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Implementing an Electronic Health Record at the Central City Medical Group

At the June 2007 Central City Medical Group (CCMG) board meeting, Deb Moore, Executive Director, alerted the board to important changes at CCMG, the result of mounting tensions caused by the implementation of an electronic health record (EHR) over the previous nine months. She announced a change in medical leadership and stated that physician morale was spiraling downward. While the external payment environment had been the biggest challenge over the last few years, the present and compounding challenge was the growing gap between the patient workload and physician capacity, as physicians remained well below historic productivity levels while they learned to use the new EHR. The workload was so overwhelming that one of the most productive senior physicians, who was also the Medical Director, had just resigned her post and asked for a three-month leave of absence. Other senior physicians were threatening to retire in the coming months. At the same time, CCMG faced an extreme shortage of primary care physicians for recruitment. One of the big questions Ms. Moore put before the board was whether or not CCMG should stop accepting new patients until they could return to full productivity.

Central City Medical Group

CCMG's philosophy was that primary care was the linchpin of an effective health delivery system. The empirical evidence suggested that primary care improved population health and the overall performance of the health system by increasing access to care, improving quality, reducing medical errors, and lowering racial and socio-economic disparities in care. Primary care was particularly important for people with chronic illnesses because of their complex and continuing care needs.

However, primary care was disappearing from the inner city.[1] Medical students were not selecting post-graduate studies in pediatrics, internal medicine, or family medicine because of large student debts, the salary differential between primary and specialist practice, and concerns about heavy workloads. Even when there was supply, care coordination was missing because the payment system did not reimburse efforts to collaborate with other health and social service providers. People with chronic illnesses turned to hospital-based specialists for their care, but this resulted in fragmented care as well as increased costs and utilization.

[1] Starfield, B., Shi, L. & Macinko, J. (2005). Contribution of primary care to health systems and health. *Milbank Quarterly, 83,* 457–502.

The CCMG was established in 1980 as a collaborative endeavor between primary care physicians, nurse practitioners, the Eastern Medical Center (EMC), four neighborhood centers, and the city and state governments as an innovative primary care organization that specialized in providing care to the frail elderly. William MacMillan, one of the founding physicians, explained,

> We had a vision of providing a lifetime of compassionate and continuous care to the frail elderly, particularly those at the margins of the health system. If care to these groups is to be effective, it must have the elements of personalization and continuity. With organized multidisciplinary teams, patients can be cared for in an individualized fashion in the appropriate setting by a transfer of direct responsibilities from one member of the team to another. Movement from home to the nursing home and back, or from ambulatory care to home care or nursing-home care, becomes an internal matter, with the hospital generally extraneous to the process and used only for those problems for which it is absolutely essential.

Hailed as "a jewel among physician organizations and medical centers," the Central City Medical Group was built on four pillars. The first pillar was the provision of individualized primary care to patients. This included taking sufficient time during the office visit to understand the patient's illness and their ability to manage their own care before coming up with a personalized treatment plan. The care team supported the patient between office visits with medication management, specialist referrals, active care coordination, and being available 24 hours a day, seven days a week. CCMG providers' commitment to their patients earned them the nickname "the Central City guerillas."

The second pillar was to provide care for those on the margins, such as the elderly, the chronically ill, the urban poor, hospice patients, the mentally disabled, patients with HIV/AIDS, the physically disabled, the homebound, and nursing home residents.

The third pillar was the provision of care to patients no matter where they were: in the clinic office, home, supportive housing, hospital, or nursing home. CCMG providers believed that continuous care not only reduced hospitalizations and emergency room visits, but also improved the patient's quality of life by enabling him/her to live at home when possible. In order to practice in multiple locations, providers needed copies of their records in various places. To accomplish this in the pre-EHR world, providers documented their progress notes on NCR paper[2] with three copies. One copy went to the office to be filed in the patient's medical record, the second copy was left in the patient's home, and the third copy was used for billing. A similar system of medical records was also used for diagnostic services such as labs and x-rays.

The fourth pillar was the use of teams. CCMG pioneered the use of nurse practitioner/physician teams for the care of the homebound elderly and disabled. For the 1,000 patients in Central City Medical Group's "community practice" (seen either at home or in the nursing home), a nurse practitioner visited a patient at least once a month and provided most of the patient's primary

[2] Carbonless copy paper.

care. The physician was called in to consult on complex problems. The nurse practitioners relied on lay coordinators to communicate and follow up with other providers such as labs and pharmacies. "It was a people system with a people infrastructure," explained MacMillan.

Not mentioned as a pillar, but a fundamental component of the CCMG care model, was payment by capitation which allowed CCMG providers to do whatever they thought was best for the patient regardless of whether it was "covered" in the FFS environment. This included providing longer-than-standard visits in the office practice and house calls in the community. Historically, Central City Medical had relied on some traditional Medicare risk contracts that paid CCMG a fixed amount per member-month for all services. CCMG was generally financially successful with this arrangement due to the care model's success at managing high-cost chronically ill patients. They also had an "Evercare" contract from United Health Care for managing their Medicare nursing home patients; this had also been a financially successful arrangement for many years.

Unfortunately, the private HMOs providing Medicare risk contracts were pulling out of the Medicare risk business in CCMG's service area due to changes in the way Medicare calculated its premium subsidy, and United was having trouble marketing their Evercare product to nursing home patients for a variety of factors. The only growing risk contract that CCMG had as of 2007 was in its Senior Care Options plan, which paid risk-adjusted primary care capitation for the care of dually-eligible (Medicare and Medicaid) patients in the community, with a bonus for managing overall patient expenses. The program had only recently begun recruiting patients, and while it promised to be a good fit with the CCMG model, only about 300 patients were enrolled so far, mostly in the CCMG "Housecalls" program for high-risk frail elderly still living in the community, generally in assisted living.

By 2007, the CCMG had grown to 11 physicians, 15 nurse practitioners and physician assistants, and 17 administrative staff. All physicians had appointments at Eastern State Medical School and the EMC. The practice provided care to 5,000 office patients and made 1,000 community and house calls. The Group was governed by an independent board of directors with shared ideals. Its not-for-profit status allowed the CCMG to access funding for grants to continually improve care for its patients. Carolyn Daley, a nurse practitioner, explained the organization's culture:

> Some of the original founders were still with the group. There were many nurse practitioners who had been working at CCMG for over 20 years. It was a wonderful place to work. We took a lot of the patients that no one else wanted. We had a lot of very sick elders and people with mental illnesses in group homes. We didn't get the simple people who walked in the door; we got the people with 10 diagnoses. We have been providing care to that population for 30 years.

