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The Effectiveness of Quality of Patient Care by Using an Electronic Health Record System

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Capstone Research Study

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Abstract

The purpose of this research is to identify the effectiveness of quality of patient care by using an electronic health record system. It is not clear how EHR transcribe patients' health information in an efficient way to manage patients' care. The study will analyze different research literature to evaluate how providers are identifying risk factor and the availability of vital information at the point-of-care. A survey questionnaire will be conducted to subject matter experts to assess the efficiency of EHR. Also, there will be a data abstraction from EHR to evaluate the effectiveness of quality of patient care. The goal is to determine the efficiency of the electronic health records in assisting healthcare providers to manage patient care.

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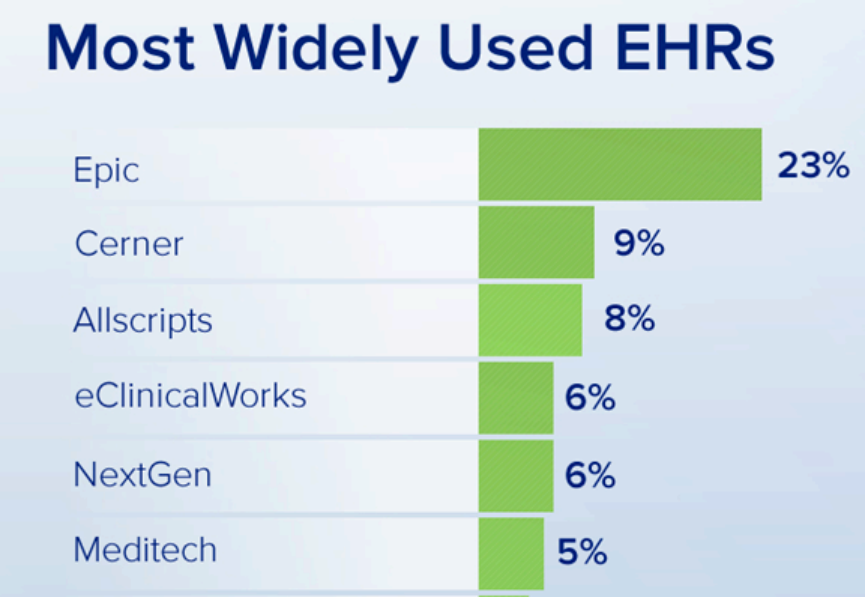
Introduction

Electronic Health Records is a software system created to assist health care providers to improve health care quality and provide an efficient patients' health record documentation. According to Health Care Quality and Convenience (2014), there are a variety of benefits with the use of Electronic Health Records such as:

- Quick access to patient records from remote locations to coordinate care
- Faster decision supports based on medical information
- Real-time quality reporting
- Legible, complete documentation that facilitates accurate coding and billing
- Interfacing with other departments such as labs and Radiology departments and other health care facilities.

Electronic Health Records provide a variety of tools that are supposed to improve provider efficiency in documenting and coordinating patient care. Nevertheless, recording the patients' information in the Electronic Health Records may not necessary determine how the system can help the health care providers provide good quality of care. It is essential to determine the barriers electronic health records from a workflow perspective that can prevent health care providers from using the system.

According to Palma (2013), "an EHR is only as good as the processes that it supports. If the technology is not supported with well-thought procedures, hospitals may invest in complicated and expensive technologies that create more waste in a system already fraught with inefficiency." The research will use a particular Electronic Health Records system called EPIC as the primary tool to document and coordinate patient health care information. EPIC stands for electronic health record software that works with hospitals and medical groups to maintain and organize electronic health care records to streamline their record creation and maintenance processes. EPIC-EHR is in the top five most popular EHR products.



Source: Shay, R. (1 January 2016). EHR adoption rates: 19 must-see stats.

According to Conn, J (2013), "while the sheer volume of alerts that range from the completely irrelevant to life threatening can dull the senses, leading to a

failure to react to a truly important warning." Poor data display is one of the issues of EHR. Health care providers and other health care employees enter all information in the patients' EHR, and if the information is not documented in the patients' EHR in a timely fashion, it can delay patient care.

There are 23 Health Care facilities in California using EPIC-EHR as their choice of Electronic Health Record system. These are some of the well-known health care organizations that are part of the EPIC usage group: California Pacific Medical Center (CPMC), Kaiser, UCSF and Stanford Lucille Packard Children. The research project will be the focus in one of the ambulatory Health Care Center located in San Francisco, CA, and use EPIC-EHR. EPIC-EHR is one of most used EHR system in the largest healthcare organizations in the Northern of California. CPMC-Health Care Center (HCC) located in San Francisco was selected for the research study because of the variety of primary care services they provide to the community such as Pediatric, Adult Medicine and Obstetrics and Gynecology. HCC serves most of the underserved patient populations in San Francisco.

I. Research Question

What is the effectiveness of quality of patient care by using an electronic health record system?

The primary objective would be to identify how effective are the EHR functions. The organization should understand the effectiveness use of EHR and reinforce policies, process, and workflows to ensure patient safety and quality of care.

Some of the sub-questions of the research project about EPIC-EHR are:

1. How does use of an EHR by physicians' practice provide improved care to patients?
2. What are the barriers of EHRs from a workflow perspective?
3. How reliable is EHR in coordinating patient care with other health care providers?

II. Background

According to Hysong, S. J., et al. (2011), "providers reported receiving a large number of alerts containing information unrelated to abnormal test results, many of which were believed to be unnecessary. Some providers also reported lacking proficiency in the use of certain EHR features that would enable them to manage alerts more efficiently. Some of the providers are dissatisfied with the EHR because of the cumbersome and complicated interface, lack of the main features, and poor EHR usability.

Most of the clinicians at the Health Care Center are not optimizing the use of all the functions in the EHR. On a recent study about the use of EHR, "about half (46%) of clinicians did not use the specific features of the View Alert window that facilitate better processing of electronic alerts. Instead, providers often used handwritten notes or external systems (e.g., ticklers on their calendar) to help process their alerts." (Hysong, S. J., et al. 2011). Abnormal test alert notification thought EHR are not always leading to timely follow-ups by the health care providers.

There are multiple functions on EPIC-EHR that the health care providers have to use at every office visit with the patients. For example, prescribing medication using the electronic prescriptions (e-prescription) function in EHR. Are the providers able to order all medications using the EHR or do they need to write them on a prescription paper?

The health maintenance list is another function in EHR that allows the providers to document patient health history such as tobacco use. The tobacco use history is a piece of information that can help determine if the patients are at high risk to develop chronic health conditions because of using tobacco. Also, it can be an alert to avoid the prescription of certain medications that can cause an adverse reaction. This tool needs to be updated every visit.

Providing patients with educational resources can assist patients to understand their health conditions and how to manage them. EPIC-EHR has a tool that allows the providers to search for patient instructions from a library in EHR, and also add individualize instructions to give to the patients. Patient instructions are necessary as part of the provider-patient coordination of care.

Electronic health records is an important electronic tool that many of the health care organizations are using to increase the quality of care, reduce medical errors, improve patient care, better communication with other clinicians, and other healthcare agencies. However, it is unclear how its tools are used and the efficiency and effectiveness of it.

Different health care providers document most of the patients' clinical information. One of the issues with EHR is that the information needs be

recorded in the system manually and many times it is missing or inaccurate. If there is any missing information or the information is incomplete, it may result in bad quality care.

The number of healthcare facilities using the same electronic health records may determine how they are coordinating patient care and outcomes. There are numbers of questions that the research project may answer. For example, how providers use electronic health records can identify patients with hypertension having their blood pressure under control? How providers using electronic health records to coordinate care of a patient with high blood sugar and help reduce the onset of diabetes as a chronic health condition? The research study will review the current practices in coordinating patient care. It is not clear what type of current practices the health care providers are using to provider better patient outcomes and the effectiveness of it.

According to Garrett, P., Seidman, J. (2011), "EHR focus on the total health of the patients going beyond standard clinical data collected in the provider's office and inclusive of a broader view on a patient's care." This statement is very similar to many other articles, but none of the items specify the internal EHR workflow to assist providers in providing outstanding quality of care and coordinating patient care efficiently. Electronic health records data are very complex and require a constant update. If the information is not entered accurately or is missing, it may affect the outcome of patient health management.

On 2013, EPIC-EHR was implemented in the Health Care Center. During the implementation of EPIC-EHR, I was the manager of primary care clinics in

the Health Care Center; therefore, I was selected to coordinate with the implementation team employee training, and transferred patients' health information from paper chart to the EPIC-EHR system. The top priority was to make the transition to EHR smoothly and with minimum disruption of care and workflow. For the last the last three years, there have been different updates in the EHR, and some providers still in need of assisting in maximizing the use of the EHR. The survey data will identify how the system is used effectively and the impact of patient care. The findings of the research will determine the effectiveness of EHR and the implementation of new processes, training, and better EHR workflows.

