

Information in practice

Kaiser Permanente's experience of implementing an electronic medical record: a qualitative study

J Tim Scott, Thomas G Rundall, Thomas M Vogt, John Hsu

Abstract

Objective To examine users' attitudes to implementation of an electronic medical record system in Kaiser Permanente Hawaii.

Design Qualitative study based on semistructured interviews.

Setting Four primary healthcare teams in four clinics, and four specialty departments in one hospital, on Oahu, Hawaii. Shortly before the interviews, Kaiser Permanente stopped implementation of the initial system in favour of a competing one.

Participants Twenty six senior clinicians, managers, and project team members.

Results Seven key findings emerged: users perceived the decision to adopt the electronic medical record system as flawed; software design problems increased resistance; the system reduced doctors' productivity, especially during initial implementation, which fuelled resistance; the system required clarification of clinical roles and responsibilities, which was traumatic for some individuals; a cooperative culture created trade-offs at varying points in the implementation; no single leadership style was optimal—a participatory, consensus-building style may lead to more effective adoption decisions, whereas decisive leadership could help resolve barriers and resistance during implementation; the process fostered a counter climate of conflict, which was resolved by withdrawal of the initial system.

Conclusions Implementation involved several critical components, including perceptions of the system selection, early testing, adaptation of the system to the larger organisation, and adaptation of the organisation to the new electronic environment. Throughout, organisational factors such as leadership, culture, and professional ideals played complex roles, each facilitating and hindering implementation at various points. A transient climate of conflict was associated with adoption of the system.

Introduction

Electronic medical record systems have great potential to improve the quality of health services.¹⁻³ However, few service providers have adopted such systems.⁴⁻⁵ The cost of implementation is an important barrier, as may be limited evidence linking adoption and improved outcome.⁶⁻¹⁰ Concerns about disruptions during implementation—with decreased productivity, increased frustration, and organisational conflict—may also hinder widespread adoption.

Electronic medical record systems may challenge longstanding beliefs about how health care should be organised and delivered. Using physicians to enter data may be inefficient and

perceived as demeaning, though negative effects may diminish as users become proficient. Clinicians and managers may need to learn how to use computers and specific software, and alter established practice patterns, which might cause frustration and resistance. Although some large healthcare systems have implemented electronic medical records, formal evaluations rarely address these organisational issues.¹¹ This missing information could enhance the viability of existing electronic medical records and greatly inform the implementation of new systems such as the UK National Programme for IT (NPfIT) for the NHS.¹²⁻¹⁴

We examined the experience of implementing an electronic medical record system in Kaiser Permanente Hawaii. Using semistructured interviews, we identified the critical events in the system implementation, the impact of organisational culture and leadership, and the effects on clinical practice and patient care processes as perceived by the system's users.

Methods

Background

Kaiser Permanente is the United States' largest non-profit healthcare system, serving 8.2 million members in eight regions. It is widely regarded as a model of cost effective care.¹⁵⁻¹⁷ Kaiser Permanente Hawaii has 26 primary care teams in 15 clinics, and one hospital. It serves 234 000 members across three islands. The average team has four doctors, three nurses, and nine other staff members.

Kaiser Permanente compared two commercially available electronic medical record systems in the 1990s, EpicCare, developed by Epic Systems, and Clinical Information System (CIS), jointly developed by Kaiser Permanente and International Business Machines (IBM).¹⁸ In 1999, Kaiser Permanente's national leadership chose the second-generation CIS system for all its regions, starting with Hawaii. CIS was thought to offer a more modern operating system and software with greater flexibility and potential for growth and customisation. The reputation and stability of IBM were also important. Another requirement was that the system be scalable—that is, able to cover the population in a single instance of the software, thus providing an integrated system for the entire national population. At the time, only CIS seemed to have that capability.

Hawaii began to prepare for CIS in December 1999 with a planned starting date of October 2000. After a 12 month delay related to the operating system, the first site started using CIS in October 2001. In 2002, Kaiser Permanente hired a new chief executive officer, who initiated a review of the choice of



The interview prompt sheet used in the study appears on bmj.com

electronic medical record. In 2003 the company decided that the EpicCare system had matured beyond CIS, and now was better able to meet its needs. All Kaiser Permanente regions halted implementation of CIS and began planning for implementing EpicCare.

