The Kaiser Permanente Electronic Health Record: Transforming And Streamlining Modalities Of Care

EHRs can help achieve more-efficient contacts between patients and providers, while maintaining quality and satisfaction.

by Catherine Chen, Terhilda Garrido, Don Chock, Grant Okawa, and Louise Liang

ABSTRACT: We examined the impact of implementing a comprehensive electronic health record (EHR) system on ambulatory care use in an integrated health care delivery system with more than 225,000 members. Between 2004 and 2007, the annual age/sex-adjusted total office visit rate decreased 26.2 percent, the adjusted primary care office visit rate decreased 25.3 percent, and the adjusted specialty care office visit rate decreased 21.5 percent. Scheduled telephone visits increased more than eightfold, and secure e-mail messaging, which began in late 2005, increased nearly sixfold by 2007. Introducing an EHR creates operational efficiencies by offering nontraditional, patient-centered ways of providing care. [*Health Affairs* 28, no. 2 (2009): 323–333; 10.1377/hlthaff.28.2.323]

A GROWING BODY OF LITERATURE CONFIRMS the value of electronic health records (EHRs) in improving patient safety, improving coordination of care, enhancing documentation, and facilitating clinical decision making and adherence to evidence-based clinical guidelines.[1] However, less is known about EHRs' impact on the efficiency of outpatient care. A recent Congressional Budget Office (CBO) report notes the paucity of documented benefits of health information technology (IT) for providers and hospitals that are not part of integrated systems.[2] In this paper we report on the impact of implementing an integrated EHR system on the use of various types of ambulatory care in one Kaiser Permanente (KP) region as an example of impact throughout the entire system.

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KP is the largest U.S. not-for-profit integrated health care delivery system, serving 8.7 million members in eight regions. Members receive the entire scope of health care: preventive care; well-baby and prenatal care; immunizations; emergency care; hospital and medical services; and ancillary services, including pharmacy, laboratory, and radiology. Nationwide, KP employs approximately 156,000 technical, administrative, and clerical personnel and caregivers and 13,000 physicians.

KP HealthConnect

In 2004, KP began implementing KP HealthConnect, a comprehensive health information system with numerous functionalities, including (1) an EHR with comprehensive documentation across care settings—inpatient and outpatient, clinical decision support, and complete, real-time connectivity to lab, pharmacy, radiology, and other ancillary systems; (2) secure patient-provider messaging available through a member Web site that also provides personal health records; and (3) electronic interprovider messaging about care that is automatically incorporated into patients' records.

The purpose of our study was to examine the impact of KP HealthConnect on several types of ambulatory care patient contacts: outpatient, urgent care, and emergency department (ED) visits; external referrals; scheduled telephone visits; and secure patient-physician e-mail messaging.

Study Data And Methods

The KP Hawaii region was the first in Kaiser Permanente to fully implement KP HealthConnect in the outpatient setting. KP Hawaii has approximately 225,000 members, a figure that was consistent during the four-year study period.

We conducted a retrospective observational study using administrative data. The baseline year was 2004; KP HealthConnect implementation in primary care began in April and was completed in November. Implementation in specialty care was completed in June 2005, and the patient-provider secure messaging function became available in September 2005. The comparison year was 2007.

Data on rates of outpatient, urgent care, and ED visits; external referrals; scheduled telephone visits; and secure patient-physician messaging were extracted from the regional data warehouse.[3] Annual total office visit rates per region were stratified by primary care and specialty care and age/sex-adjusted to a fixed age/sex distribution over the time period, using four age categories (0–19, 20–44, 45–64, and 65+).

Our study included the entire regional membership, allowing us to use the Wilcoxon-Mann-Whitney test to assess the statistical significance of the changes between 2004 and 2007 in rates of total office visits, primary care visits, specialty care visits, scheduled telephone visits, secure patient-physician messaging, external referrals, urgent care visits, and ED visits.