III. Research Design

The design of this research study requires considerable attention to the data collection obtained from the participants such as keys informants, subject matter experts, and patients. The research methods involved in the study were quantitative and qualitative methods. The data collections included individual interviews, focus group interview, and survey to patients and health care providers. A total of 24 providers received the survey via email, but only 19 responded. A total of 67 patients participated in the survey from different health care organizations. One of the limitations of the case study was to obtain enough patients to answer the questionnaire. The primary objective of the survey was to identify how efficient are the EHR functions. The organization should understand the effectiveness use of EHR and reinforce policies, process, and workflows to ensure patient safety and quality of care.

Literature Review

Electronic health records (EHR) primary purpose is to facilitate patients' health records among health care providers efficiently. However, there is insufficient information that can validate how the EHR functions help to promote patients' quality of care, and how effective is to share patients' information electronically to improve patient care. This chapter will analyze different literature about EHR functions, patients' coordination of care, and technical workflow that could determine the effectiveness of EHR. The various literature reviewed may correlate with this research study and the outcome of it.

According to Shay (2016), “less than a decade ago, nine out of ten doctors in the U.S. updated their patients’ records by hand and stored them in color-coded files, and 67% of providers reported not liking the functionality of their EHR systems”. The Health Care Center director of operations stated that EPIC-EHR was implemented in the Health Care Center in 2013, before its implementation the doctors documented the patients’ health records by hand and stored them in alphabetical –coded files.”

Source: EHR Adoption Rates 2012-2016-Shay (2016).

Year	EHR Adoption Rate
2012	39.6%
2013	48.1%
2014	50.4%
2015	62.8%
2016	59%

EHR and Coordination of Patients' Care.

According to Burton, Anderson, and Kues (2004), "electronic health records will help coordinate the care of 60 million Americans with multiple chronic conditions" (p.1). One of the advantages of the Electronic Health Record is that physicians are enabled to treat patients in a variety of settings to exchange and update patients' health information, and then other physicians can access quickly. With the EHR implementation initiative, the hope was to reduce inefficiencies associated with medical delivery and improve patient quality of care. Nevertheless, there is still an "alarming statistics concerning the quality of national health care" (Sasha J., et al. 2015).

Most of the time patients with multiple chronic conditions are at a higher risk to be hospitalized more frequently. According to Burton, Anderson, and Kues (2004), "Furthermore, the poor communication of care has been associated with poor clinical outcomes such as conflicting clinical advice" (p.2). Electronic health records can help improve communication among physicians resulting in better health outcomes and decreasing the hospital admissions.

It is important to define quality to have a better understanding of the effectiveness of patient care using electronic health records. According to Friedberg, Chen, and Van Busum (2013), "quality is any activity that improves patients' chances of having good clinical outcomes, avoiding harm, or having good experiences with the health care system. For example, according to H. Sing, et al. (2009), "early detection of colorectal cancer through timely follow-up of positive Fecal Occult Blood Tests (FOBTs) remains a challenge. In their

previous study, they found 40% of positive FOBT results eligible for colonoscopy, and had not documented response by a treating clinician at two weeks despite procedures for electronic result notification." Cancer is a chronic health condition that if identify at an early stage it can be treated immediately, and many times the patients will have a positive outcome.

On the other hand, when the electronic health record "alert the ordering provider about an abnormal test result such as Positive Fecal Occult Blood Tests (FOBT). It can improve the availability of vital information at the point of care" (H. Sing, et al. 2009). The lack of follow up on lab test results is a good example of how using Electronic Health Records is not always reliable. There is always the possibility of technical or workflow related issues that can affect the automated communication in the electronic health record leading to the lack of response.

On regards of patients' quality of care using EHR, many organizations have implemented clinical measures to evaluate and improve patients' quality of care. Some of the clinical measures data are abstract from EHR. According to Kern, Barron, and Dhopeshwarkar, on a study performed to the association of EHRs and ambulatory quality in a community-based setting. The study results show that "electronic health record use was associated with significantly higher quality of care for four of the measures: hemoglobin A1C testing in diabetes, breast cancer screening, chlamydia screening, and colorectal cancer screening."

According to Poissant, L., et al. (2005), "time efficiency is recognized as an important facilitator or barrier to EHR implementation." Most of the health care providers face an increase time pressure on spending more time trying to

find bits of information that is accessible in the EHR, but in different places. The more places to look in the EHR system to review patient information, the less efficient the system can be. It is essential to find a way that providers would spend less time navigating the system. Electronic Health Records (EHR) has the potential to improve productivity and the efficiency of the physicians (Bae & Encinosa, 2016). The integration of EHR and how useful would be in providing quality of care would depend on the doctors' technology capabilities and their experience in clinical practice.

EHR workflow

Friedberg, Chen, & Van Busum, 2013 stated, “poor electronic health record use, tedious data entry, and interference with face-to-face patient care, inefficient and less fulfilling work content, inability to exchange health information between EHR products, and degradation of clinical documentation were prominent sources of professional dissatisfaction.” Also, health care providers from multiple specialties and practice settings described frustration because many patients' health information was not shared among the different electronic health records users (Friedberg, Chen, & Van Busum, 2013). These types of flaws in the electronic health records can interfere with the health care providers’ ability to provide good quality of care.

The data stored in an EHR are shaped by many workflows, interactions, and idiosyncrasies. As Hripcsak and Albers point out, "for phenotype development and validation to someday reach a data-driven, high-throughput state, ‘the physics of the medical record' will have to be much better understood."

(Hripcsak and Albers 2013). The implementation of electronic health records promised to provide a remarkable amount of clinical data available. However, “the data are complex, inaccurate, and frequently missing, and the record reflects complex processes aside from the patient's physiological state (Hripcsak and Albers 2013).

When physicians become very comfortable with the EHR system, they learn to be more dependent on built-in medical decision-using tools that can be a risk in a critical human decision-making, resulting in a clinical error. Burstin, H (2013) stated, "using data electronically captured during and across the continuum of care delivery to measure performance holds the potential for less burdensome, timelier reporting." It takes some simple actions such as copy and paste that may cause a typing error to be copied over and over that can lead to a potential risk of patient quality of care resulting to a wrong medical decision-making. Many times physicians tend to practice independently and do not ask for help when they do not understand some of the tools of EHR. (Palabindala, V., Pamarthy, A., & Jonnalagadda, N. (2016)). The effectiveness of EHR may depend on of the user knowledge of the EHR system. The lack of knowledge may know allow the health care providers to be efficient and effective affecting the quality of care.

Electronic health records (EHR) are still in their infancy. Perhaps in 10 years or so, they might be mature enough to realize more of their promise. According to Simpson, K (2015), "many aspects remain cumbersome and no intuitive for the user. Duplicate entries of the same or similar data into separate

systems are often required because the systems don't "talk" to each other." According to the Director of Operation of the Health Care Center, "when EPIC-EHR was implemented in the Health Care Center, the system was not set up to merge or share information with the Department of Public Health-Vaccine for Children Program. It is a requirement for the HCC as a community license clinic to share vaccine records with the department of public health. This process continues to be done manually. The providers have to do duplicate data entry. The tool is in the system, but it is unknown why it cannot be activated." Evaluating EHR effectiveness is an ongoing process, and efficiency of the system can also impact the patient quality of care.

For example in primary care:

Behforouz, Drain, & Rhatigan, 2014	Behforouz, Drain, & Rhatigan, 2014	Lown & Rodriguez, 2012
Diminishing clinicians' ability to grasp the complex social histories that patients present to their clinicians, notable for their substantial influence on the presence and course of disease states."	"Threatening the therapeutic nature of clinician–patient communication, especially when clinicians themselves see the “power” of the consultation residing not in working to share a healing presence but	Eroding the patience of clinicians as they make the transition from paper charting to the EHR."

	existing in an electronic network as represented on the computer screen.”	

All of these factors can influence the effectiveness of EHR, and ongoing study will allow finding processes and recommendations to overcome any barriers with EHR, and improve effectiveness and efficiency.

According to Cifuentes, M, et al. (2015), "Practices experienced common challenges with their EHRs' capabilities to document and track relevant health information, support communication and coordination of care among integrated teams, and exchange information with other EHRs. Practices developed workarounds in response to these challenges: double documentation and duplicate data entry, scanning and transporting documents, reliance on the patient or clinician recall for inaccessible EHR information, and use of freestanding tracking systems.” Developing workaround processes is necessary to prevent continuity of patient care. Nevertheless, practices need to begin to identify EHR solutions such customizing some of the EHR tools. According to HCC Director, when EHR was first implemented in the HCC, it increased the time the physicians were documenting in the patients’ chart and less time face-to-face interaction with the patients. The providers learned that other facilities that were using epic created customized EHR templates. When using customized progress note template in the EHR, the providers can document faster, and the EHR

system became more efficient, and improved physicians' documentation workflow. (HCC (2016))

Romano and Stafford (2011) stated, "One EHR function of key relevance to quality is clinical decision support, a feature that alerts, reminds, or directs health care providers according to clinical guidelines." When this type of function is use, efficiently lead to outstanding quality of care and determine the effectiveness of the EHR. According to Rothman, Leonard, and Vigoda (2012), "Unintentional consequences of clinical decision support, such as alert desensitization, can decrease the effectiveness of a system." This is a powerful statement because if the physicians do not use all the EHR tools to manage patient care, the EHR system can become ineffective.