See **Exhibit 1** for an overview of CCMG's provider and utilization statistics, and **Exhibit 2** for key financial indicators over the last nine years.

New Leadership at the Central City Medical Group

Deb Moore joined the Central City Medical Group in 2005 as its first non-physician Executive Director. Moore held a Master of Science degree in Health Policy and Management from the Harvard School of Public Health. Moore's strong business and information technology background made her an attractive candidate to the board of directors. Prior to joining Central City Medical, Moore was a founder and COO of Vobena, Inc., which she built into a $100 million company with 1,000 staff providing IT-based business process solutions to state Medicaid, SCHIP, and other health and human services programs. Prior to that, she was the co-founder and Vice President, Finance, of HealthFirst Administrators that provided access to health care coverage through brokering managed care programs. In that role, she directed all the financial, IT, and human resource aspects of the corporation, and developed it from start-up to $10 million in annual revenues.

Throughout her career, Moore had worked to improve health care access to disadvantaged groups, and CCMG's mission "to provide a lifetime of compassionate, continuous, high quality primary care to adults" appealed to her. She explained,

> I had never managed healthcare delivery before and I felt passionate about CCMG's mission. I was also very interested in bringing a framework to define and measure quality. Early in my career, I had been an executive assistant to a research group that included Donald Berwick and I had also been a teaching assistant for Harvey Fineberg. I had been following the evolution of the health care quality movement during my years as a COO in business. Fineberg said to me, "It is a small enough ship that you can possibly change its direction," and I felt like this would be a place where I could understand and promote measuring and improving quality.

Reasons for EHR Implementation

When Moore began her term as Executive Director, Central City Medical's clinical information systems were mainly paper-based and its computer system was limited to individual desktops. Moore recalled her early impressions:

> Even though other industries—and I came from a business that was very IT-oriented—had gone electronic, everything at CCMG was still manual. We had an inbox, a super inbox, and other places to put information. We had systems on top of systems and band-aid processes. It was unavoidable that paper was sometimes lost, phone calls were sometimes not returned, and files were running off the shelves. Sometimes charts went missing and on rare occasions, you would find papers that had fallen under providers' desks. Since half of our visits were not in the office, providers were taking charts out of the office and the trunks of their cars became filing cabinets—until HIPAA, when they had to leave them in the office and work from memory!

However, the reasons why CCMG began seriously considering an EHR extended beyond improving operational efficiency to providing high quality care to patients. CCMG's leaders recognized that implementing an EHR would be particularly advantageous because of the way the practice was structured. Most providers worked part-time in the office and part-time in the

community. Some providers spent all their time in the community, shuttling between nursing homes, hospices, and patient homes. Because providers were on the go so much, they did not always have access to their patients' paper charts. If a specialist or family member called to discuss a patient, the provider would need to wait to view the chart or try to recall the patient's condition from memory. Thus, giving providers tablet computers with EHR would make their lives easier and improve the quality of patient care. Also, since CCMG practiced team-based care and had 24-hour on-call services, the EHR would provide information on patients cared for by their colleagues wherever and whenever it was needed.

CCMG also provided a comprehensive telephone triage service to its patients. Because of its focus on geriatrics, many of its patients, both in the office and the community, were elderly and had at least one chronic problem. CCMG had a full-time nurse practitioner answering the triage line and giving advice to patients on how to manage their chronic conditions and what to do about episodic problems. Before EHR go-live, phone operators would run back and forth to the Triage desk with hand-written phone messages if several calls came in at once. The nurse practitioner staffing Triage would try to decipher whom she had to call back and what their problem was, which was not always clear. The file clerk also had to scramble to find paper charts for every patient who called. Using an EHR would allow the operator to take messages and send them to the nurse practitioner electronically, and the nurse practitioner could access the patient chart at the click of a mouse.

CCMG's high proportion of chronic disease patients would make a chronic disease management system particularly useful to the practice. EHR disease registries could track the outcomes of one patient, one physician's patients, or the entire practice on a particular measure such as glycated hemoglobin, an indicator of how well-controlled a patient's diabetes was. This information would help patients and physicians identify areas for improvement and track their accomplishments. Best practice alerts would remind physicians when patients with certain conditions were due for tests and treatments.

Finally, CCMG needed to measure its quality of care to participate in pay-for-performance initiatives for additional revenue and also to demonstrate the effectiveness of its model. Moore explained,

> We really believed that we had a unique model that made a difference but we couldn't demonstrate it without good data. We saw ourselves as an innovator in primary care; becoming an early adopter of the electronic health record in our setting was a continuation of our leadership.

MacMillan added,

> It seemed that we needed to go in that direction. We saw that the world was changing rapidly and we thought to ourselves, "How does Central City keep its edge as an innovator?" As we continue to move into the new world, we felt we needed to measure what we did. Our model stressed providing high quality of care and reducing costs and so the idea of an EHR made a lot of sense.

Decision to Proceed and the Planning Process

As the leadership discussed the benefits of an EHR, their resolve to pursue it increased. As a result of connections on the board, they were lucky to get some world leaders in health IT to educate them on the technology. Other factors in the environment also facilitated CCMG's decision. The literature was "buzzing" with the benefits of EHRs. EMC, with which CCMG was closely aligned, was also considering an EHR, and they encouraged CCMG to lead the way for physician practices.

However, some physicians were skeptical. They were worried that it was too expensive and that it would seriously disrupt the practice. They suggested waiting a year or two. To get them on board, Moore arranged a meeting with the physicians and asked MacMillan to explain the benefits of EHRs. MacMillan recalled,

> During the meeting, one physician said, "I don't need this. I know my patients." I asked, "What if you are on call and someone else's patient calls you?" He replied, "I would call their physician at 2:00 a.m. just the same way as I would want them to call me at 2:00 a.m. if they needed to speak to me about one of my patients."

Visioning session

In January 2006, the board gave approval for EHR implementation. For the next nine months, CCMG staff worked hard at planning for the EHR. CCMG was able to access free consulting services from Doctor's Office Quality-Information Technology (DOQ-IT), part of a CMS-sponsored Quality Improvement Organization, to support its EHR implementation planning. DOQ-IT's role was to get small and mid-size physician groups ready for EHRs in order to provide quality data to the Centers for Medicare and Medicaid Services (CMS). Their assistance to CCMG focused on the broader project goals, including operations redesign and change management, as well as helping to define requirements and select the EHR.