Study Findings

■ **Office and telephone visits.** Age/sex-adjusted total office visits per member decreased 26.2 percent between 2004 and 2007 ($p < 0.001$), and total scheduled telephone visits per member increased nearly ninefold (Exhibit 1). Exhibit 2 summarizes the changes in office and telephone visits.

■ **Secure messaging.** In September 2005, KP Hawaii launched My Health Manager, the secure online patient-physician messaging function of KP HealthConnect. In the remaining months of 2005, members initiated more than 3,000 secure e-mail messages, a rate of 0.03 secure messages per member. In 2006, members sent nearly 25,000 messages (0.11 per member). In 2007, they sent more than 51,000 messages (0.23 per member). The increase between 2005 and 2007 was statistically significant ($p < 0.001$).

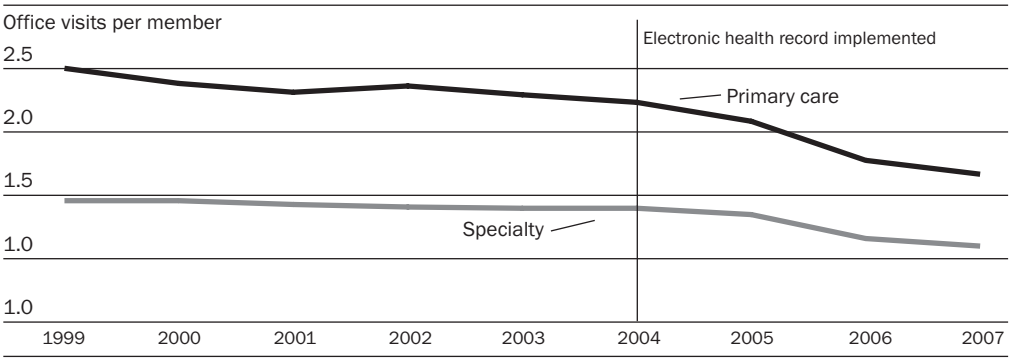
The total number of patient contacts via office and telephone visits and secure messaging increased 8.3 percent after EHR implementation, from 5.18 contacts per member per year in 2004 to 5.61 contacts per member per year in 2007 ($p < 0.001$).

■ **Other factors.** We explored other factors that could explain decreased use of ambulatory care visits. Enrollment in KP Hawaii did not change over the four-year study period, nor did the proportions of members over age sixty-five (12 percent) and those with at least one chronic condition (29 percent). The ratio of providers to members remained stable over time at 1.9 physicians per 1,000 members. The rate of referrals to external providers decreased 53 percent between 2004 and 2007 ($p < 0.001$).

The rate of ED and urgent care visits increased between 2004 and 2007—urgent care visits by 19 percent ($p < 0.001$) and ED visits by 11 percent ($p < 0.001$) (Exhibit 3).

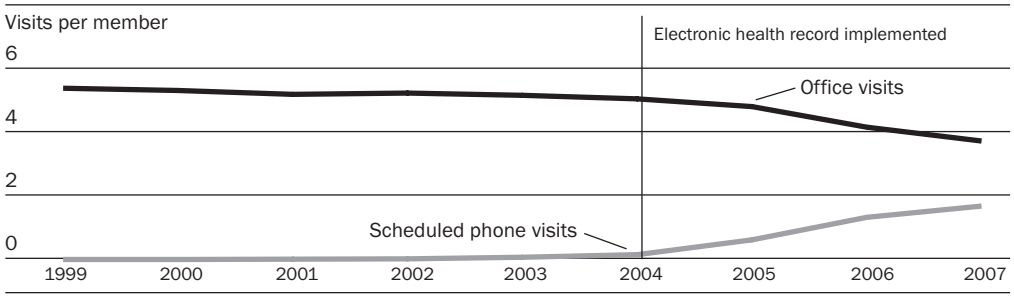
■ **Quality and patient satisfaction.** KP Hawaii captures Healthcare Effectiveness Data and Information Set (HEDIS) data as part of its routine quality surveil-

EXHIBIT 1
Changes In Office Visit Rates Among Kaiser Permanente (KP) Hawaii Members, 1999–2007



SOURCE: Authors' analysis using data from the Kaiser Permanente Hawaii Data Warehouse and secure messaging database.