These articles concluded that electronic health records help the health care providers to treat patients in a variety of settings allowing them to share information with other health care providers to coordinate patient care. Electronic health records primary functions are to store patient health information, patient support, health management and coordination of patient care. Venter and Frankel (2016) stated, "now, almost 20 years later, let us also face the fact that, whether still experimental or not, EHRs are here to stay." Its primary functions rely on adequate technical and workflow support to eliminate poor communication of care and improve clinical outcomes.

According to DesRoches et al., (2010, "Although there is little data to suggest that they significantly improve clinical outcomes. "It remains too early to know how and whether population-based "big data" will have a measurable

influence on individual patient outcomes" (Bates, et al. 2014), it is undeniable that EHRs have a made a huge footprint on the landscape of clinical medicine. The ultimate goal is to assist the providers to use EHR efficiently and efficient to provide outstanding quality of care and reduce clinical error. There is insufficient data research to compare quantitative data on the effectiveness and quality of care in using electronic health records.

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The literature review information identified some key factors that can be compared with the primary data collected. For example the tedious data entry, lack of face-to-face interaction with patients, the inability to exchange health information between EHR products, and degradation of clinical documentation resulting in professional dissatisfaction. Also, access to the EHR system in a variety of settings to exchange information is one of the advantages of EHR because the patient's information can be obtained quickly. On the other hand, the lack of interface among not EPIC-EHR system requires duplicate entries because the systems do not talk to each other. Ultimately the primary purpose

should that all of the EHR functions should provide adequate technical and workflow support to eliminate poor communication of care and improve clinical outcomes.

Research methods

The design of this research study requires considerable attention to the data collection obtained from the participants such as key informants, subject matter experts, and patients. The data collection's primary objective is to identify the different factors that provide positive or negative outcomes of the quality of care and the effectiveness of patient care coordination by using electronic health records. The research methods involved in the study were quantitative and qualitative methods. The quantitative data approach generated numerical data of the information obtained from the surveys that were converted into numbers. The qualitative method approach produced non-numerical data from the data received from the different interviews conducted and open-ended questions.

I. Research Question

What are the effectiveness and the quality of care in using an Electronic Health Record (EHR) system?

Some of the sub-questions of the research project are:

1. How does use of an EHR by physicians' practice provide improved care to patients?
2. What are the barriers of EHRs to coordinate patient care?
3. How reliable is EHR in coordinating patient care with other health care providers?

II. Operational Definitions

- Electronic Health Records Software: EPIC is electronic health record software that works with hospitals and medical groups to maintain and organize patients' medical records. The goal of EPIC is to streamline their record creation and maintenance processes.
- California Pacific Medical Center-Health Care Center (CPMC-HCC):
- According to the "Health Care Center" (2015), "The Health Care Center (HCC) at CPMC provides primary care services to families in San Francisco and the Bay Area. In addition to providing quality patient care, we are committed to community outreach, health education, and wellness."
- Health Maintenance history: It is a tool in EHR to document patients' interval medical and family health history including medication use.
- Electronic prescription: it is a tool in the EHR system to prescribe medication without the need to write it on a prescription pad.
- The effectiveness of EHR: Effectiveness is defined as the overall workflow of EHR and health care providers in managing patient care outcomes.
- The quality of patient care: Quality is the degree to which patients' outcomes; safety and satisfaction are consistent with the results achieved by top-performing of health care providers.
- Perinatal community health worker: Employees who assist physicians and midwives in coordinating obstetric care.

- The subject matter expert: It is an employee with the responsibility to conduct EHR training and support doctors and nurses.
- Referral coordinator helps facilitate the referral process to other specialist or ancillary services.
- Community Health Workers (CHW) assists physicians to manage patients' care who have chronic health conditions by monitoring the outcome of the treatment plan.

III. Study data and methods

The research project employed mixed method design for collection data. The study will incorporate a primary qualitative component and embed in a quantitative component. The qualitative method will be used to conduct a survey to health care providers and a subject matters expert within the study practice. The quantitative method approach will collect survey response rate and statistical report from the EPIC electronic health records.

The quantitative and qualitative data gathered 30 respondents including physicians, nurses, health care employees and patients. These participants were identified to use EPIC-EHR as a primary tool to manage patients' care. The main goal of the data collected was to analyze how factors at different levels interfere with the use of electronic health records system and the health care providers' ability to provide excellent quality of care.

Table 1 Practice

	Category	Number of practices
Size	Small (<9 physicians	3
Specialty	Primary Care	2
	Multispecialty	2
Other	Subject Matter Experts	1

A review of scholarly literature was conducted to capture evidence of the effectiveness of quality and patient coordination of care by using EHR. Some expert opinions were used to validate some of the EHR benefits and functions. Few useful articles could be compared with this research study. Most of the articles were the focus in the implementation of EHR and outcome of it. There were limited studies of patients' experience with their coordination of care in the use of EHR.

Participants:

	Procedure
Survey	The survey was offered to 24 key informants working in different departments of the Health Care Center, but only 19 key informants responded to the survey. The study has a combination of 10 questions in which five of them require free text answers and five multiple answer options. The participants were asked to choose the best option from their satisfaction level that most closely described the efficiency of some of the EHR functions to provide good quality of care and coordination of care.

Individual interview	Individual interviewed were conducted to one physician subject matter expert, one nurse case manager, and one referral coordinator. The physician subject matter expert provided essential information to understand how EHR helps health care providers to coordinate patient care and some of the barriers that they have to overcome. The case manager and referral coordinator provided insight of how EHR can expedite the referral process to other specialist and ancillary services.
Focus Group	Each group was asked a specific question of how they use EHR to coordinate patients care, barriers and the effectiveness of the EHR system. The focus group interviews were conducted to a group of referral coordinators, nurses, and register nurses. Referral coordinators: Three participants from three different practices Pediatric, Adult Clinic and Ob/Gyn clinics. Community health workers: Three employees from a chronic disease management clinic. Register Nurse: Two nurses from primary care department (Adult and Pediatric Clinic)

IV. Internal Validity

The participants of the study were composed of health care providers and patients. Each group has many different types of access to the EPIC-EHR system from various health care organizations. They share the same common goal to access patients' medical records and have experience in using some of the EHR functions at different access level. The qualitative data was mainly obtained from key informants who are employees of the health Care Center.

V. External Validity

The sample of participants was selected randomly to avoid any bias. Patients from different health care organizations that use EPIC-EHR participated in the case study. Any findings in the study could help the health care organizations to implement new systems to improve the use of EPIC-EHR system. Also, patients' from different health care organizations who participated in the study helped to determine the effectiveness in EPIC-EHR as a system regardless of the organization. Patients' feedback would assist in determining weakness and strengths, and EPIC-EHR user organizations can use this information to improve the system.

Results and Findings

Measurements

The qualitative data was transcribed to quantify data by coding specific information related to the quality of care and effectiveness of EHR. The data was organized in groups such as access to test results, access to request medicine refill, access to apply for referral, and request makes an appointment. These

categories were measured by percentage rate per number of respondents, and these are the categories that patient identified as patients' EHR access tools.

The Likert scales measure was used for the qualitative data. The answers in the survey were assigned numeric rating scales to provide a detailed graph, which indicates the magnitude of the difference between each answer.

The quantitative data was measured into rating scales, matrix, and weighted averaged. The rating scale helped the researcher to quantify the answers received from the participants that are important for the effective performance of the research study. The answers were assigned numeric rating scales to provide a descriptive graph, which indicates the magnitude of the difference between items.

Some of the findings from the primary data analysis connected, agreed and disagreed with the secondary data from the review of the literature.

These are some examples:

Secondary Findings	**Primary Findings**
Burton, Anderson, and Kues (2004) stated, “one of the advantages of the Electronic Health Record is that physicians are enabled to treat patients in a variety of settings to exchange and update patients’ health information, and then other physicians can access quickly.	Dr. J.D (2016), she believes that EHR has a tremendous potential and appreciates that she can view patients’ visits records from outside the organization, and all types of test done in the patients’ medical records within the organization and other health care organizations that use the same EPIC-

Furthermore, the poor communication of care has been associated with poor clinical outcomes such as conflicting clinical advice."	EHR system. On regards of the poor communication of care. Dr, M. Treece (2006) stated that sharing patients' information with other health care organizations helped him to coordinate patient care more efficiently and prevent poor clinical outcomes.
According to Simpson, K (2015), "many aspects remain cumbersome and no intuitive for the user. Duplicate entries of the same or similar data into separate systems are often required because the systems don't "talk" to each other."	According to the Director of the HCC, EPIC-EHR is not able to interface with the Department of Public health to share patients' vaccines records and keep track that patients are up-to-date with the vaccines. This task needs to be done manually in another system of patients' records resulting in duplicate entries.
According to Rothman, Leonard, and Vigoda (2012), "Unintentional consequences of clinical decision support, such as alert desensitization,	According to the health care providers-survey results, 12% find very difficult to update the patients' medication list. If the medication list is not updated, the

can decrease the effectiveness of a system." This is a powerful statement because if the physicians do not use all the EHR tools to manage patient care, the EHR system can become ineffective.	providers can prescribe drugs that can result in an adverse reaction. If the health care providers do not use this tool efficiently, the EHR medication list update functionality becomes ineffective.

