’s much-needed technological innovation.

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Table 1. Descriptive Statistics for Worker-Level Variables

<i>Variable</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Loading on 1st Principal Component</i>
engagement index	0	1	
suggestions have been valued	3.99	1.53	0.58
issues have been ignored	3.43	1.65	-0.52
unionized super-user improves my use	4.01	1.77	0.38
affected staff were asked for guidance	3.77	1.52	0.50
introduced to technology by a union member	0.11	0.31	
received follow-up training from a union member	0.18	0.39	
relies on a “super-user” in their clinic	0.39	0.49	
made specific recommendations for effective use	0.15	0.36	

Notes: Values based on responses from those medical assistants (MAs) and member intake specialists (MISs) reporting expected use of the system ($n = 362$). The engagement index is standardized at mean zero and a standard deviation of one. The four components of the engagement index were answered on a seven-point, Likert-type scale in which 1 = “strongly disagree” and 7 = “strongly agree.” The remaining variables are binary.

Table 2. Descriptive Statistics for Patient-Level Variables, by Clinic

<i>Clinic Name</i>	made appointment with first person spoken to			satisfaction with length of phone call required to make appointment		
	<i>Mean</i>	<i>Std. Dev.</i>	<i>n</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>n</i>
Bruford	0.78	0.41	3,911	-0.07	1.01	4,051
Collins	0.73	0.44	1,992	0.01	1.00	2,078
Copeland	0.81	0.40	2,755	0.004	0.99	2,864
Dolenz	0.79	0.41	3,898	0.04	0.96	4,056
Escovedo	0.80	0.40	2,925	0.09	0.97	3,016
Fleetwood	0.80	0.40	2,948	0.20	0.93	3,046
Henley	0.80	0.40	3,237	0.09	0.97	3,371
Mullen	0.78	0.41	992	-0.10	1.05	1,028
Pearl	0.77	0.42	2,967	-0.02	0.97	3,084
Peterson	0.79	0.40	932	-0.04	1.04	976
Schock	0.80	0.40	2,771	-0.05	1.02	2,898
Slichter	0.79	0.41	2,825	-0.08	1.02	2,921
Starkey	0.79	0.40	2,884	-0.07	1.04	3,018
Torres	0.77	0.42	2,829	-0.03	1.01	2,992
Ulrich	0.82	0.38	245	0.08	0.90	255
Watts	0.80	0.40	3,070	-0.07	1.04	3,194

Notes: Values based on responses to patient satisfaction survey. The first variable—“made appointment with first person spoken to”—is binary. The second variable—“satisfaction with length of phone call required to make appointment”—is standardized at mean zero and a standard deviation of one.

Table 3. IT and Employee Involvement as Determinants of Patient Satisfaction with Length of Phone Call Required to Make an Appointment for an Office Visit

<i>Variables</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
Time Trend	0.01*** (6.98)	-0.01** (-2.73)	-0.05*** (-5.21)	-0.05*** (-4.91)	-0.05*** (-5.03)
Time Since “Go-Live”		0.03*** (4.97)	0.06*** (5.65)	0.06*** (5.34)	0.06*** (5.46)
Transition Period			0.15* (2.26)	0.15* (2.27)	0.15* (2.33)
Module-in-Use			0.44*** (6.31)	0.43*** (5.91)	0.40*** (5.57)
Engagement				-0.02 (-0.32)	-0.15* (-2.28)
Module-in-Use × Engagement					0.19*** (3.33)
<i>n</i>	496	496	496	468	468
clusters	16	16	16	15	15
<i>R</i> ²	.11	.16	.26	.25	.26

Notes: Significance test performed using Huber-White standard errors. Dependent variable is patient satisfaction with the length of time it took to make an appointment by telephone for each clinic in a given month.

Key: * $p < .05$, ** $p < .01$, *** $p < .001$.