EXHIBIT 2
Changes In Office Visit Versus Telephone Visit Rates Among Kaiser Permanente (KP) Hawaii Members, 1999–2007



SOURCE: Authors' analysis using data from the Kaiser Permanente Hawaii Data Warehouse and secure messaging database.

lance.[4] Between 2004 and 2007, many scores were not comparable over time because of changes in the HEDIS measure set. For the majority of measures that were comparable, performance remained stable during the study period (Exhibit 4). Overall quality was, at the least, maintained.

We were unable to use Consumer Assessment of Healthcare Providers and Systems (CAHPS) data to assess patient satisfaction because measures were not comparable across all years.[5] However, results from KP Hawaii member satisfaction surveys remained essentially unchanged. In 2004, 84 percent of surveyed KP Hawaii members rated their overall visit satisfaction at 8 or above on a scale of 1 to 10; in 2007, 87 percent did so. In 2004, 78 percent of KP Hawaii members rated the

EXHIBIT 3
Ambulatory Care Contact Per Member Rates Among Kaiser Permanente (KP) Hawaii Members, Selected Years 2004–2007

Type of contact	2004	2005	2007	Net change	Percent change[a]
Total office visits[b]	5.01	–[c]	3.70	−1.31	−26
Primary care	2.24	–[c]	1.67	−0.57	−25
Specialty care	1.40	–[c]	1.10	−0.30	−21
Scheduled telephone visits	0.17	–[c]	1.68	1.51	869
Secure e-mail messaging	–[d]	0.03	0.23	0.23	597
All ambulatory care contacts	5.18	–[c]	5.61	0.43	8
External referrals	0.04	–[c]	0.02	−0.02	−53
Urgent care	0.13	–[c]	0.15	0.02	19
ED visits	0.16	–[c]	0.18	0.02	11

SOURCE: Authors' analysis using data from the Kaiser Permanente Hawaii Data Warehouse and secure messaging database.

NOTE: ED is emergency department.

[a] All results are statistically significant ($p < 0.001$).

[b] The number of total office visits is greater than the sum of primary and specialty care visits because total office visits include care rendered by nurse practitioners, physician assistants, registered nurses, optometrists, social workers, and rehabilitative therapists, as well as physicians.

[c] Not applicable.

[d] Not available.

EXHIBIT 4
Healthcare Effectiveness Data And Information Set (HEDIS) Scores Of Kaiser Permanente (KP) Hawaii Members, 2004 And 2007

Measure	2004	2007	Trend[a]
Commercial population			
Childhood immunization status—combination 2	85.9%	85.9%	No change
Appropriate testing for children with upper respiratory infection	88.9	92.3	Favorable
Appropriate testing for children with pharyngitis	86.0	88.0	Favorable
Colorectal cancer screening	37.2	41.4	Favorable
Breast cancer screening in women ages 52–69	73.2	81.4	Favorable
Chlamydia screening for women			
Ages 16–20	52.3	60.0	Favorable
Ages 21–25	48.3	62.4	Favorable
All, ages 16–25	50.0	61.3	Favorable
Comprehensive diabetes care			
HbA1c testing	85.9	88.6	Favorable
Poor HbA1c control	35.0	40.4	Unfavorable
Use of imaging studies for low back pain	81.7	76.8	Favorable
Antidepressant medication management			
Effective acute-phase treatment	64.5	62.2	Unfavorable
Effective continuation-phase treatment	52.8	47.4	Unfavorable
Follow-up after hospitalization for mental illness			
Within 7 days	66.7	73.1	Favorable
Within 30 days	75.4	85.1	Favorable
Medicare population			
Colorectal cancer screening	51.8	58.9	Favorable
Breast cancer screening in women ages 52–69	78.8	87.6	Favorable
Comprehensive diabetes care			
HbA1c testing	93.9	96.8	Favorable
Poor HbA1c control	15.6	16.6	Unfavorable
Antidepressant medication management			
Effective acute-phase treatment	64.0	73.8	Favorable
Effective continuation-phase treatment	57.1	63.3	Favorable
Osteoporosis management in women with a fracture	36.6	27.9	Unfavorable