The purpose of the data collected is to answer the research question of "what is the effectiveness and quality of care in using electronic health records." Also, the data analysis will help to answer the research question with the aid of the following sub-questions:

1. How does use of an EHR by physicians' practice provide improved care to patients?
2. What are the barriers of EHRs to coordinate patient care?
3. How reliable is EHR in coordinating patient care with other health care providers?

The data sample includes patients from different health care organizations and health care providers from various clinics. The quantitative and qualitative data show that EHR is very efficient and enable patients and health care providers to coordinate patients' care efficiently, although some issues were identified with the effectiveness of EHR.

I. Qualitative Data-

1. Focus Group Interview

Questions: How satisfied are you with the reliability of EHR in coordinating patient care with other health care providers? What are the barriers of EHRs from a workflow perspective? Is the physician more effective and efficient in addressing patients' health issue by using the electronic health records during the office visit?

- Triage Nurses

Even though there are some challenges in the use of EHR, most health care providers, and patients found EHR to be effective and efficient. During the focus group interviews and comments received by patients and health care providers, they found the EHR system to be a convenience in coordinating patient care, which results in a good quality of care.

In a focus group interview with three nurses, they agreed that it is easier to assist patients in getting tests done because the physicians have documented the test order in the patients' medical records. There is no need for patients to pick up a lab form in the office. According to A. Samaniego, R.N, "it is easier to communicate with the doctors to coordinate patients care." An example provided by the nurse's focus group: "if the patients were in the emergency department at any hospital that uses EPIC-EHR such as UCSF, they could see the patients' records about that visit. Access to the patients' medical record eliminates time requesting records to be sent to the clinic via fax." The nurses stated it is easier to obtain medical records from different hospitals that use same EHR system.

During the interview with the nurses, they indicated that the EHR system email function helps them to communicate with patients so they can coordinate triage care faster or schedule an office visit. According to the nurses, “we can provide more information to patients on regards to the physician treatment plan of action such as referral to other specialists, coordinate their care without having them to come and see the doctor again, and eliminate the amount of calls and unnecessary office visits.” (HCC-Triage nurses, 2016)

According to the nurses, “sometimes pharmacies call the clinics complaining that the provider failed to give verbal approval to dispense some of the medications. However, EHR gives us access to the patient entire medication list; the nurses have the consent from the physicians to give the approval without asking the doctors.” (HCC-Triage Nurse, 2016).

According to Levitz, E. R.N, “the nurses can give home care instructions because we can see patient medication prescribed, so it is more efficient to coordinate patient care. There are some medications that the patients are taking that require extra precaution and close follow-up, so the information in the patients' chart helps us to discuss how to manage the medication treatment and give other recommendations as needed.” (Levitz, E., RN, 2016)

- Referral Coordinators

During the focus group interview with the referrals coordinators from three different HCC-Clinics, they found EHR to be helpful and efficient to coordinate patient care because they have access to test results and any other clinical documentation. Access to some of the patients’ clinical information helps

facilitate the referral process effectively because it does not delay treatment and avoid duplicate information.

- Community Health Workers (CHWs)

Community Health Workers assist the primary care physician at the HCC to coordinate patients' treatment plan to manage their chronic health diseases such as diabetes and hypertension. One of the CHW who asked to be anonymous stated that it is easier to coordinate patient care when health care providers can share and see entire patient's clinical information.

A CHW that requested to be anonymous indicated that there is some limited access in EHR. The physicians EHR access level is not the same as the rest of health care providers that assist in managing patients' medical care. Also, some medical history forms need to be completed manually and scan into the EHR system.

2. Individual Interviews

Three individual interviews were conducted. The participants were physician subject matter experts; register nurse case manager, and referral coordinator. The three members shared their personal experience with the use of EHR, and how they manage patient care and challenges that they encountered with the use of EHR.

- Case Manager RN

According to Levitz, E., RN, " EHR allows me to obtain the most recent patient's health care summary to share with other specialist or home care facilities to coordinate patient care." Nevertheless, there was an open-end

discussion with the nurse, and she expressed some of the patients' concerns about the less face-to-face interaction. According to Levitz, E., “there is a disconnection in the art of touch among the providers because the doctors are more focus on the computer documenting their health information.”

- Referral Coordinator

A referral coordinator from Pediatric Clinic stated that she finds EHR very helpful in providing good quality services because she can access patients’ clinical notes to coordinate referral authorization to patients to be seen by another specialist. There are some functions in the EHR system that she does not use such as sending messages to patients to alert them of the referral. She does not find a need to use this function because she rather calls the patients directly to inform them of their referral status. Also, some patients do not have access to EHR, so communicating using EHR is not effective for her coordination of care.

- Physician Subject Matter Experts

Dr. J.D is an EHR subject matter expert with more than two years of experience as a doctor EPIC-EHR trainer. She believes that EHR has a tremendous potential and appreciates that she can view patients’ visits records from outside the organization, and all types of test done in the patients’ medical records within the organization and other health care organizations that use the same EHR system. On the other hand, there are some challenges in using EHR that Dr. J.D discussed in the interview.

According to Dr. J.D, “How do you sort out all the extraneous from a quality key component? It's hard to determine, what is the critical information that a provider needs during the face-to-face encounter to sort out clinical information that is relevant to the patient health condition? Which is something that the EHR cannot do right.”

For example, a child getting seeing complaining of a cough, there is not an indication in the child EHR that can tell the physician that the child was diagnosed with asthma before or any other health condition related that triggers a cough. There is so much information in the patients’ records to review, limited time assigned to the office visit, and many places to go within the system to review entire medical history. It is a challenge to decide how many tabs to view to gather enough information.” Dr. J. D also mentioned the use of the health maintenance list tool in EHR. The health maintenance list is helpful only if the patients' information is physically transcribed into the EHR.

“EHR has such a potential, you just need to learn to make it work, but there is a time limit to review the patients’ records, and we don’t have enough time within our schedule. There is always a fear that if not all the records are reviewed, am I missing something?” (J.D. MD, 2016)

II. Primary Data Results - Qualitative data

In analyzing the interview data, few issues emerge in using EHR, which will be discussed in this section. Some of the issues identified are:

1. Limited access to patients' entire medical records from other health care organizations. Only physicians and any other clinical provider have full access to patients' medical records.

2. Different medical records numbers created for the same patient in various organizations that use the same EHR.

3. There is still a significant amount of clinical documentation that is received on paper and scanned into the system because most of the EHR systems do not interface with each other.

4. Different insurance companies require different steps in EHR to order labs test, and there is a need to a more regular lab order set.

5. From a quality key component, it is challenging to sort out critical information that it is relevant to patients' health conditions. There are different places to look in EHR and how do you sort out all the extraneous information.

6. Parents have a difficult time to access most of their child information. An access request to their children's EHR is very cumbersome. It requires extra verification and submits an application form.

Health care providers and patients shared how EHR help them coordinate care effectively:

1. Patients can see their medical records

2. Review Lab results

3. Communicate via email

4. Patients can receive appointment reminders and updates of their due health maintenance exam.

5. Physicians can coordinate patients' care with any other health organizations that use the same EHR. Burstin, H (2013) stated, "using data electronically captured during and across the continuum of care delivery to measure performance holds the potential for less burdensome, timelier reporting."

- Identified Issues with EHR by Key informants and patients

A focus interview was conducted to employees that main responsibility is referral coordinators from Pediatric, Adult Medicine, and Ob/Gyn departments. The referral coordinators identified a challenge of accessing patients' medical records from other health care organizations. They have limited access to view patients' medical information, which results in a delay to refer patients to be seen by other health care providers. They have to request that a portion of the medical records to be faxed, but they and are not always faxed immediately. Access to patients' entire medical records allows them to share information with other health care providers to coordinate care.

According to the referral coordinators, "most of the organizations have a different medical record number, so it becomes a problem to locate patients' medical records especially when there are patients with similar names. It is very easy to make a mistake by a document in the wrong patient medical records because of the similarity of personal information." (HCC-Referral coordinators, 2016)

A physician from the Ob/Gyn clinic stated that sometimes that pathology reports takes longer to receive because they need to be entered into the system.

Not all the pathology results are entered into the system electronically because not all pathology departments use the same EHR system or interface with EPIC-EHR. (Anonymous)

According to a community health worker, “there is limited access to see patients test results and most of the forms and questionnaire use during the office visit is not in the system, there is a need to do a lot of scanning. This process becomes cumbersome and providers have to look into different areas within the EHR to locate the forms.” (Anonymous)

A parent stated, "I have limited access to my children records. I cannot obtain access to my kid's online records immediately; it requires a verification process." (Anonymous)

A patient stated, “face-to-face interaction is very limited depending on the provider who is seeing my child. The providers spent a portion of the office visit typing in the computer and reviewing the records.” (Anonymous)

Diana Limon, a mother with of a child diagnosed with diabetes Type 1, stated, “the email function to communicate with the doctor could be frustrating. It's easy to send an email, but when you have to log in all over again to be able to get a response sometimes is frustrating. Other times, I receive emails from another source, which is very frustrated because I have to create username information to open the email. When you have to create a password just to open emails, it is time-consuming.”