In February 2006, Dan Hoster, one of the staff from DOQ-IT, facilitated a visioning session with CCMG providers on "why do we want an EHR." A number of important goals and considerations for EHR implementation were identified during the session. Hoster described his impressions of CCMG's culture:

> I am a big fan of the Central City Medical Group. They are a mission-driven organization that was able to pull providers together to work for a cause. They had a real drive to improve care and they saw the electronic health record as a tool to do that. We could get all physicians in a room together at a 7:00 p.m. meeting.
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> One of the things I was impressed by was the very quick translation they made with what the EHR could do for them and their patients. They were able to go from technology to value in one meeting. It some other places, it would take a long time to get to this.

Exhibit 3 provides a summary of the discussion at the visioning session.

Project Plan and Timelines, Communications Plan and Budget

Following the visioning session, Moore and the management team established a three-tier project management structure including a leadership committee, a project steering committee, and a vendor selection committee. CCMG had a very collaborative culture and a great deal of effort was made to involve everyone in the process. **Exhibit 4** provides a list of the committee membership. A project plan outlining the key tasks that needed to be accomplished and a budget for the EHR was developed. **Exhibit 5** describes the Project Plan, and **Exhibit 6** outlines the EHR budget.

Because of the small size of the organization, a decision was made to dedicate internal resources for the project rather than to hire someone from the outside. Marion Kraft, the Group's Medical Director, became the clinical director for the project and Lester Mann, a physician assistant, assumed responsibility as project manager. A communications plan was established to get commitment from all project stakeholders. **Exhibit 7** outlines the EHR Communications Plan.

Vendor Selection

In preparation for their task, members on the Vendor Selection Committee read the literature on EHRs and undertook site visits to other practices that had implemented them. Carolyn Daley, a nurse practitioner in the community, noted,

> We were very thorough in our search to find a good EHR, but we found that no one system met all of our needs. There were some EHRs for visiting nurses, or for office practices, but none that we looked at was perfect. We narrowed our options down to three and we undertook site visits where users told us about the pros and the cons of their systems. At one of the sites, the doctor told us, "I don't use it when I go out to visit the nursing homes because it takes too much time." The decision about which system to use was not taken lightly, and we did a lot of work on it.

After their initial research, the Vendor Selection Committee invited the three short-listed vendors to demonstrate their systems. About 20 people from CCMG, including clinicians, nurse practitioners, and administrators, attended the session. After seeing the demonstrations, the committee settled on eClinicalWorks (eCW). eCW was a young and developing company that had been established two years earlier. They had implemented their system in some smaller practices and one larger practice. Kraft explained,

> It was very important to me to make sure that the EHR did not make it hard to practice medicine. When choosing eCW, I really liked how it looked. Aesthetics count. eCW feels like you are always in the chart. A good system should also have functionality. The selection of our system was a difficult task. It is like someone who has never been on a boat deciding what boat to buy.

Mann added,

> We put the decision to a vote and it was a very democratic process. We chose eCW software and IT support for the first year. The other two options were about two to three

> times as much. The difference between the more expensive options and eCW was functionality. For example, in the more expensive systems, you could run reports of all patients that hadn't been seen in a year or who were due for a checkup. There were, however, many things I liked about eCW right away. It had a lot of color and the navigation was intuitive. We did not choose eCW just because it was the least expensive.

While CCMG recognized that the system was not perfect, they also recognized that eCW was actively working to improve it. They felt that the problems that they were seeing now would not necessarily be present by the time they were using the system. Another important consideration was that eCW was the vendor of choice for EMC, which planned to implement it soon.

In June 2006, following the leadership's recommendation of eCW, the executive committee of the board gave approval to proceed with that vendor. The board expressed the importance of having implementation be on time and within budget. The board emphasized that it was important that providers not be distracted excessively, while recognizing that implementation would also require a redesign of work processes. Following the board's approval, Moore and members of the Vendor Selection Committee wrote a comprehensive Request for Proposal with assistance from the staff at POQ-IT. At the end of the month, CCMG signed a contract with eCW.

Preparing to Go Live

Workflow redesign

Moore decided that the implementation of the EHR was a good time to look at the center's existing practices and implement new standardized work processes. To facilitate this process, CCMG first documented descriptions of the practice's current work processes. This step highlighted how cumbersome some of CCMG's processes were. For example, at the front desk, the receptionist had to fill out up to five different forms when checking in a patient. Elizabeth Crowley, CCMG's Chief Operating Officer, commented,

> Implementing an EHR is not only about the product. You are making a huge change to your business. You have to look at your processes and say how do I really want to do such and such, not how did we do it historically with our paper records. It is about process improvement. We referred to it as "the new Central City Medical Way."

After documenting the current work processes, the leadership team sat down, reviewed the functionalities of the EHR, and designed new work processes, making sure to preserve the patient safety imperatives built into the old ones. Kraft explained,

> No one wanted to simply "pave over cow paths" and did we ever repave cow paths. It was like the dawn rising. As you get closer, you see more and more. You realize how much is changing. Every piece of paper needs a plan. But when you are working in a system, it is hard to come to a consensus for a new way of doing things.

Exhibit 8 provides a description of the office workflow.

New job descriptions

The leadership also developed a plan to shift employees into different jobs. For example, the file clerk, whose sole job had been to pull and file paper charts, became the scanning clerk. An administrative assistant who formerly had transcribed dictation now took on other administrative responsibilities such as payroll, because the browse and drop-down menus of the EHR reduced the need for dictation.

Training and testing

There was an intensive week of group training one month before go-live by eCW at their site in Westborough. It was the first time the system was run and it showed some glitches. Moore explained, "Once we started training, the system would crash during the training so lots of time was wasted." A detailed training manual was developed by Central City Medical staff to assist providers and staff with the transition to the new system and processes. **Exhibit 9** provides a cover letter from Moore to the staff accompanying the training manual prior to going live.

The Project Steering Committee decided not to have a pilot. Concordant, a consulting company, recommended that CCMG consider "load testing" the system to see how well it would perform but the cost of doing this at $15,000 was too expensive. Instead, CCMG decided on a phased approach to implementation. Office functions would be implemented in the first phase, clinical functions in the second, and the disease registry in the third.

Going Live

On October 30, 2006, CCMG went live with the practice management piece of the EHR: check-in, scheduling, new patient registration, recording telephone messages, and billing. CCMG's super-users— providers who volunteered to take on extra responsibilities to help the practice make a smooth transition to EHR—began testing the clinical functions of the EHR at the same time. The entire practice went live with the clinical functions on January 15, 2007. These included taking visit notes in the EHR, electronic prescribing, and electronic lab orders. In addition, starting in January, all documents entering the practice were scanned, e-filed in the EHR, and delivered to providers electronically.