At that time, a third of the company's Hawaiian sites had implemented CIS fully, and the rest had read-only access, some with order entry functionality. For many in Kaiser Permanente Hawaii, the 28 month experience had been, to use a Hawaiian surfing metaphor, truly a "wild ride."

Interviews

JTS held semistructured, audio recorded interviews^{19 20} with 12 clinicians and five managers in four teams, located in four clinics and the Kaiser Permanente hospital, and with nine CIS project team members during March and April, 2003, about one month after the announcement to halt CIS implementation. Preparation for the new electronic medical record system began during the interview period. In the clinics with CIS implemented, it remained in use until replaced by EpicCare in 2004.

In the 60-90 minute interviews we sought respondents' views on four implementation issues: (a) critical events in the CIS implementation; the roles played by (b) organisational leadership and (c) culture; and (d) the CIS related changes in clinical practice. (The appendix on bmj.com shows the prompt sheet.) JTS transcribed the interviews, and a research assistant independently assessed the transcription accuracy, which reached 100%. We analysed interviews inductively and thematically.²¹ Responses were coded and collated to create themes. Unclear responses were clarified with interviewees. We held regular discussions to review themes and clarify factual aspects raised by data. This paper reports only themes that were mentioned by at least four respondents (of a total of 26).

Results

Critical processes in the implementation of CIS

Respondents identified four critical decision making processes—selection of the electronic medical record system, its design and early testing, its adaptation for widespread use, and adaptation of the organisation to the new electronic medical record.

Selection of the electronic medical record system

Only one respondent expressed approval of the CIS choice at the time of the interview. All the others perceived the choice of system as problematic: 18 reported dissatisfaction with the choice, 10 thought clinicians had not adequately "bought into" the decision, and seven identified conflicting priorities between the organisation as a whole and individual clinicians.

"It was a bit of a turkey. I was actually on the group that picked it. So we had to go out and defend a product that we knew was flawed. And other people knew it was flawed, you know: 'It isn't the right one; it's a turkey; why are we doing this?' So that was a particularly difficult set of circumstances."—Clinician, implementation team member

"There was a faction of people who felt strongly CIS was not the best option for us. In retrospect I have to say they were right."—Clinician

"With CIS it seems the highest priority was, 'How can we document as completely as possible and then extract information easily so we can get paid and so maybe we can do research?' but had very little to do with taking care of the patient who comes to your office."—Clinician

The conversion of CIS from the IBM OS/2 operating system to Windows took longer than expected, causing a 12 month delay. Nine respondents criticised the higher than anticipated and escalating implementation costs, and felt that Kaiser Permanente disproportionately bore the software development costs.

"We had a 12 month preparation period. The product wasn't delivered for another 14 months. That affects your culture."—Clinician manager

"The delay had multiple consequences to our whole experience with this. Lot of time goes by, lot of things happen in peoples' lives. And my internist needed to go do other things. And my paediatrician also needed to move. So the implementation date is shifting, and my players are (too)."—Clinician

"It cost so much more to do the conversion to Windows from the [IBM] OS/2 environment in Colorado than it was expected to, that all of the money that we thought we were going to be spending on improved functionality was basically used up."—Clinician, implementation team member

"Any improvements we had to pay for. So we're paying for IBM's entire development costs."—Clinician, implementation team member

Knowledge of the competing EpicCare system varied between respondents. A few respondents had seen both systems in other Kaiser Permanente regions and reported favouring EpicCare. Respondents consistently recalled suspecting that CIS was the wrong choice for Kaiser Permanente Hawaii, but may have been biased by the recent negative experience. At interview, 24 respondents were optimistic that EpicCare would prove a better system. All respondents thought the hardest challenge—to change from paper to computer—had been accomplished with CIS and that the new implementation would be easier. But at least eight respondents were cautious, noting that EpicCare would still require modifications in clinical workflows and that assessment of any electronic medical record needed to be set in context of a wider transformation in care delivery systems. Formal evaluations of the new EpicCare system are ongoing.

"We took one trip to Colorado, which had an older version of CIS, and one trip to North West [EpicCare] and we really liked [EpicCare], it just looked good. But Colorado had made [CIS] work and so we were using some of their tools and methods, but some of them wouldn't work in Hawaii."—Clinician, implementation team member

"Going from paper to one computerised medical record is probably the big step, so we took a big step to go to CIS and it'll just take a small step to get to [EpicCare]. So we don't think it'll take us very long to change to a new medical record system. And we knew that whatever we changed to could only be better. It couldn't be any worse."—Clinician

"Even [EpicCare] is going to take us more time. On a bad day we might see 30 patients. There's no way that you can do that on a computerised system unless you're going to do as lousy a note as possible."—Clinician

Design and early testing

Software design problems and inadequate early testing turned clinicians against CIS, fuelling resistance. Twenty three respondents reported substantial software problems, partly resulting from system designers' misunderstanding of clinical processes or because clinicians working on template design did not have access to a working prototype or adequate IT knowledge.