III. Primary Data Results - Quantitative

Health Care Provider Survey - Appendix A

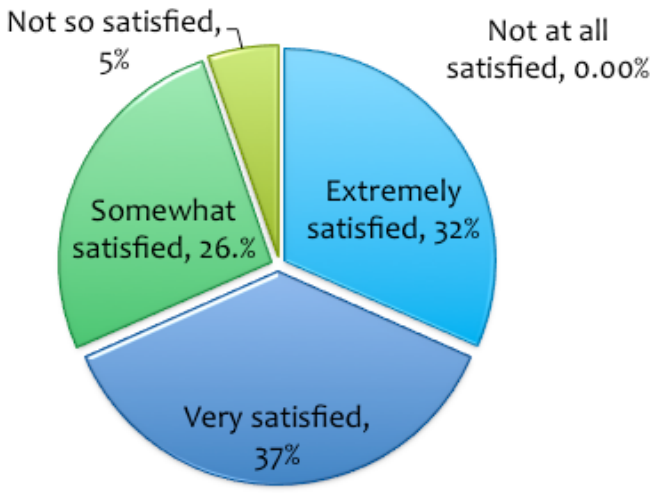
- **These are the total of health care providers responses**

- **- Total participants: 19**

Answer Choices	Responses
MD	23.53%
Midlevels (NP, CNMs)	29.41%
RN	17.65%
other	29.41%

-

How satisfied are you with the reliability of EHR is coordinating patient care with other health care providers?

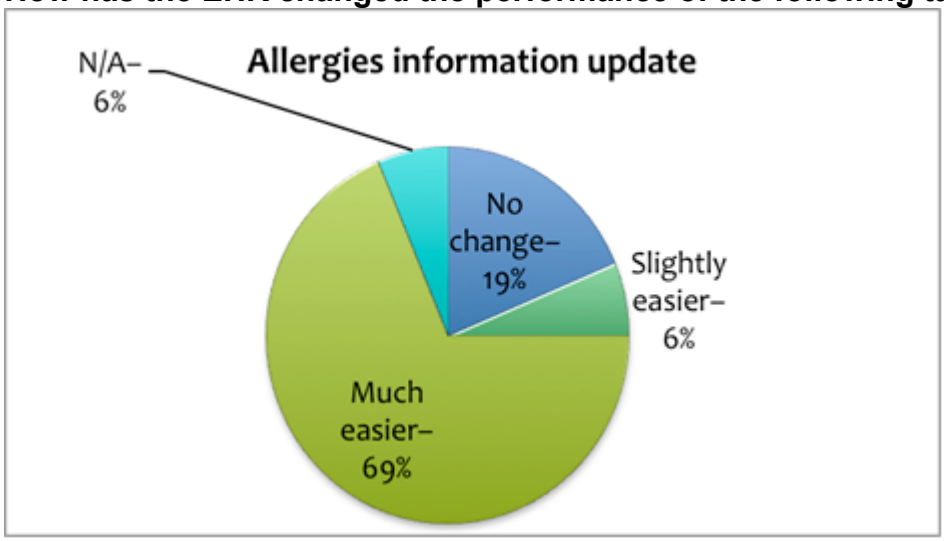


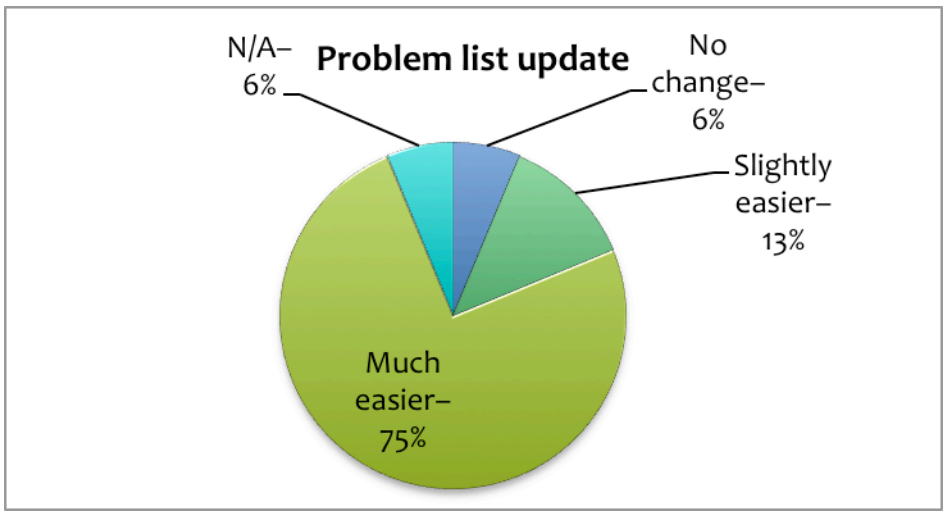
The survey data results indicated that 37% of health care providers who participated in the survey are very satisfied with the reliability of the EHR in coordinating patient care. Dr. Michael Treece, MD, pediatrician, provided an

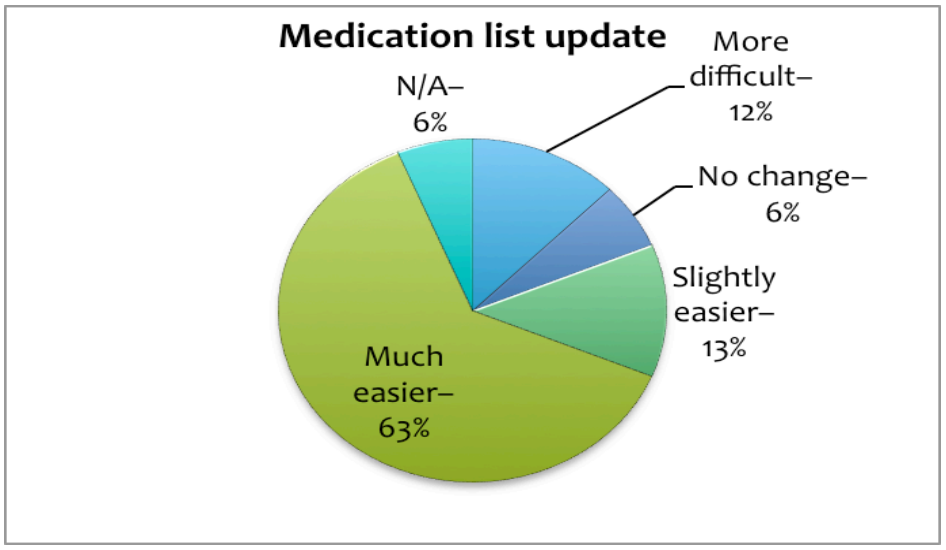
example of this question about one of his patient health history. He stated that one of his patients diagnosed with seizure disorder received primary care from him, Neurology care at UCSF, and GI care at Lucille Packard Children's Hospital. According to Dr. Treece, “he was able to read this patient’s records from the specialist visits, reconcile medication, refill medications he had not ordered, and avoid giving antibiotic that might have reacted badly with the anti-seizure medication the patient was taking. If he'd had to put all that together from a paper chart, by fax and telephone, it would have taken him a longer and probably would have missed some of the patient’s information from page to page.”

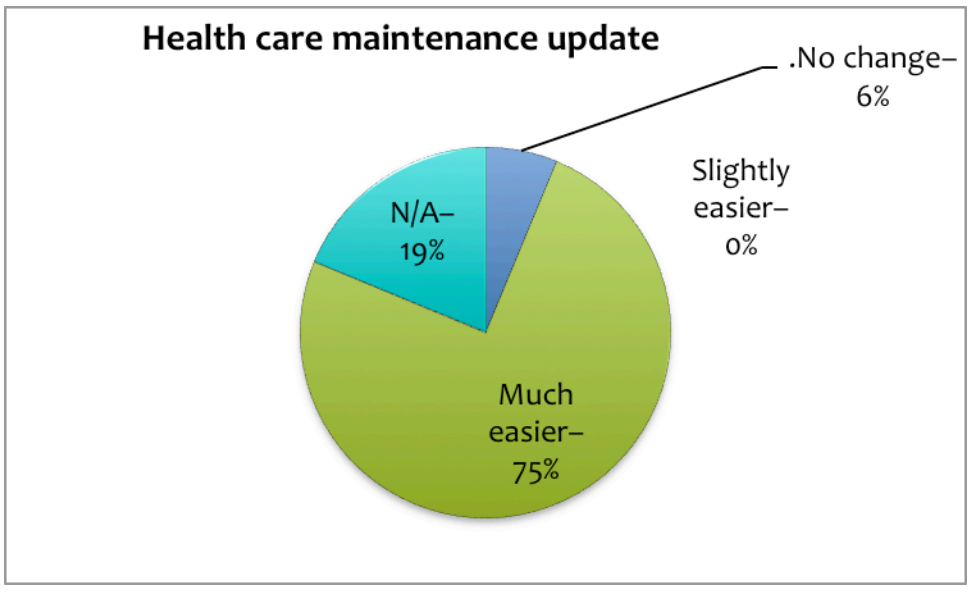
On the other hand, Dr. K.D, an internist at HCC, is somewhat satisfied with the reliability of EHR in coordinating patient care. According to Dr. K.D, “discontinued medications are still refilled automatically, updates are not effective right away, and different insurance requires different steps in lab orders; there is a need to a more uniform lab order set.”