SOURCE: Kaiser Permanente Hawaii HEDIS data.

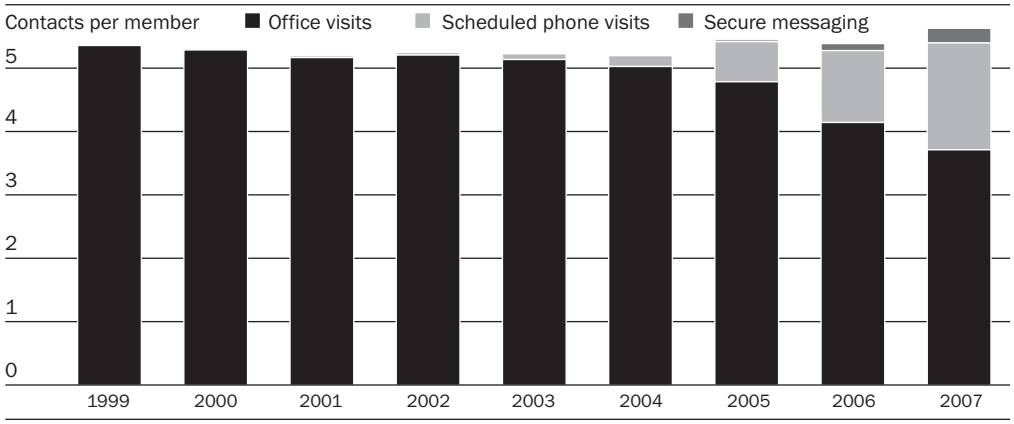
[a] Trends reflect changes in the HEDIS scores; no statistical significance testing was conducted.

level of interest and attention of their health care providers at 8 or above; in 2007, 79 percent did so. Additionally, in 2007, 90 percent rated their satisfaction with telephone visits at 8 or above.[6]

Discussion And Policy Implications

We examined the impact of an integrated EHR on ambulatory care use and found a 26.2 percent decrease in the annual age/sex-adjusted total office visit rate over four years. In 1999, office visits accounted for 99.6 percent of all ambulatory care contacts. Eight years later, they represented 66 percent of patient contacts. Scheduled telephone visits accounted for 30 percent of patient contacts, and secure messaging represented the remaining 4 percent (Exhibit 5). Between 2004

EXHIBIT 5
Distribution Of Patient Contacts Over Time Among Kaiser Permanente (KP) Hawaii Members, 1999–2007



SOURCE: Authors' analysis using data from the Kaiser Permanente Hawaii Data Warehouse and secure messaging database.

and 2007, these new modalities of care enabled an overall increase in patient contacts and access of 8 percent.

Although ED and urgent care use rose between 2004 and 2007, the increase represents only approximately 5 percent of the volume of the decrease in total office visit rates. Therefore, it is unlikely that the rise reflects a shift in the location of care from office-based sites to ED and urgent care settings. Further, the rise in ED and urgent care visit rates was delayed relative to the decrease in office visit use, which suggests alternative causes.

■ **Maintenance of quality.** The majority of twenty-two HEDIS scores that were comparable between 2004 and 2007 were at least maintained, with a few exceptions: poor HbA1c control in both the commercial and Medicare populations, management of antidepressant medications in the commercial population, and osteoporosis management in women with a fracture in the Medicare population.[7]

■ **Organizational assists.** Organizational efforts to shift ambulatory care use could also explain the changes in rates. Copayments increased $2 per visit per year between 2004 and 2007 as part of a stepped program to increase consumer cost sharing in the most prevalent benefit plan. However, previous larger copayment increases were not related to similar decreases in office visit rates.