During the implementation phase, the Project Steering Committee became the Implementation Committee. It brought together the Executive Director, the Chief Operating Officer, the Medical Director, a nurse practitioner, the Project Manager, the Billing Manager, the Office Manager, and the Community Nurse Practitioner liaison. The team members represented their constituencies well. The Executive Director and Chief Operating Officer pushed for the practice to eliminate every shred of paper as soon as possible. The Medical Director and clinicians showed that this was not always possible given the workflow of the office visit, demands on clinician time, and the need to preserve patient safety. The Office Manager and clinicians worked together to ascertain how the telephone operators and receptionists could best help providers. Though sometimes there was tension between team members, generally the team functioned smoothly and made reasoned and effective decisions.

However, some office physicians complained that their focus on the computer screen interfered with their ability to communicate with patients. One physician complained, "In the old days, you started out by asking the patient, 'so tell me your story' and listening. EHRs on the other hand try to guide you in your thinking. Not only is it not the way I think, but it is not the way I was trained in medical school. I was taught to start by being open to ideas and listening to the patient. This just isn't what I signed up for." "If you want me to increase productivity," added another physician, "get rid of the electronic health record and implement it when it is ready."

While the implementation of the office functions went relatively smoothly, CCMG encountered problems in rolling out the clinical functions and were never able to roll out the disease registry. The Committee developed a detailed list of all the problems encountered during implementation, meeting daily during the early months of implementation and weekly thereafter, and prioritizing problems based on their level of urgency. If the problem was resolved, it was taken off the list or moved to a list for "continuing education."

Exhibit 10 provides an example of the types of problems encountered from January 30 to February 8, 2007.

Connectivity in community visits

CCMG faced several barriers while trying to implement the system in the community. The leadership's original vision was that every long-term care facility where CCMG providers worked would set up remote Internet access. Providers would bring their tablets to facilities, connect to the Internet, and use eClinicalWorks for notes, prescribing, and billing just as they did in the office. In reality, few of the facilities had been able to achieve a reliable wireless connection. Although cafés, universities, and airports had wireless, expecting that nursing homes would have reasonable Internet access turned out to be a naïve assumption.

CCMG asked the facilities to pay for installing wireless themselves but had to hire an IT consultant to recommend a connectivity solution for each one. The consultant's recommendations identified the most strategic placement of hardwiring, ports, and wireless routers. As of April 2007, only four out of 11 facilities had reliable wireless. For home visits, of course, there was no connectivity solution; few of CCMG's elderly patients had wireless in their homes. CCMG purchased Verizon wireless cards (devices that plug into a laptop and connect to the Internet via Verizon's wireless broadband network) for its providers, but the connection was often too weak to support a large application such as eCW.

The lack of Internet connectivity was frustrating for providers working in the community. When they could not connect, they took visit notes on paper, and later had to enter billing information into the EHR. Sometimes they also typed their notes into the EHR. To keep up with their work, providers worked from home, making them feel overworked and exhausted. Some simply filed the paper notes in the paper charts patients had at the long-term care facilities, and billed using paper, so the information never made it into eCW. As of April 2007, CCMG's billing office was still receiving 10% of billing information from providers on paper. Daley explained,

> We went live on a Saturday and I was on call. I had a patient with 25 medications who had been admitted to a nursing home. I had no technician, so I had to input all the data, and what normally would have been a 1.5-hour admission took me 4 hours. I can't say I wasn't well trained, but the system just didn't do what I wanted it to do. For example, each of my patients and each of their meds was a non-standard dose, so each dose had to be adjusted and I spent a lot of time figuring it out as I went along. We hadn't learned this in the class. So going live was very hard.
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> The original goal was to take a tablet, take notes in the patient's room, finish the note, and print it on-site to put into the patient chart. You have to keep in mind that I go to three different sites every day, so this wasn't really feasible. Instead I would take hand-written notes, see my patients, then go home and type the notes. My plan was to stop at 4:00 p.m. and do my notes, but instead I was doing my notes at night, until 10:00 p.m.
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> We had tremendous difficulties with the hardware and software. It was forever breaking down. They kept telling us, "You are on the forefront of this. Think of all the other people who will be helped by you figuring this out." The Wi-Fi cards on the laptops would lose connectivity several times a day. We had someone in our office that we could call and he would try to figure out why the system wasn't working for us. That's another reason why I started doing the notes at home or in the office, because the connectivity and printer were faster and more convenient.
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> The data server was down every day from 12 midnight to 6:00 a.m. for a planned backup, which made it hard for doctors who were working the night shifts. It meant that doctors were not able to get the patient records during this time. The physicians that were most upset were the ones who had been told that the EHR was going to help them to have better access to information, and then they couldn't access the records they needed during the overnight shift.

In addition, as of April 2007, the "inking" function still did not work on most tablets. Inking enabled users to sign orders directly onto their tablet screen using a special pen, eliminating the need to print and sign orders. Neither eCW nor CCMG's local area network vendor, Concordant, could figure out why trying to ink produced errors on some tablets.

Even when a nursing home had connectivity that allowed a health worker to access the Internet, the health worker still needed to connect to the eCW servers, which were hosted within the CCMG local area network. To do this, remote providers needed to access the CCMG network through the EMC Wide Area Network (WAN). Any disruption in either the CCMG network or the EMC WAN would disrupt service. In addition, with other clients, eCW engineers had been able to support end users by logging into their servers remotely, using a method that was not permitted on the Caregoup network. For this reason (among others), the Central City Medical Group clinic decided to terminate their network support by Caregroup and seek alternative access to the Internet.

Cumbersome interfaces

Many of CCMG's technical problems involved interfaces—software programs that were supposed to transfer information between CCMG and other organizations. As a stand-alone practice, CCMG had to exchange information with a host of different entities: laboratories,

pharmacies, insurance companies, and EMC, where it referred patients for specialist visits and procedures. None of these interfaces proved simple to set up.

eClinicalWorks told CCMG that it would be able to create a bidirectional interface for transmitting orders and receiving labs from Quest Diagnostics (CCMG's primary lab) by its go-live date of October 30, 2006. But as of April 2007, the Quest interface was still not working. CCMG continued to send lab orders on paper and receive paper results. Use of the interface first stalled because of technical problems with transmissions. After eCW and Quest spent months fixing these bugs, CCMG providers spent a few weeks making sure the system was fail-safe, so that abnormal labs would always be brought to the attention of providers. Three providers meticulously tested what would happen if an abnormal lab came back for office providers, community providers, and providers who were on vacation. Then, these super-users decided to pilot the interface before taking all providers live on it. It was a good thing they did, because those providers who sent orders electronically did not receive electronic results—only paper results. Meanwhile, some providers who had not sent any electronic orders started getting results back electronically. Quest and eCW were still trying to determine why this occurred in April 2007.