"It was pretty clear that this product had a lot of problems—from our very first site."—Clinician, implementation team member

"Well, it's basically a beta test of something, and it was very rocky."—Implementation team member

"There were unexpected changes in the product that was delivered—think non-starts: 'You said you were going to deliver X, you delivered Y. Y can't be worked with. You must go back and redo this to deliver X.' So there were classic systems failures."—Clinician manager

"The problem for internal medicine is that they go through a more complex process to arrive at a diagnosis, but CIS isn't really designed to do that. CIS assumes that the diagnosis is known at the beginning, or shortly after the beginning, of the visit."—Implementation team member

"We worked very hard on [templates] for various clinical problems. But that work was not reflected in the [templates] that we actually received

from IBM.”—Clinician, implementation team member

Adaptation of the electronic medical record for widespread use

Respondents also noted the importance of adapting the electronic medical record system. Four respondents noted the difficulty and expense of modifying CIS software. Respondents also reported that differences over software development priorities among the vendor, national and regional headquarters, and individual clinicians exacerbated software problems and strained relationships. Clinicians sought improved usability and flexibility, whereas national headquarters prioritised business and executive functions like accurate coding and reimbursement.

“We wanted to make a whole lot of changes, and [IBM] would point out why it would take time and cost money, and the smallest change would be a fight and it would cost tens of thousands of dollars.”—Implementation team member

“Executive decisions were made to limit the scope to things that would increase revenue, that would do a better job of coding, and that would make the system scaleable to be used in places like California—all of which are extremely important—but along the way usability and user input got crossed off the page.”—Clinician, implementation team member

Adaptation of the organisation to the new electronic medical record environment

Seventeen respondents reported that CIS had reduced clinician productivity, primarily because of extra work, such as processing laboratory result reports, entering orders, and navigating through the system. Fourteen clinicians reported that the extra time burdens from using CIS (estimated to be 30–75 minutes a day) persisted even after the initial learning period and affected patient care (such as by making it more difficult to fit in “overload patients”). The reasons varied: eight respondents regarded CIS as poorly designed and requiring too many steps to accomplish simple tasks; 12 felt that the system was cumbersome and poorly designed to accommodate the range of clinical needs or patients with multiple problems and requiring multiple templates; and nine reported a lack of clinical capacity to absorb changes during implementation.

“We don’t have enough [full time equivalents] of physicians. And we get complaints from patients: ‘Why can’t I see my doctor on time?’ That’s very common. Then we’re adding CIS. We don’t have enough time to begin with.”—Clinician

In response, some doctors worked late or through lunch and reduced their routine contact with colleagues. Although the CIS implementation included temporary provision of extra clinicians to help with the initial additional workload, several respondents doubted whether they would be able to achieve pre-CIS productivity levels.

“We’d started out in the high 90th percentile in terms of our utilisation, so when we tried to add the constraints of the system, basically it broke.”—Clinician

Implementing CIS required clear delineation of roles and responsibilities among staff. Sixteen respondents said that CIS preparation had revealed a variety of questionable practices and sharpened people’s sense of accountability. For example, the completeness and quality of charting improved. Eleven respondents believed implementing CIS had clarified staff responsibilities for clinical decisions, but these tasks required much unanticipated work.

“Somehow it has changed the psyche of people, they are more aware of what they are putting in the chart. It’s almost like they didn’t really care what they wrote on paper, but now it’s electronic and people can read everything.”—Implementation team member

“A whole lot of operational issues related to scope of practice. A lot of stuff we had to manage came to the surface because of CIS. Individual security profiles controlled access to information and ordering authority in different components of the system. Well that needed to be correlated to the person’s scope of practice. We never had a formal infrastructure for nursing supervisors to manage that.”—Implementation team member

“Because of the risk of litigation we have to keep to a higher standard. If you don’t have those systems and don’t enforce them then you are in big trouble. You can’t cover anything up in the electronic environment, it’s there for everybody to see.”—Implementation team member

Revised roles created shifts in work responsibilities, which led some doctors to complain that they were becoming expensive order entry clerks. But others welcomed the greater accountability.