Figure 1. Scatterplot of Engagement Score vs. Performance Gain at Scheduling Module “Go-Live” for Each Clinic

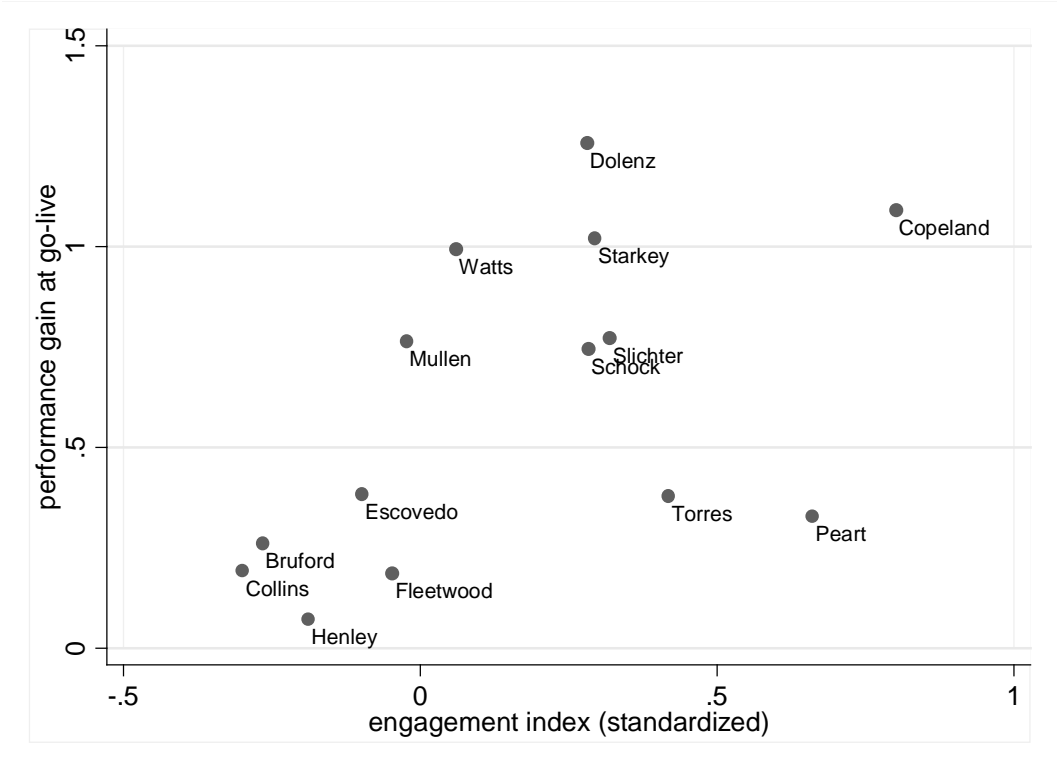


Figure 2. Scatterplot of Share of Workforce Claiming the Presence of a Super-User vs. Performance Gain at Scheduling Module “Go-Live” for Each Clinic