After a few months of false starts, e-Prescribing in eCW was finally functioning smoothly. Problems continued to occur when pharmacies did not receive prescriptions that eCW showed had been transmitted via SureScripts, the e-prescription highway software. Also, some pharmacies were not set up to accept e-prescriptions, so the medical assistant in charge of prescriptions sent orders to those pharmacies via eCW's electronic fax server. During implementation, some members of CCMG's management team recalled that their physicians would print a prescription from their EHR systems and hand it to the patient, rather than transmitting the order to the pharmacy electronically. If transmissions continued to fail, CCMG would have to decide whether to simply print prescriptions and hand them to patients.

Finally, CCMG exchanged information with EMC through three programs: CCC, OMR, and the ER Dashboard. CCMG transmitted test orders to EMC via CCC. This program did not interface with eCW, so providers had to minimize eCW on their computer screens and open CCC in order to transmit orders. Providers then had to transcribe these orders into eCW so the order information was recorded in the patient's EHR, forcing them to do double work. Providers were able to view the OMR, the EMC medical record, and the ER Dashboard, a record of patient progress in the ER, by clicking a button in eCW. However, this gave them access only to read-only files rather than actually aggregating the information into one record.

Chart migration

Before go-live, CCMG's leadership scripted a detailed chart migration plan that would gradually phase out paper charts in favor of electronic records. The plan called on clinicians to review and document the most important information, such as the patient's problem list, medications, and allergies, in the electronic system. Providers also marked all of the pages from the paper chart that they wanted scanned into the electronic system. The goal of the chart migration was to eliminate the need for the paper chart the next time the patient was seen. Shelves in the office

were supposed to become progressively emptier as chart-filled trucks lumbered off to Iron Mountain.

However, chart abstraction turned out to be extremely time-consuming for physicians. Instead of combing through every page of hefty paper charts and abstracting them, physicians were flipping through them, entering crucial information into the EHR, and then giving the charts back for refiling on the shelves. Because of this, file clerks still delivered paper charts to providers before every visit and to Triage when patients called. The providers' slow adjustment to the system was a drag on productivity.

Kraft noted,

> At the time of go-live, we cut back schedules to two patients per hour, down from three to four. This gave providers time to learn the system and migrate data from the paper chart into the new system. The ultimate response was a work slowdown. Providers were only willing to see eight patients in a four-hour shift.
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> I did much of the customizations required in the system and it was hard. It was hard working so much on something that you knew others would hate. They did not want that kind of structure. It is not how they think. It is not how I think. I was not taught to think that way in medical school.
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> It would have been better to have those working to make this happen somewhat removed from the practice. It was personally very painful to have to feel your colleague's anger while working in the clinic.

Chronic disease management

CCMG was still trying to realize the benefits of eCW's chronic disease management system. Every time someone tried to run a report on patients with a certain condition, eCW returned an error. The support technicians could not figure out how to fix this function, which was integral to creating disease registries.

Drug interactions

Although the EHR had a feature for checking drug interactions, it never really met the clinic's needs. Moore commented,

> The functions that would have improved quality were, in general, not usable. For example, the alerts about medication interactions should be a quality layer. However, the way they were designed, and since CCMG patients were on several medications at a time, the alerts would flash constantly. It became like "The boy who cried wolf." The system did not have reasonable thresholds. So, in the end, we turned off the alerts.

External support for implementation

CCMG expected support from several organizations when it embarked on EHR implementation, including DOQ-IT, EMC, and eClinicalWorks. Yet, in the end, none of these groups could help

CCMG resolve all the problems it faced, and CCMG staff had to invest much time and energy in figuring out the answers themselves. Of course, CCMG turned for help to eCW technical support, with mixed results. Sometimes, support personnel resolved problems and answered the questions. Too often, they were unresponsive, and occasionally they were utterly clueless about the features of their own program. When eCW could help, their support was slow and cumbersome. Clients of eCW were expected to submit their issues and questions online. They would then wait for one or two days for someone from eCW to get back to them. When they contacted CCMG, they would ask CCMG staff to repeat the problem as if they were not aware of the problem that had been submitted. If the eCW staff person could not solve the problem, they would indicate that someone from the company would call back soon. This whole process proved frustrating for CCMG.

Provider Morale

Since its implementation nine months earlier, nothing at CCMG had seemed the same. Every day the EHR presented new problems, like the day when every patient was given a diagnosis of "abdominal discomfort" due to a glitch in the new system. The EHR implementation team was constantly trying to figure out how to deal with software bugs, Internet connectivity issues, work process changes, and provider morale.

Provider morale was shaky. Many community providers who had trouble accessing the Internet were doing billing and sometimes visit notes at home. Even some office providers continued to take notes on paper, and then typed them into the EHR after hours. Providers had yet to see the benefits of electronic records in terms of easier workdays and were still distrustful of eCW because of its many software glitches. The implementation process exacerbated tensions between the founders, now in their 30th year of practice at CCMG, and the younger leadership who were pushing for change. Bonds between colleagues were fraying. Physicians got angry. Brower explained,

> Over time, some people were able to focus on the benefit and some were heartbroken. On a particularly bad day, one of the cheerleaders of our system said to me, "I am tired of defending this crappy system."
>
> It definitely stressed the practice and made some underlying tensions worse. We had to have a "manners intervention," asking some providers "not to hit reply all" or copy all CCMG employees when you have a comment to make about what's not working or what you hate about the system. We needed an EHR vendor and an organizational behavior specialist.