“No question in my mind, it’s forced me to be more organised, more accountable. It’s forced me to do what I should have been doing all along.”—Clinician

Respondents also reported innovative adaptations, such as allowing nurses to act as results managers to screen laboratory results and do follow-up work. Medical assistants started prioritising electronic task items. Some clinics started to reconsider the visit (consultation) itself and developed new triage systems and appointment types, such as greater use of telephone consultations.

“We’ve seen more sharing of responsibility, having nurses do follow-up phone calls, and understanding specifically what a [medical assistant] can do, and shifting some work off the physicians on to others.”—Clinician, implementation team member

“‘Would you like to talk to a doctor on the phone, who’ll talk to you within an hour and possibly could help you out, without you having to come in?’ And the majority of patients are thrilled with it.”—Clinician

Organisational culture and implementation

Cooperative cultural values minimised active resistance to change but also inhibited effective feedback. Twelve respondents emphasised the importance of the local culture, which reflected Hawaiian values. “Caring for Hawaii’s people like family” is not only the company’s motto and advertising slogan, it is the explicit standard for assessing innovations. These values were also a barrier to effective implementation. Respondents characterised Hawaiians as averse to conflict and likely to interpret negative feedback as personal criticism. The culture minimised active resistance but also inhibited criticism before and during implementation, thus depriving decision makers of important feedback.

“It’s the natural culture of Hawaii to be very polite. We don’t beep our horn; we don’t cut our way in line. You never talk stink. That’s a phrase that’s used here, ‘You don’t talk stink.’ You don’t say bad things about other people. If you give constructive feedback—if somebody asks for it—they get a bit of a shock if they actually get it. So culture: big influence here.”—Implementation team member

“Hawaii’s culture is very non-confrontational, you know, ‘Just be nice, agree’; so the feedback has been relative to that.”—Implementation team member

Organisational leadership and CIS

Participatory leadership was valued in the decision making phase, but decisive leadership from the top was valued in the implementation phase. Fourteen respondents discussed the importance of leadership. Respondents often stated that the electronic medical record system selection process needed to be more participatory. In particular, respondents felt that Kaiser Permanente did not listen sufficiently to local leaders and clinicians, and dismissed early the concerns of Kaiser

Permanente Hawaii about CIS. In the implementation phase some respondents valued decisive hierarchical leadership. Respondents described local leaders as being consensus seeking, which at times exacerbated implementation challenges or encouraged passive resistance to change. Some respondents approved of the more directive leadership style exhibited by one specialty chief in particular, but noted that its effectiveness hinged upon the chief's well established clinical and professional reputation.

"From a change management perspective that was the nightmare, because we depended on the chiefs and the supervisors of the clinic to be really clear about their performance expectations with CIS implementation."—Implementation team member

"It was more autocratic. A decision was made—'That is how it is going to be'—so that made it easier for the team to roll it out. Because it was real clear for the clinicians, really clear."—Clinician

Conflict

As these critical processes unfolded, a climate of conflict associated with CIS arose. Being contrary to the cooperative ethos, this counter climate fuelled anxiety about the direction in which the organisational culture might be heading. Conflict manifested at various levels. For example, five respondents reported internal conflict between their commitment to "going electronic" and scepticism about CIS, and some initially receptive clinicians became alienated by the implementation. A mingled feeling of relief and loss associated with the withdrawal of CIS was intensified by a feeling that Kaiser Permanente Hawaii's core values had been salvaged.

"They felt mixed signals. There was the signal, 'We've got to implement this,' and there is themselves saying, 'Well we've got to make it work for us, and if I don't feel comfortable with it, then what should I do?' And it was very hard for physicians to speak out."—Implementation team member

"I felt like an officer asked to take my troops to Vietnam, and people are telling me I should go to Congress about why we are going to Vietnam. You know that may be true, but my focus needed to be on making sure my troops survived and did well."—Clinician

"What got docs here frustrated was nobody really seemed to listen. And they had to compromise their values and ethics to help the system work. That's where I saw very amiable, nice, quiet people starting to talk stink behind the scenes."—Clinician

"A lot of people and resources were put on hold in the region to get the project done. So it's particularly hard right now because of the change in the direction of the project. Even though you know it's for the best, there's all this self reflection about all [the] work we did and all that we didn't do in the region. So it's bitter-sweet. I think we are trying to overcome this image of a failed project."—Clinician, implementation team member