The initiation of total panel management (TPM) in 2004 might have had a minimal impact on office visit use. In the TPM model of care, primary care teams identify members of their patient panel who need medications, testing, or other evidence-based care and then use multiple strategies to address these needs, such as telephone visits and secure messaging, in addition to office visits. TPM can reduce the need for multiple office visits among people with chronic conditions; however, only 10 percent of KP Hawaii clinics were engaged in TPM during the study pe-

riod. In addition, office visit use uniformly decreased in clinics without TPM.

■ **An EMR head start.** The existence of an earlier electronic medical record (EMR) may also have affected our findings. KP Hawaii had partially phased in another electronic system, Clinical Information System (CIS). At the time of KP HealthConnect implementation, a third of care sites had had full CIS functionality for just over two years; the rest had read-only access.[8] An 87 percent drop in daily pulls of paper charts after KP HealthConnect was implemented indicates that CIS was largely used alongside paper charts. However, the two systems shared some functionality. It is possible that CIS also slightly reduced office visits, which would have attenuated the effects we observed from KP HealthConnect.

■ **Efficiency and productivity.** We did not examine changes in the efficiency or productivity of providers immediately around the time of implementation. Temporary decreases in productivity of as much as 15 percent are common at implementation.[9]

EHRs may increase the time it takes to document patient visits.[10] We did not examine the impact of KP HealthConnect on net efficiency. Doing so would have required quantifying costs of increased documentation time and savings in nursing, receptionist, and appointment clerk time from decreased office visit rates. In addition, costs to patients of office visits—such as out-of-pocket expenses and time costs of travel, parking, and missed school or work—are often overlooked when one is calculating net efficiency. An average visit in the community can consume 103 minutes (Exhibit 6). In contrast, e-mail messaging and scheduled telephone visits consume much less time; logic suggests that the efficiency gains offset any increases in documentation time.

■ **Study limitations.** Limitations of our study include the fact that the system ar-

EXHIBIT 6
Average Time Spent By Patients For An Ambulatory Care Visit In The Community, 1998–2008

Patient activity	Minutes
Travel to and from ambulatory care[a]	50
Receptionist check-in/out[b]	10
Waiting room wait[c]	15.9
Exam room wait[d]	10.4
Time with provider[e]	16.4

SOURCES: See below.

[a] C.B. Forrest and B. Starfield, "Entry into Primary Care and Continuity: The Effects of Access," *American Journal of Public Health* 88, no. 9 (1998): 1330–1336.

[b] L.A. Backer, "Strategies for Better Patient Flow and Cycle Time," *Family Practice Management* 9, no. 6 (2002): 45–50.

[c] K.M. Leddy, D.O. Kaldenberg, and B.W. Becker, "Timeliness in Ambulatory Care Treatment: An Examination of Patient Satisfaction and Wait Times in Medical Practices and Outpatient Test and Treatment Facilities," *Journal of Ambulatory Care Management* 15, no. 42 (2003): 138–149.

[d] Leddy et al., "Timeliness in Ambulatory Care Treatment."

[e] Kaiser Permanente, internal study, 2008.

chitecture and implementation schedule precluded a randomized controlled trial. We were also unable to compare our findings against utilization rates in other KP regions because they were all in various stages of implementing KP HealthConnect during our study period. However, we note that the rate of ambulatory care visits has been rising since the mid-1990s in the United States as a whole.[11]

Additional limitations include the fact that our data on quality and patient satisfaction were drawn from contemporaneous tools and were not specific to this study. Changes in the HEDIS measure set between 2004 and 2007 restricted our ability to compare quality before and after EHR implementation. The long-term effects of telephone visits and secure patient-physician messaging on efficiency, quality, and patient satisfaction are unknown and require measuring impacts during a longer time period.