Back to the June 2007 Board Meeting

Moore was deeply concerned about CCMG's ability to deal with provider burnout, reduced productivity, and the increasingly tense work environment. She had several proposals for the board to discuss to reduce the pressure on physicians, including stopping the time-consuming CCMG practice of "rounding" or following their patients in the hospital, closing the practice to new patients, and getting out of some community nursing home contracts, None of these would help the practice's bottom line, currently projected to run a $520,000 deficit, well below the

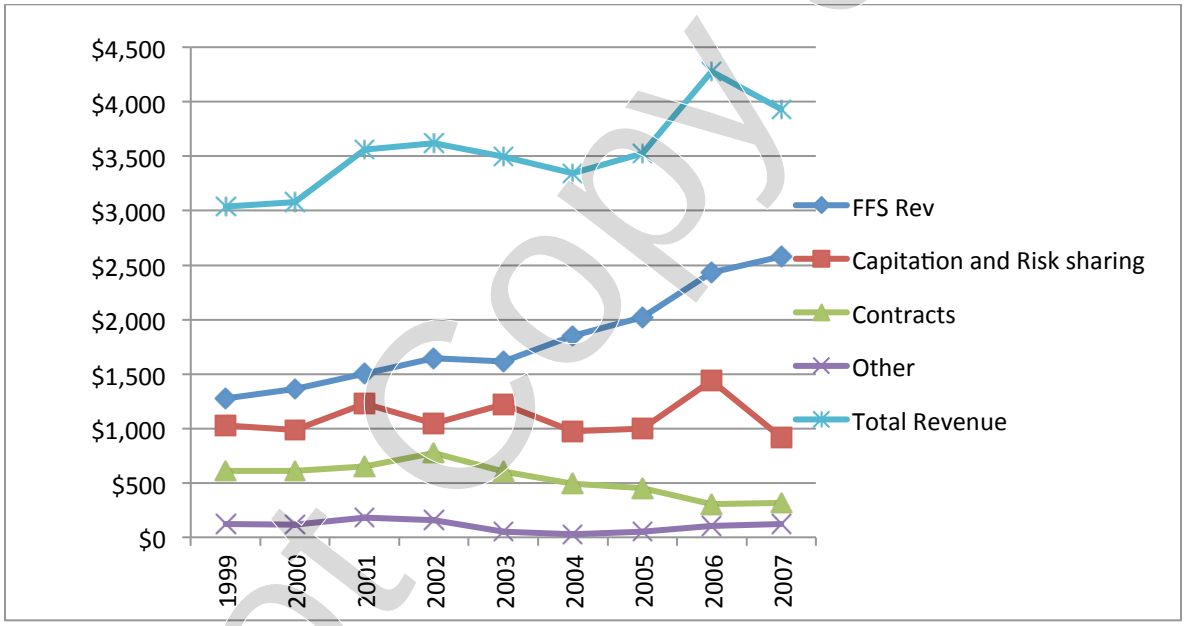
breakeven budget approved by the board in March. Recruitment of lost physician capacity would take at least a year and would require an up-front investment that the practice could ill afford at this time. She wondered if it was time to retrench and allow those providers who were least successful to continue with the use of paper records until they could start to recruit new providers.

The board had a lot to discuss.

Exhibit 1: Central City Medical Group Provider and Utilization Information, 2003

Setting	FTE Providers	Patients per year	Visits per Year
Office	6.0	4000	10,653
Community (nursing homes)	9.8	800	14,457
House Calls	3.16	133	956
Hospital	3.58		2195
Total	**22.5**	**4,922**	**28,261**

Exhibit 2: Financial Information



- CCMG fiscal year ends March 30th, so 2007 is March of 2007

Central City Medical Group Profit Margin

	1999	2000	2001	2002	2003	2004	2005	2006	2007
Profit Margin	12.2%	14.1%	13.9%	1.7%	-4.0%	-12.0%	-12.7%	1.3%	-12.8%

Central City Medical Group Staffing Levels

	1999	2000	2001	2002	2003	2004	2005	2006	2007
MD FTE	6.8		8.3	9.0	9.2	9.6	9.0	9.2	9.0
NP/PA FTE	9.6		10.9	12.3	13.1	12.6	14.1	13.9	14.6
ALL OTHER FTE	12.8		13.8	14.0	14.8	15.0	16.0	16.8	19.2

Exhibit 3: Summary of the Discussion at the Visioning Session Held February 7, 2007

Several high-level goals and objectives were identified during a "Goal and Vision" meeting on February 7 at CCMG. These can also be considered guiding principles as the team moves though the system selection and implementation process.

Healthcare quality

- The EHR will increase CCMG's ability to track preventative services. During the operation redesign phase, new policies and functions will be developed to ensure that patients stay up to date with procedures, appointments, and tests.
- The EHR and resulting systems will also facilitate the measurement of chronic care management. Initially the DOQ-IT measures will be used to show quality.
- Timely, safe review and routing of lab and other results. The system will maximize the use of outside data.

Operational efficiency

- One of the primary drivers for system implementation is increased operational efficiency. Focuses for the initial implementation will be determined by the head of each functional area as they go through the process of evaluating their department.
- The system needs to provide interconnectivity with community practitioners to be able to document and care for patients who are serviced at these outside sites. Community practice providers will have ready, real-time access to patient records and communications. New workflows will also be developed to improve and ensure good communication with the community practice.
- The EHR needs to have available—or to have developed—interfaces to frequently used laboratories, including the Eastern Medical Center. Other interfaces may include nursing homes and other frequently used labs.
- Health information management systems will aim to increase the availability of clinical information.

Culture and Transitions

- The EHR needs to provide staff with a tool to enhance operational efficiencies, enabling staff to provide better and faster service to patients.
- The EHR must be "user friendly" to facilitate effective training and operations in a fast-paced environment.
- Proper training will take a high priority in implementation. This includes training for the EHR/PMS, but also any other skills needed to fit the new workflows or practice.
- Providers will be encouraged to document care at the point of service, and the office and systems will be designed to facilitate this.
- The new systems will continue to support CCMG's group practice of medicine.
- Providers will be given time to learn the system.
- Communication about the project will be timely, regular, and comprehensive. Everyone at CCMG will be "in the loop," and will know who to ask if they have questions about their role in the organization. They will also be comfortable contributing to the project.