Discussion

Seven key findings emerged on the implementation of the CIS electronic medical record in Kaiser Permanente Hawaii:

- Many users perceived the initial selection of CIS to be detached from the local environment
- Software design and development problems increased local resistance
- CIS reduced clinicians' productivity
- CIS initially clarified and then changed roles and responsibilities
- Culture had varying effects: cooperative values minimised resistance to change early on but also inhibited feedback during implementation

- Leadership had varying effects: participatory leadership was valued for selection decisions, but hierarchical leadership was valued for implementation
- An overall effect was a counter climate of conflict in the company, which withdrawal of CIS resolved.

Implications for other healthcare organisations

These findings have notable implications for health service providers contemplating adopting an electronic medical record system. A participatory process in selecting the system and in fine tuning its capabilities is important. Clinical staff must be able to provide input to the decision, and feel that their input has been noted. This grass roots involvement is important to generate commitment. There may never be a perfect software system for all users, and all decisions will carry some uncertainty about how well the selected system will meet future needs or even achieve immediate goals in specific local environments. Extensive software testing of the vendor's claims for baseline functionality and the system's adaptability to local needs is important before implementation. Users' frustration with software problems can quickly escalate to the entire electronic medical record system and result in resistance to implementation.

Organisational culture and leadership have complex roles during implementation of an electronic medical record. Building a supportive, cooperative culture may pay dividends during the stress of implementation, but special efforts may be required to obtain critical feedback about the process, such as formal requests for suggestions on system improvement. Different leadership roles and styles are needed in different phases of the process: during selection of the record system, participatory leadership helps to gather input and get support from system users; during implementation, however, decisive hierarchical leadership can more quickly resolve problems to avoid frustration or the development of resistance. This finding reflects the dual leadership roles found in "ambidextrous organisations"²² and supports the theory that successful innovative organisations behave in organic ways when initiating new ideas but may adopt mechanistic approaches to use the ideas.

Roles, responsibilities, and relationships of clinical staff—During the early stages of implementing an electronic medical record system, changes in clinicians' productivity may require both extra staff and the ability to make continuous adjustments during implementation. As the organisation adapts to the new electronic system, the capability to document not only what care a patient received but who provided it and when means that patient care responsibilities and processes may need to adapt to revised professional and legal standards of care. These changes can improve efficiency and patient service, such as through new types of consultation.

Limitations of study

Our study captures only a snapshot of the implementation experience, during a volatile phase of implementation and during transition from one electronic medical record system to another. We observed the implementation creating a fundamental organisational change, which resulted in some conflict. The respondents' perceptions should be viewed in this context. Some nuances of this "wild ride" may be locally unique. In fact, another Kaiser Permanente region had previously implemented an earlier CIS version successfully. However, we suspect that the overall findings highlight issues likely to be faced by organisations implementing or modifying an electronic medical record system.

Learning and adapting to the new technology at Kaiser Permanente Hawaii were ongoing during our study, and we did not

What is already known on this topic

Electronic medical record systems have great potential to improve the quality of health services, but implementing such a system can be extremely disruptive

Better understanding of organisational contexts and responses to implementation may help to minimise disruption, but few formal evaluations have been made

What this study adds

Introduction of an electronic medical record system to a non-profit healthcare organisation created several challenges: many users perceived the initial selection of the system to have been detached from the local environment, sparking doubt and resistance; problems with software design and development increased local resistance, as did clinicians' reduced productivity during implementation

The system initially clarified and then changed roles and responsibilities—often, though not always, for the better

The organisation's cooperative culture minimised overt resistance to change but also inhibited constructive feedback during implementation. Leadership also had varying effects: participatory leadership was valued during selection of an electronic system, but hierarchical leadership was valued during implementation

have the opportunity to observe the clinical settings in the "normal" phase of operation. Future research should focus on validating our findings by studying other implementations, gathering data over longer periods and during different stages of the process.

Contributors: JTS contributed to the conception and planning and conducted the fieldwork as a visiting scholar at University of California, Berkeley. He also transcribed and analysed the recorded interviews and wrote the original manuscript and final draft. TGR contributed to the conception, design, interpretation, and writing of the study. TMV contributed to the interpretation and writing of the study. JH contributed to the conception, design and interpretation, and writing of the study. James Kinsman, at Kaiser Permanente, contributed to the administration of the study. Geoffrey Galbraith and Kathy Mau, at Kaiser Permanente Hawaii, contributed to the recruitment of participants and administration of the study. Judy Li, at University of California, Berkeley, validated the interview transcripts. JTS, TGR, TMV, and JH are guarantors for this manuscript.