Our report falls short of a comprehensive evaluation of the impact of KP HealthConnect, which would require monetizing efficiency shifts. This is challenging in KP's integrated cost structure and beyond the scope of this study. In contrast to fee-for-service systems, Permanente Medical Group physicians receive a fixed salary regardless of the number of services rendered. Permanente Medical Groups provide medical care for members under a mutually exclusive contract with the Kaiser Foundation Health Plan.

■ **Economic impact of EHRs.** Further study may yield important findings about the overall economic impact of implementing a comprehensive EHR in the outpatient setting. It should be noted, however, that the CBO suggests that the adoption of more health IT is generally not sufficient to produce significant cost savings in the absence of incentive structures that reward (or, at a minimum, do not disincent) efficiencies.[12] The U.S. Department of Health and Human Services (HHS) suggests that a comprehensive evaluation would include measures of quality, patient safety, costs of direct care, administrative efficiencies, decreased paperwork, and expanded access.[13]

■ **Consistency with previous KP study.** Our findings are consistent with those of a study KP published in 2005.[14] Decreased office visits and increased scheduled telephone visits indicate that to some degree, telephone visits can substitute for office visits with immediate access to complete, current patient information via an integrated EHR. However, the previous study did not involve the more comprehensive KP HealthConnect system or secure e-mail messaging. KP also documented that secure e-mail messaging can provide an asynchronous, convenient substitute for some office and telephone visits.[15]

The 26.2 percent reduction in office visits indicates greater efficiency of care with an integrated EHR. With complete patient data available, unnecessary and marginally productive office visits are reduced or replaced with telephone visits and secure e-mail messaging supported by easy access to patients' medical records. For example, doctors reported that the EHR enabled them to resolve patients' health issues in the first contact or with fewer contacts.[16] In sum, our study

"Until public and private policies reward care strategies other than face-to-face visits, few providers will adopt them."

strongly suggests that an integrated and comprehensive EHR shifts the pattern of ambulatory care toward more-efficient contacts for patients and providers while at least maintaining quality of care and patient satisfaction.

■ **Importance of aligned financial incentives.** Importantly, our results were obtained in an integrated delivery system with an economic model that aligns financial incentives with providing effective and efficient care, regardless of how that care is delivered. As the CBO notes, "How well health IT lives up to its potential depends in part on how effectively financial incentives can be realigned to encourage the optimal use of the technology's capabilities."[17]

A specific example from KP Hawaii illustrates the potential that health IT holds for transforming care when incentives are properly aligned. The Hawaii regional team of nephrologists took advantage of the ready availability of comprehensive clinical information on all patients to risk-stratify the entire regional population with chronic kidney disease. Using evidence-based guidelines to electronically review the health records of thousands of members, they instituted proactive, risk-driven, electronic consultations instead of relying only on primary care providers to refer patients for specialty care. These consultations sometimes recommended traditional specialty visits but often provided care recommendations remotely, using electronic communication. Nephrologists used KP HealthConnect's internal messaging feature to provide KP primary care physicians with clinical management advice tailored to specific patients. Over three years, major improvements occurred in key indicators of quality of care for chronic kidney disease.[18]

■ **Policy implications.** Until public and private policies reward care strategies other than face-to-face visits, few providers will adopt them. Only in 2008 did the Centers for Medicare and Medicaid Services (CMS) add codes for telephone contacts that are intended to supplant office visits and for online management. Medicare, however, listed both services as noncovered for 2008, leaving it to the discretion of individual insurers whether to pay for these services.[19] Private insurers reimburse providers for online visits on a very limited basis.[20]