Exhibit 4: Committee Structure and Membership for EHR Planning

Executive Steering Committee:
Deb Moore, Executive Director
Elizabeth Crowley, Chief Operating Officer
Dawn Kraft, Medical Director
Judy Stein, Clinical Manager of Community Programs and Nurse Practitioner

Project Team:
Deb Moore, Executive Director
Elizabeth Crowley, Chief Operating Officer
Lester Mann, Project Manager
Leah Kelly, Project Manager
Susan Smith, Billing Manager
Mary Fredericks, Manager, Front Office
Carolyn Daley, Nurse Practitioner (Community)

Vendor Selection Committee:
Deb Moore, Executive Director
Elizabeth Crowley, Chief Operating Officer
Marion Kraft, Medical Director
Judy Stein, Clinical Manager of Community Programs and Nurse Practitioner
Phillip Levy, Physician
Anne Weinstein, Physician
Lester Mann, Project Manager
Leah Kelly, Project Manager
Susan Smith, Billing Manager
Mary Fredericks, Manager, Front Office
Carolyn Daley, Nurse Practitioner (Community)

Exhibit 5: Project Plan

February 2006
- Complete CCMG EHR needs assessment
- Develop Project Charter
- Develop preliminary budget
- Communication meetings with Board of Directors, stakeholders, providers, and staff

March 2006
- Select EHR software programs to be considered
- Vendor demonstrations
- Design multiple workflows to capture present office and community work using Visio data sheets

April 2006
- Conduct site visits
- Assess hardware, office configuration options based on needs assessment
- Submit RFI to chosen software vendors
- Conduct reference checks
- Vendor selection

May 2006
- Contract negotiations
- Design new workflows for office and community
- Sign software contract
- Select hardware vendor and sign contract
- Develop chart abstraction strategy
- Develop preliminary implementation strategy
- Obtain firm vendor deliverables and dates

June 2006
- Develop pre-training plan
- Update implementation strategy
- Update chart abstraction strategy
- Major update for practice and stakeholders

July 2006
- Develop Go-live plan

August 2006
- Install hardware
- Install software PMS
- PMS training 8/14/06
- PMS go live 8/21/06

September 2006
- Install software EHR
- Install network and peripherals
- Test and implement interfaces
- Convert data from old system to new system

October 2006
- 10/16/06 Training
- Go live EHR 10/23/06

Exhibit 6: EHR Budget (FY2007)

Software (EHR & PMS)		$200,000
Hardware		$ 77,000
First Year's Svc/Maint		$ 16,900
Implementation & Training		$ 20,000
Allocated Clinical Time		$ 19,619
Lost Revenue		$134,572
Contingency	5%	$ 23,405
Total		$491,495

Exhibit 7: EHR Communications Plan

A critical factor of implementation success is communication with the practice. The following plan explains the process by which each functional group and stakeholder will be communicated with.

CCMG Physicians/Nurse Practitioners: The Communications Plan for the clinicians consists of two prongs: communication and involvement.

Communication:

- The Project was formally rolled out to the clinicians at the February provider meeting.
- The clinicians will receive a monthly update on the EHR Project through the monthly update memo to clinicians and the Board of Directors (which covers all important accomplishments and challenges, including EHR), and it will be an item on the monthly provider meeting agenda.
- At key milestones in the project, the clinicians will receive a more formal and structured presentation at provider meetings.

Involvement:

- Both the EHR Project and the larger EHR Committee include physicians and NPs practicing in the office and in the community. These individuals bring the full perspective of our practice and will be encouraged to seek opinions and share information informally with the larger provider group.
- Clinicians will be involved in the work flow redesign portion of the EHR project at the brainstorming and decision-making level.

Non-Clinician Staff of CCMG

The managers of the non-clinician staff are involved in both the EHR Project Team as well as the EHR Committee. Managers are responsible to keep their teams updated and answer questions and concerns regarding the project on a regular basis. In addition, the non-clinical staff will be updated through periodic e-mails from the project managers and general staff meetings. The managers of the non-clinician staff are also involved in the selection of the PMS and EHR systems and the work flow redesigns.

CCMG Patients

It is the goal of CCMG that the implementation of EHR improves the quality of care and the patient experience. We will utilize input from a customer service survey regarding the current patient experience in the office as we redesign work flows.

The most important vehicle of communication with our patients is through our clinicians. We will work with the provider group to develop key messages for the patients around changed work flows, potential short term inconveniences, and improvements in patient care. The Front Office staff will also be trained to be ambassadors of the EHR implementation.

CCMG communicates with its patient population as a whole through newsletters and brochures to accompany our annual appeal. We will use these communications—including a newsletter this summer and annual appeal communications in the fall and winter—to highlight the value that the EHR will bring to the patients and to improving customer service and quality of care.

Eastern Medical Center

In keeping with the CCMG mission of providing integrated care throughout the continuum, it is a goal of this project to provide as seamless and efficient interface as possible with the patient data generated in the EMC system. To this end, we will communicate with the EMC at all levels and involve them in our project when possible. We will also participate in outpatient EHR planning process at the EMC. We will ensure that communications and planning for date integration and interfaces is timely and proactive.

Nursing Homes, Assisted Living Facilities, and Other Partners

Our key partners will be affected by our transition to EHR as well as having opportunities to assist us in making it a success. Our ongoing communications with them will include:

- A briefing to our partners to be provided in June. It will be determined whether this is communicated via letter, e-mail, or meeting on a case by case basis.
- A survey of our institutional partners to determine connectivity, workspace, and other issues related to planning for the use of EHR on their site. This will be conducted shortly after the briefing.
- Informal updates will be provided monthly by a "key contact" (e.g., the Medical Director, lead NP at the site) for each partner.
- A second briefing will be provided immediately prior to go-live to let them know of the new processes and procedures that will impact that site.

Exhibit 8: Office Work Flow: The Short Version

I. Office Visit

Goal: Consistent flow of patients and support to providers in seeing them

Chart Migration

- Three days prior to visit, will give the chart to provider; provider will fill out sheet; front office will enter
- After visit, mark the pages that you would like scanned (caution them to limit)
- Do not put anything else in the paper chart—not notes, not documents dated after today
- Chart will continue to be delivered to you for the next 2–3 visits to use for reference ONLY

Check In

- No basic change to flow, though developing more and more skilled MA staff; emphasizing to them to be available
- The check-in person will verify the patient's EMC number. This will enable provider to use the "button" for look up in WebOMR.
- MAs will put vitals into eCW

Provider Seeing Patient

- Can determine in EHR when patient is in room
- Enter certain things during the visit. These will then appear on the post-visit summary which you can print for patient to take with them:
    - Orders for lab tests
    - Orders for other tests at the EMC
    - Prescriptions
    - Referrals
    - Follow up visits to CCMG
- Review patient's meds and do refills for as long as possible up to 11 months (to reduce refill calls and make more convenient for patients).

Completing the Note in EHR

- The note can be completed during the visit or after the visit. For patient safety and billing timeliness, we ask that notes be completed within 72 hours. How much of your note you do during the visit will vary by clinician and by patient.
- Lab tests to Quest will go directly to Quest. However, orders for imaging and other tests at the EMC must be entered into CCC directly. Providers can enter the test into CCC or send a telephone encounter to the Clinical Support Hub requesting that the test be entered into CCC.