How has the EHR changed the performance of the following tasks?



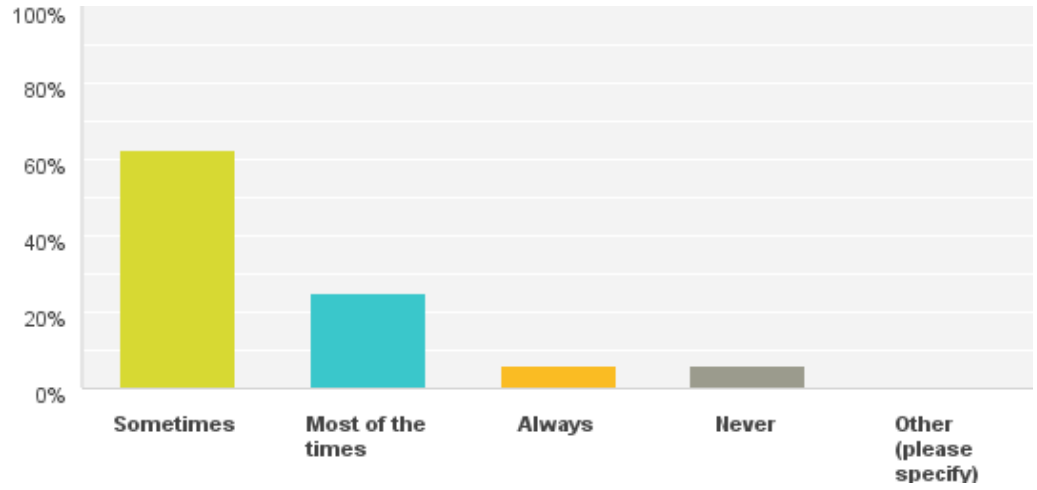

Problem list update
N/A– 6%
No change– 6%
Slightly easier– 13%
Much easier– 75%


Medication list update
N/A– 6%
More difficult– 12%
No change– 6%
Slightly easier– 13%
Much easier– 63%


Health care maintenance update
.No change– 6%
Slightly easier– 0%
N/A– 19%
Much easier– 75%

The data indicates that 69% of the health care providers found much easier to update allergy medication, the problem list updates with 75%, the medication list update with 63%, and health care maintenance list with 75% much easier. On the other hand, medication list was the only item on the list with 12% more difficult to update. 19% of the participants indicated that there is no change in updating the allergies information. Out of 18 key informants, only 15 completed this section of the survey.

The health maintenance list is up-to-date every visit?



Answer Choices	Responses
Sometimes	62.50%
Most of the times	25.00%
Always	6.25%
Never	6.25%
Other (please specify)	0.00%

The health maintenance list is an EHR function that allows the providers to check patients' health history. Only 62.50% use this feature sometimes, 25% most of the times, 6.25% always and 6.28 never. There is not an indication in the data collected by participants the reason of not using this tool always. This survey question can identify how effective the health care providers are in using EHR to provide good quality of care by updating the patients' health records.

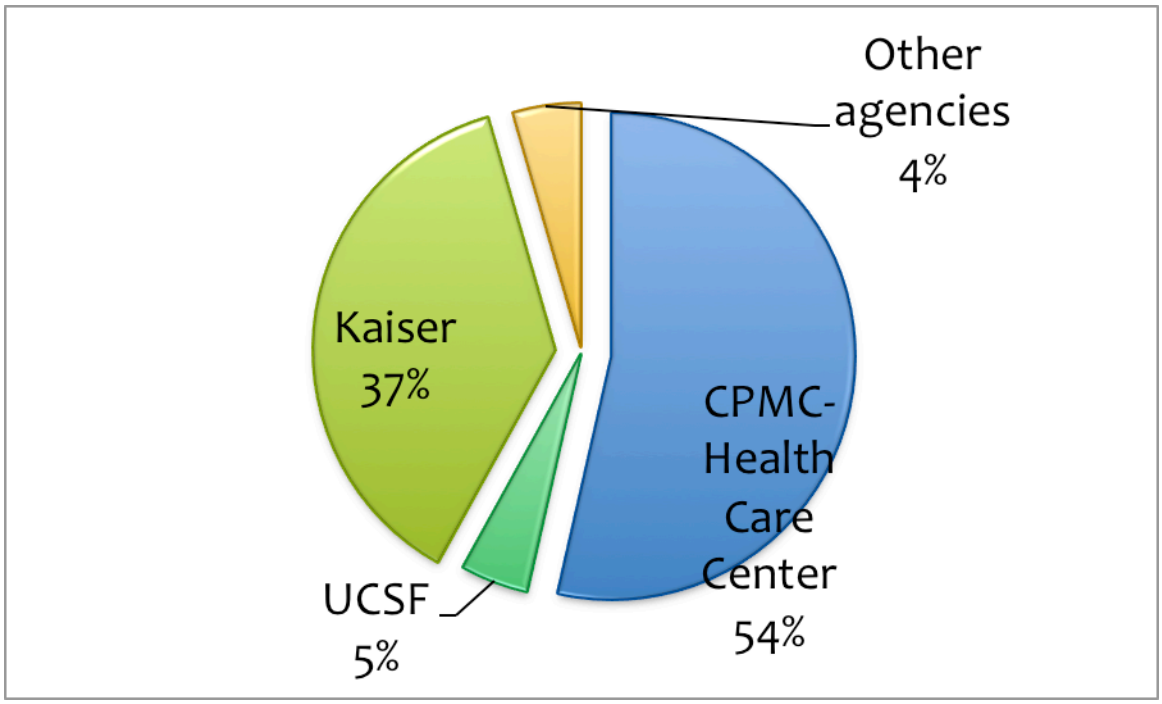
What is your level of comfort with computer technology?

Answer Choices	Responses
very comfortable	76.47%
some what comfortable	17.65%
not comfortable	5.88%
Total	

The participants in the survey are 76.47% in the level of comfort with computer technology. There is a 5.88% not comfortable, and 17.4% somewhat comfortable. This data helped to identify how effective the user can be with using EHR as a technological tool.

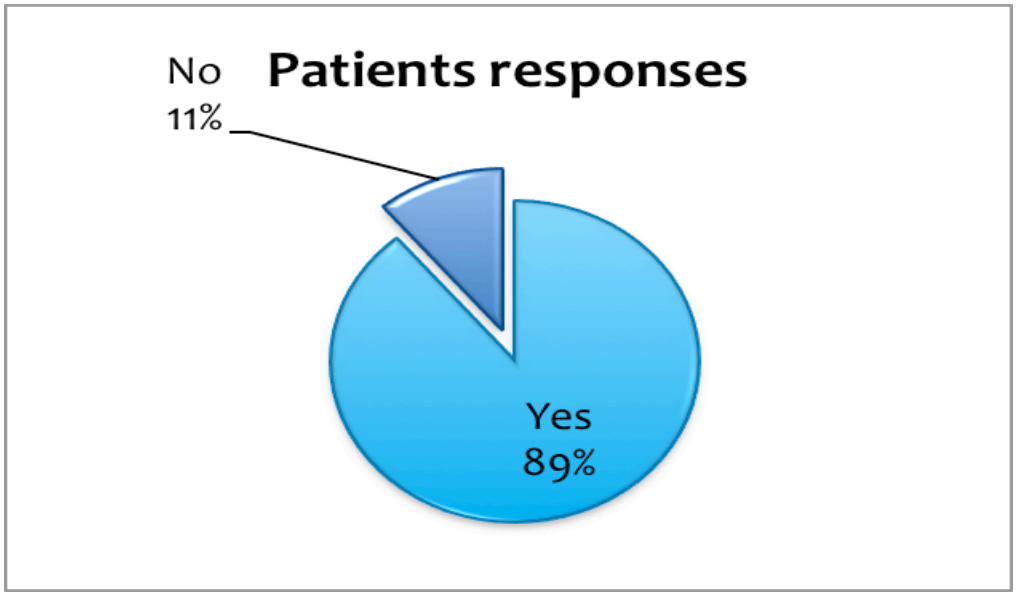
Patient Survey Appendix B - Total Responses 67

Patients who participated in the survey receive care in this Health Care and other health care organizations.