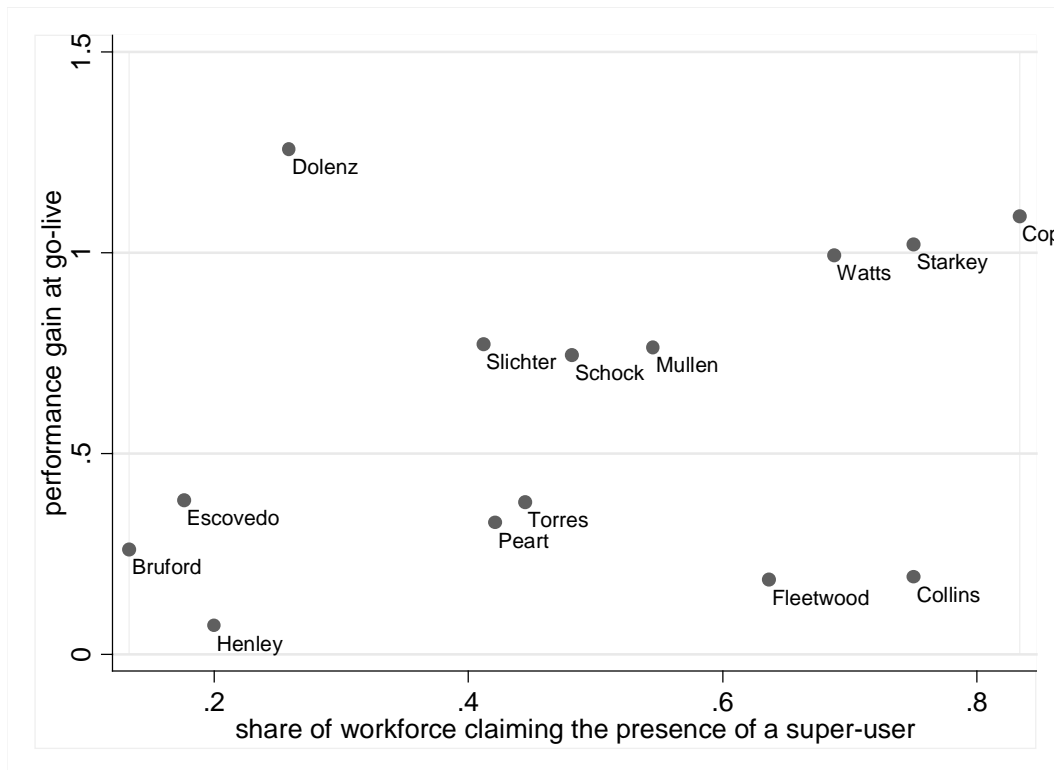


Figure 3. Scatterplot of Share of Workforce Introduced to the System by a Co-Worker vs. Performance Gain at Scheduling Module “Go-Live” for Each Clinic

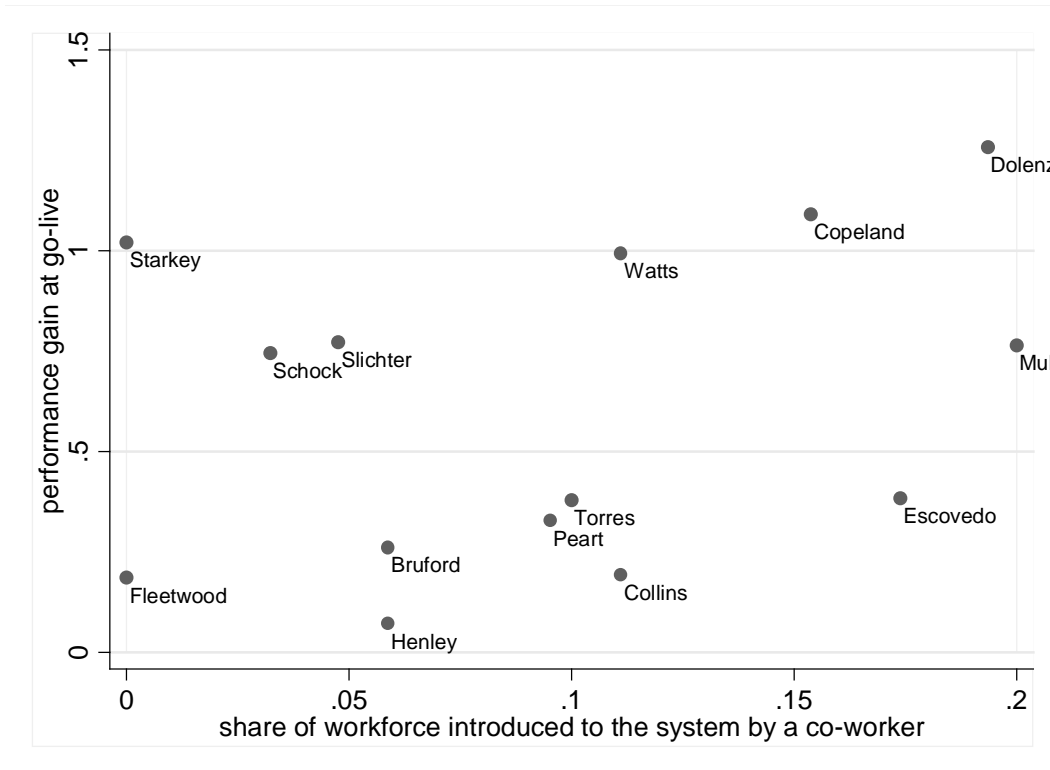


Figure 4. Scatterplot of Share of Workforce Receiving Follow-up Training from a Co-Worker vs. Performance Gain at Scheduling Module “Go-Live” for Each Clinic