Check Out

- In certain cases, the receptionist will schedule referral visits or follow up tests. This includes cases where the patient is frail and elderly. Otherwise, patients will be requested to schedule their own tests and referral visits, with the number provided on the post-visit summary or by the check-out receptionist.

II. Follow-Up and Document Processing Work Flows:

Goal: Consistent processes where tasks are performed with those with the right skills and knowledge (and handled by as few people as possible).

Labs from Quest

- Labs will appear in the lab in-box of the ordering provider, sent directly from Quest. (L at the top of your screen)
- The provider has the option to:
    - Call the patient. (Patient phone number and chart will be right there!)
    - Forward the result to triage to call the patient. Document what you want them to say!
    - Forward the result to Amy to send a letter.

Other test results and specialist follow-up

- Results that arrive by fax or hard copy will be scanned into the patient's chart and assigned to the ordering provider for follow up.
- If you are the ordering provider, the documents will appear in your document in-box (D at the top of your screen)
- The provider has the option to:
    - Call the patient. (Patient phone number and chart will be right there!)
    - Forward the result to triage to call the patient. Document what you want them to say!
    - Forward the result to Amy to send a letter.

Forms

- Forms will be delivered in hard copy to the Clinical Support Hub. There they will be completed and delivered to the mail room.
- The mail room will scan the document and file it in the patient's chart before sending it out.

III. Telephone Calls

Goal: to handle telephone "events" with a minimum of conversations with the patient and rapid turnaround.

- One of the two telephone operators answers the call, documents the reason for calling in a telephone encounter, and forwards it to the Clinical Support Hub, Triage, or the provider. Operators are trained to know which calls go where and what information to obtain so the next call to the patient will provide the answer to their question/issue.
- Clinical Support and Triage handle telephone encounters sent to their respective in-boxes. In general, calls relating to symptoms or of a clinical nature are sent to triage. If triage or clinical support need to consult the provider, they will forward the telephone encounter on to them, documenting their request.
- When calls are sent to providers, patient is told that the provider will call back as soon as they can but in all cases within 48 hours.
- CALLS WHICH ARE URGENT WILL CONTINUE TO BE PAGED OUT TO PROVIDERS WHEN THEY ARE NOT IN THE OFFICE.

- Providers will receive telephone encounters in the telephone in-box (T at the top of your screen).
- Providers have the option of calling the patient themselves or forwarding the telephone encounter to triage or the clinical support hub.

Exhibit 9: Letter from Deb Moore, Executive Director

Dear Office Providers:

This manual has been prepared by the EHR Team to go along with the training provided by eClinical Works. We hope it will be useful in a couple of ways.

First, we are using the implementation of eCW to make a number of changes in the processes and procedures in the practice that will better serve our patients and support you better as providers. The first two documents in here will help you understand these changes and how eCW fits into the practice.

Second, the last two documents will be references for you as you begin to use eCW to chart patient visits, order tests and prescriptions, and follow up on results. They should provide a place for you to go to review what you have learned in training or to refresh your memory on how to do a particular task.

The members of the EHR team (Lester, Leah, Mary, Susan, Elizabeth, Marion, and Nancy Cohen) have done a ton of work and an amazing job preparing for this "go live." And they have done so while maintaining a full load of clinical and/or management responsibilities. I want to acknowledge their tremendous efforts—without which we would be nowhere. I am so proud of their skill and commitment.

As we go forward, I know you will encounter things—both in the software and in the work processes—that are not working or are in need of improvement (everything always is). We count on everyone to keep telling us when this is the case. There are also parts of the system and project that are not quite ready and will be implemented over the next few weeks.

Lastly, I want to thank everyone in the practice for all of your patience and understanding these last months. I know the meetings, stress, and resulting chaos as we have planned and implemented this project have been frustrating to everyone. Thank you also for the many times you have covered and filled in for the members of the team so they could work on the project.

Ultimately, we can only measure the success of EHR—like everything we do—by its improvement in our ability to care for our patients and to advocate for our model of care. With all the team's work and with your incredible dedication to those we serve, I have great confidence we will be successful by that measure.

With great respect and gratitude,

Deb

Exhibit 10: Working List of Problems Encountered from January 30, 2007 to February 8, 2007

Date	Issue	Resolution	Responsible for Resolution	Resolved?
30-Jan	If Triage submits an Encounter, Billing cannot tell who the patient's precepting provider is.	It would be helpful for Triage to enter the precepting provider's name in the billing box. Mary fixed it(?)	Susan; Leah; Mary	Yes
31-Jan	There have been problems with CVS 407, including sending prescriptions that they did not receive.	The central server at CVS fails 7% of the time. When this occurs we need to troubleshoot each case.	Lester	Yes
5-Feb	Computers with Dragon freeze frequently—eCW "fix" was done on all PCs with Dragon but there are still problems.	A Dragon trainer came on 3/30 and will check on possible user errors/set up problems in additional to training Zack, Joe and Ted on Dragon. As of 4/10, Dragon is working in rooms 3 and 6, and Joe's and Zack's PCs and tablets.	Elizabeth; Ted	Yes
5-Feb	Currently there is a cumbersome system for putting new letters into eCW, which Amy knows but is difficult for others.	As of 2/20, we have a shared drive where we can store the letters. As of 3/22, Leah will ask Ted to take out the folders for each provider, so there is just one Letters folder.	Leah; Jessie	resolved
5-Feb	Dr. Keough has been asking Bill to scan new patients' entire previous medical records, rather than following the workflow of flagging what she would like scanned.	Postponed.	Mary	Yes
5-Feb	Mary is not sure if some paper items that come in the mail need to be scanned, such as inpatient notification papers from insurance companies and lists of all MD's prescriptions from ExpressScripts.	We will no longer scan inpatient notification papers because we get the same information from EMC. We will put ExpressScripts lists in MDs' boxes, and ask them to flag them if they would like to have them scanned. Need to update workflow and retrain providers on this.	Mary	Yes
8-Feb	Sometimes providers get errors that crash eCW.	Providers should print screen, and then we will fax the print-outs to eCW.	Elizabeth	Moved to support
8-Feb	Need a review process for the folders in the Documents box.	Mary reviewed the folders with Zack and Dr. Keough (no other providers volunteered). Based on their input, Mary will set up a behavioral health folder.	Mary	Yes