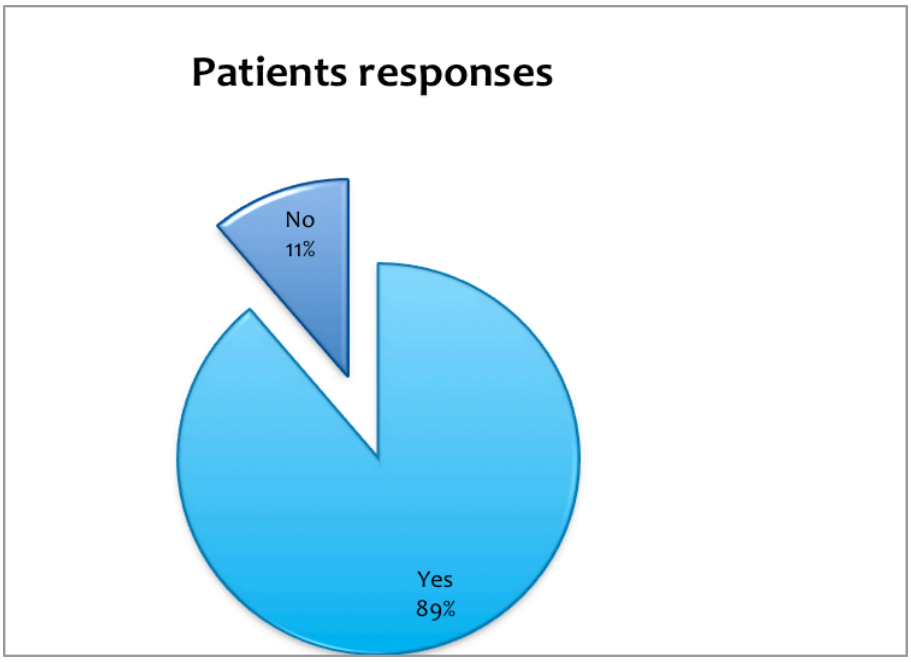
67 patients took part in the survey study. The patients are from four different health organizations that use the EPIC-EHR system. This information will allow the data to compare how the system is efficient in coordinating patient care amount the various health care organizations.

Are you able to communicate with your physician via email using electronic Health records?



89% of the patients can communicate with their physician using EHR, and 11% do not use it. This data indicates that most of the patients who participate in the survey are actively coordinating their care with their physicians via EHR email function. Most of the patients who do not use EHR are homeless or elderly.

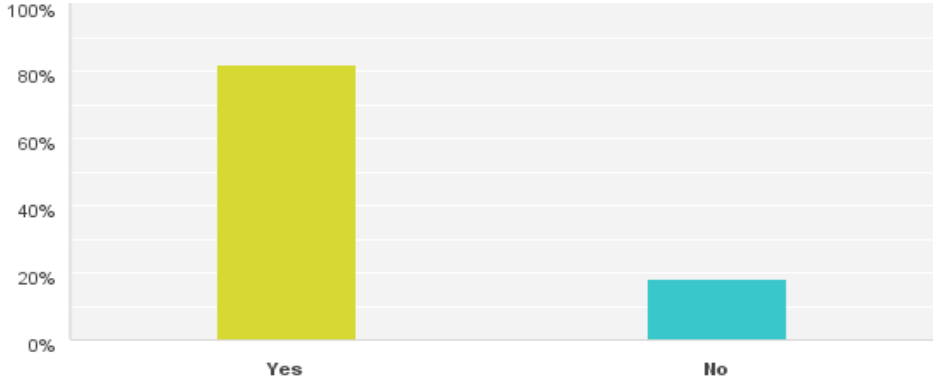
Have you noticed that the physician is more effective and efficient in addressing your health issue by using the electronic health records during the office visit?



This data result shows that 89% of patients notice that the physicians are Efficient in addressing their issues during the visit. This data confirms that Patients agreed that EHR system in effective in coordinating their care. Only 11% did not agree with the physicians being more efficient in addressing their health issues by using EHR.

According to A. Cano (2016), “my doctor can immediately send the test order to the lab or x-ray, and pharmacy. He can access all my records during the office visit. He can explain better what I need and how to treat my health condition.”

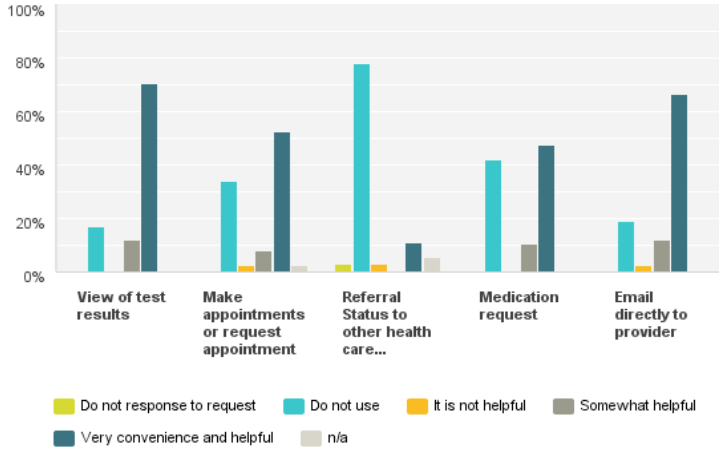
Do you have access to your records and labs?



Answer Choices	Responses	
Yes	**81.82%**	36
No	**18.18%**	8
Total		**44**

This data indicates that 81.82% of patients who participated in the survey have access to their medical records and labs. This function is what allows patients to coordinate their medical records with the physician. Only 18.8% do not have access to their labs and medical records.

What are the EHR tools do you use to coordinate your care via electronic health record?



	Do not response to request	Do not use	It is not helpful	Somewhat helpful	Very convenience and helpful	n/a	Total	Weighted Average
View of test results	0.00% 0	17.07% 7	0.00% 0	12.20% 5	70.73% 29	0.00% 0	41	4.37
Make appointments or request appointment	0.00% 0	34.21% 13	2.63% 1	7.89% 3	52.63% 20	2.63% 1	38	3.81
Referral Status to other health care providers	2.78% 1	77.78% 28	2.78% 1	0.00% 0	11.11% 4	5.56% 2	36	2.35
Medication request	0.00% 0	42.11% 16	0.00% 0	10.53% 4	47.37% 18	0.00% 0	38	3.63
Email directly to provider	0.00% 0	19.05% 8	2.38% 1	11.90% 5	66.67% 28	0.00% 0	42	4.26

This survey data shows the different EHR access to patients. The data indicates the most useful function in coordinating patient care. View test results with 70.73% and email to the providers with 66.67% are the most conveniences and helpful features. This section represents the most common EHR functions that patients can have access.

IV. Patients' comments

A patient who requested to be anonymous stated that she receives cares in both Kaiser and Sutter. The patient said that she could view her medical records from both organizations. "I can easily reach my providers directly without going thru medical assistance of the front desk. If I review my labs and have questions, I can quickly email my PCP. If I need my appointments changed, I can easily send or change my appointments on-line. Overall, I like this easy access to my feedback from my providers." (Anonymous)

Y. Turner, six years cancer survivor patient stated that during that time she had 5-6 physicians working on her case. UCSF, CPMC, and Stanford sharing records were critical to her care. According to Turner, Y., “when you are so ill, it becomes difficult to translate all of the information you receive and being able to reference your dates, results, etc. EHR makes it so much easier to understand.”

Most of the patients shared the same experience in the effectiveness and quality of service in using EHR. They can see their lab results as soon as they are released. They can communicate with their providers and request appointments at any time.

Many of the patients who completed the survey shared the same experience as Rodriguez, C. She is a patient from Kaiser who uses EHR patients’ tool to communicate with all of her doctors. According to Rodriguez, C, “it is a fantastic way to communicate with all of my Doctors and get test results. This saves me so much time when I may have a few questions. My hope is that this frees up time for patients that may have more urgent matters. It also decreases my exposure to those patients who are sick.” (Rodriguez, C. 2016)

O. Corea is an elderly cancer survivor. His children were able to coordinate his care using the patients’ EHR function. They could email his doctor and request prescription refills. The physicians were able to coordinate his care more efficiently because they could see his medical records.

M. Lowell stated, “I would say it is a huge improvement and allows access to all kinds of information. It is great to be able to access test results over time,

and there is lots of useful information on different medical conditions and medications. It does not substitute for face-to-face interaction." (Lowell, M. 2016)

Soto, M. stated, "my gynecologist and primary MD use electronic medical records and it is great as they can quickly pull up my history instead of filtering through a large file of documents. I can also log in at UCSF to view my entire medical history, office visits, and diagnosis." (Soto, M. 2016)

V. Surveys Questions

1. How satisfied are you with the reliability of EHR in coordinating patient care with other health care providers?

The survey results indicated that 33.33% of the health care providers are either extremely satisfy and very satisfy with the reliability of EHR in coordinating patient care with other health care providers. Only 27.78% of the health care providers were not so satisfied with the reliability of EHR in coordinating patient care. In the qualitative data collected, health care providers' access to patients' medical records from various health care organizations allows them to coordinate care more efficiently and improve the quality of care. By having access to all the records, the physicians have the ability to reconcile medication, refill medications, and avoid giving medication that can react badly with some other medication the patient may be taking.

2. What are the barriers of EHRs from a workflow perspective?

From a workflow perspective, providers spend more time reviewing patients' records. There is lot paper information scanned in the patient EHR that requires an extra amount of time to find critical information. Most of the

information scanned in the EHR comes from other health care organizations that do not have the same EHR system.