■ **Factoring in consumers' preferences.** Aligning nonfinancial incentives for using EHRs to improve the efficiency of care is also necessary. For instance, the National Committee for Quality Assurance (NCQA) relies on office visits as the predominant indicator of quality-related activity.[21] However, consumer choice is a key component of value-driven care.[22] Increasing evidence identifies patients' clear preferences for and satisfaction with e-mail messaging with their doctors.[23]

The KP experience is similar; among users of KP HealthConnect in KP Northwest, 85 percent rated their satisfaction as 8 or 9 on a nine-point scale.[24] In a sepa-

rate survey, 85 percent of users indicated that the ability to communicate electronically with their physicians enabled them to better manage their health.[25]

If face-to-face visits remain the gold standard for quality, care standards will not reflect the preference of consumers for alternative, more convenient modes of care when they are appropriate or reinforce more efficient care delivery options.

Kaiser permanente's work in this area is still in progress. We will continue to evaluate the impacts of KP HealthConnect on care and administrative efficiencies, quality, safety, and access over the long term. This report is interim, insofar as KP continues to innovate and improve workflows to create a new value equation for patients and purchasers. However, it provides a view into the transformation of ambulatory care that emerges and is increasingly possible when technology and incentives align with patients' preferences.

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NOTES

1. See, for example, R. Kaushal, K.G. Shojania, and D.W. Bates, "Effects of Computerized Physician Order Entry and Clinical Decision Support Systems on Medication Safety: A Systematic Review," *Archives of Internal Medicine* 163, no. 12 (2003): 1409–1416; L.C. Burton et al, "Using Electronic Health Records to Help Coordinate Care," *Milbank Quarterly* 82, no. 3 (2004): 457–481; J. Hippisley-Cox et al., "The Electronic Patient Record in Primary Care—Regression or Progression? A Cross Sectional Study," *BMJ* 326, no. 7404 (2003): 1439–1443; J. Butler et al., "Improved Compliance with Quality Measures at Hospital Discharge with a Computerized Physician Order Entry System," *American Heart Journal* 151, no. 3 (2006): 643–653; and B. Chaudhry et al., "Systematic Review: Impact of Health Information Technology on Quality, Efficiency, and Costs of Medical Care," *Annals of Internal Medicine* 144, no. 10 (2006): 742–752.
2. Peter R. Orszag, Congressional Budget Office, "Evidence on the Costs and Benefits of Health Information Technology," Testimony before the House on Ways and Means Subcommittee on Health, 24 July 2008, http://www.cbo.gov/ftpdocs/95xx/doc9572/07-24-HealthIT.pdf (accessed 22 December 2008).
3. "Total office visits" include care from medical and osteopathic doctors, resident physicians, nurse practitioners, physician assistants, registered nurses, optometrists, social workers, and rehabilitative therapists. "Primary care visits" include clinic-based care from internal medicine, family practice, and pediatric physicians. "Specialty care visits" include clinic-based care by other specialty and subspecialty physicians. "Scheduled telephone visits" include prearranged phone calls between providers and patients. "External referrals" include only non–Kaiser Permanente ambulatory consultations. "Emergency department visits" include visits to KP and non-KP emergency departments (EDs). "Urgent care visits" include care at KP urgent care centers; these are not included in total office visits.
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5. Agency for Healthcare Research and Quality, "CAHPS: Surveys and Tools to Advance Patient-Centered Care," 2008, http://www.cahps.ahrq.gov/default.asp (accessed 21 November 2008).
6. Kaiser Permanente, internal study, 2007.
7. Hawaii regional clinicians conducted a close review of antidepressant follow-up and noted discrepancies between care that occurred and care that was "counted" under HEDIS criteria. For instance, if follow-up on the use of antidepressant medications occurred during a visit but depression was not the primary diagnosis, it did not count toward the HEDIS measure. Scheduled telephone visits that were inaccurately

coded as "telephone encounters" also did not count toward the measure.

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22. DHHS, "Value-Driven Health Care Home," http://www.hhs.gov/valuedriven/index.html (accessed 21 November 2008).
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