Funding: The Commonwealth Fund of New York supported Tim Scott through a Harkness Fellowship. The Garfield Foundation provided funding for the data collection.

Competing interests: TMV and JH work for Kaiser Permanente, the organisation implementing the system under study.

Ethical approval: The Kaiser Permanente Hawaii Institutional Review Board gave ethical approval.

- 1 Institute of Medicine. *The computer-based patient record: an essential technology for health care*. Washington, DC: National Academy Press, 1997.
- 2 Institute of Medicine. *Crossing the quality chasm: a new health system for the 21st century*. Washington, DC: National Academy Press, 2001.
- 3 Institute of Medicine. *Priority areas for national action: transforming health care quality*. Washington, DC: National Academy Press, 2003.
- 4 Miller R, Sim I. Physicians' use of electronic medical records: barriers and solutions. *Health Aff* 2004;23:116-26.
- 5 Miller R, Hillman J, Given R. Physician use of IT: results from the Deloitte research survey. *J Health Inf Manag* 2004;18:72-80.
- 6 Garrido T, Jamieson L, Zhou Y, Wiesenhal A, Liang L. Effect of electronic health records in ambulatory care: retrospective, serial, cross sectional study. *BMJ* 2005;330:581-5.
- 7 Raymond B, Dold C. *Clinical information systems: achieving the vision*. Oakland, CA: Kaiser Permanente Institute for Health Policy, 2002.
- 8 Gibbs W. Taking computers to task. *Sci Am* 1997;278:64-71.
- 9 Kaplan B. Development and acceptance of medical information systems: an historical overview. *J Health Hum Resour Adm* 1988;11:9-29.
- 10 Littlejohns P, Wyatt J, Garvica L. Evaluating computerised health information systems: hard lessons still to be learnt. *BMJ* 2003;326:860-3.
- 11 Aarts J, Doorewaard H, Berg M. Understanding implementation: the case of a computerized physician order entry system in a large Dutch university medical center. *J Am Med Inform Assoc* 2004;11:207-16.
- 12 Department of Health. *Building the information core: implementing the NHS plan*. London: Department of Health, 2001.
- 13 Humber M. National programme for information technology. *BMJ* 2004;328:1145-6.
- 14 NHS Information Authority. *NHS IA strategic plan for 2002-05*. Birmingham: Crown, 2002.
- 15 Feachem R, Sekhri N, White K. Getting more for their dollars: comparison of the NHS with California's Kaiser Permanente. *BMJ* 2002;324:135-43.
- 16 Ham C, York N, Sutch S, Shaw R. Hospital bed utilisation in the NHS, Kaiser Permanente, and the US Medicare programme: analysis of routine data. *BMJ* 2003;327:1257-61.
- 17 Light D, Dixon M. Making the NHS more like Kaiser Permanente. *BMJ* 2004;328:763-5.
- 18 Wiesenhal A. Transitions of clinical information systems. *Permanente Journal* 2003;7(4):59-61.
- 19 Ives ED. *The tape-recorded interview: a manual for fieldworkers in folklore and oral history*. 2nd ed. Knoxville, TN: University of Tennessee Press, 1995.
- 20 Whyte W. Interviewing in field research. In: Burgess R, ed. *Field research: a sourcebook and field manual*. London: George Allen and Unwin, 1982:111-22.
- 21 Krippendorff K. *Content analysis: an introduction to its methodology*. London: Sage, 1980.
- 22 O'Reilly Cr, Tushman M. The ambidextrous organization. *Harvard Business Review* 2004;82(4):74-81.

(Accepted 20 September 2005)

doi 10.1136/bmj.38638.497477.68

School of Management, University of St Andrews, St Andrews KY16 9SS
J Tim Scott senior lecturer

School of Public Health, University of California, Berkeley, CA 94720, USA
Thomas G Rundall professor

Kaiser Permanente Centre for Health Research, Hawaii, HI 96817, USA
Thomas M Vogt director

Kaiser Permanente Division of Research, Oakland, California, CA 94612, USA
John Hsu physician scientist

Correspondence to: J T Scott jts1@st-andrews.ac.uk