Also, the lack of interface with other health care organizations or laboratory affects the physicians' ability to expedite test orders and receive some results immediately such as Pap smear test results. According to Simpson, K (2015), "many aspects remain cumbersome and no intuitive for the user. Duplicate entries of the same or similar data into separate systems are often required because the systems don't "talk" to each other." Not all the health care organizations use the same EHR system; therefore, the health care providers cannot access the patients' entire medical records. The lack of access required to request patients' files and scanned in the system. This process requires additional revision of documents, and there may be missing information that can affect the physicians' ability to coordinate care efficiently.

3. What is the necessary training and use of an EHR to achieve improved delivery of care?

The data collected indicates that health care providers are 76.74% very comfortable with computer technology, 17.65% are somewhat comfortable and 5.88% not comfortable. They also are found very difficult to update the health maintenance, and some functions are not entirely used. The data collected and lack of qualitative response do not provide enough information to determine if training is needed to achieve improved delivery of care. Most of the data indicates that health care providers are very comfortable with the use of EHR to coordinate patient care.

4. Is the physician more effective and efficient in addressing patients' health issue by using the electronic health records during the office visit?

The data showed that 92% of the patients agreed that physicians are more effective in addressing their health issues during the visits because they have access to all their records. Nevertheless, some of the patients admit that the EHR will never replace the face-to-face interaction, which is getting affected by the use of EHR. According to Levitz, E., "there is a disconnection in the art of touch among the providers." Most of the times providers are more focus on documenting the patients' clinical information in the EHR during the visit.

The comment from Levitz, R.N about the disconnection of the art of touch among providers, agreed with Venres, et. al (2005) comment. "There is threat in the therapeutic nature of clinician–patient communication, especially when clinicians themselves see the "power" of the consultation residing not in working to share a healing presence, but existing in an electronic network as represented on the computer screen."

(Hripcsak and Albers 2013). The implementation of electronic health records promised to provide a remarkable amount of clinical data available. Health care providers agreed that they have access to view entire patients' health records. However, "the data are complex, inaccurate, and frequently missing, and the record reflects complex processes aside from the patient's physiological state (Hripcsak and Albers 2013). They also agreed that the lack of interface with other EHR system results in missing information. One of the barriers of EHR is

that physicians have to spend more time reviewing patients' records because of the large amount of data scanned in the patients' medical record from other doctors who do not use EPIC-EHR. The analysis of this information requires an extra amount of time to find critical information. According to Dr. J.D, "How do you sort out all the extraneous from a quality key component? It's hard to determine, what is the critical information that a provider needs during the face-to-face encounter to sort out clinical information that is relevant to the patient health condition? This is something that the EHR cannot do right. According to Cifuentes, M, et al. (2015), "Practices experienced common challenges with their EHRs' capabilities to document and track relevant health information, support communication and coordination of care among integrated teams, and exchange information with other EHRs.

The health care provider survey results indicated that 33.33% of them are either extremely satisfied and 33.33% are very satisfied with the reliability of EPIC-EHR in coordinating patient care with other health care providers. Only 27.78% of the health care providers were not so satisfied with the reliability of EHR in coordinating patient care. From a physicians practice, the clinicians identify some functions in the EHR that make their job more efficient and help them to manage patients' care. For example, 66.67% indicated that is much easier to update allergy medications, and 20% reported that EHR did not make any difference in the performance of this task. This is an important function in EPIC-EHR because it can help them coordinate treatment plans and prevent an adverse reaction to treatment. Also, the medication list update tool in the system

was the only function with 13.33% that clinicians identified as more difficult to update. One of the feedbacks from the providers is that updating the medication list is very time-consuming and there are drugs listed from other physicians that are unclear if the patients are actively taking. (Anonymous)

It is also important to understand how comfortable the providers feel with computer technology. The lack of information technology knowledge can be a barrier to how efficiency the physicians can be in using the EHR system. The data collected indicates that 76.74% of the health care providers are very comfortable with computer technology, 17.65% are somewhat comfortable and 5.88% not satisfied with it.

In the qualitative data collected, health care providers have access to patients' medical records from various health care organizations allowing them to coordinate care more efficiently resulting in better quality of care. By the physicians having access to all the patients' medical records, they have the ability to reconcile medication, refill medications, and avoid giving medication that can react badly with some other medication the patient may be taking.

From a workflow perspective some of the barriers of EHRs that providers consider a challenge is that they have to spend more time reviewing patients' records. There is lots of paper information scanned in the patients' medical record that require an extra amount of time to find critical information. Romano and Stafford (2011) stated, "One EHR function of key relevance to quality is clinical decision support, a feature that alerts, reminds, or directs health care providers according to clinical guidelines." Dr. J.D mentioned in her interview,

"How do you sort out all the extraneous from a quality key component." This is not an easy task because the EHR system does not provide an alert feature of critical health conditions that could help them prioritize relevant critical health information. The Health maintenance list, which is a list that has most of the patient health history only 65% of the time is always updated and 25% most of the time. This function assists in reviewing patient health history, but if it is not updated always, it defeats the purpose of it. They found very difficult to update the health maintenance.

Also, the lack of interface with other health care organizations or laboratory affects the physicians' ability to expedite test orders and receive some results immediately such as Pap smear test results. The lack of interface with other EHRs system is what Cifuentes, M, et al. (2015) was referring when they stated that practices experienced common challenges with their EHRs' capabilities to document and track relevant health information, support communication and coordination of care among integrated teams, and exchange information with other EHRs. Not all the health care organizations use the same EHR system; therefore, the health care providers cannot access the patients' entire medical records. The lack of access required to request patients' files and scanned in the system. This process requires additional revision of documents, and there may be missing information that can affect the physicians' ability to coordinate care efficiently.

During the interview process with some of the key informants, they identified an issue of having different medical record number assigned to the

patient in the various health care organizations using the same EHR system. This created a problem in searching for patient information because there is a significant amount of patients with a similar name. According to Simpson, K (2015), "many aspects remain cumbersome and no intuitive for the user. Duplicate entries of the same or similar data into separate systems are often required because the systems don't talk to each other."

On the other hand, the data showed that 91% of the patients agreed that physicians are more effective in addressing their health issues during the visits because they have access to all their records. There are a 9% of patients who do not believe that their physicians are more efficient because they still receive the same outstanding care from the doctor. Nevertheless, some of the patients admit that the EHR will never replace the face-to-face interaction, which is getting affected by the use of EHR. This finding reflects what Ventres, et al., (2005) stated, EHR threatened the therapeutic nature of clinicians' patient communication, especially when clinicians themselves see the power of the consultation residing not in working to share a healing presence but existing in an electronic network as represented on the computer screen. The nurse Levitz, E. have received feedback from patients about physicians trying to document and reviewing the medical records during the office visit resulting in a limited patient-physician centered visit. According to Levitz, R., there is a disconnection in the art of touch among the providers. Most of the times providers are more focus on documenting the patients' clinical information in the EHR during the visit. Access to lab results, email, and make appointments were the most useful EHR

functions by patients. They shared the same experience in navigating these tools and obtaining positive outcomes in coordinating their care with the health care providers.

The surveys and interviews result findings provided specifics perspective of the efficiency and effectiveness of EPIC-EHR from patients and healthcare providers, as well as some barriers. Also, there are some functions and workflows in the EHR system in the HCC that requires more research study and policy that could help restructure the use of EHR. Some essential functions can be utilized more efficient and maintain or improve the use of EHR without affecting patient care.

The data collected and lack of qualitative response do not provide enough information to determine if training is needed to achieve improved delivery of care. Most of the data indicates that health care providers are very comfortable with the use of EHR to coordinate patient care.

Conclusions

Epic is the EHR system utilized in the Health Care Center and some of the larger health care organization in the northern of California such as Kaiser, Stanford, and UCSF. When the health care organizations share the same EHR system, it facilitates coordination of care between patients and health care providers. The purpose of the research study was to identify the effectiveness and quality of care in using EHR. The research study surveys and interviews reported that EHR is an effective and efficient tool if all the functionalities are used appropriately. 91% of the patients noticed that physicians are more

effective and efficient in addressing their health issues during the visit. Healthcare providers and patients can view their medical records and communicate with each other via EHR e-mail.

Overall the health care providers are very satisfied and found EHR reliable to provide excellent quality of care. Some of the non-clinical employees who participated in the interview agreed that they have limited access to the patients' EHR. The literature articles reviewed in this research study confirmed that health care providers from multiple specialties and practice settings described frustration because many patients' health information was not shared among the different electronic medical records users (Friedberg, Chen, & Van Busum, 2013). The research study identified that EPIC-EHR provides the necessary functions for patients and providers to communicate with each other and coordinate care efficiently.

Recommendations

After reviewing and analyzing the final findings of the research study, EHR is a system with many functions that allows health care providers and patients to coordinate care. Overall patients and health care providers are satisfied with EHR. However, there are some areas in the EPIC- EHR system that needs to improve to make sure that patients receive the quality of care they receive.

Here are some of the recommendations that can help to improve and overcome some of the barriers:

1. Provide more EHR access to non-clinical employees who collaborate with providers in coordinating patient care. The organization should review their

access policy and evaluate how limited access may delay patient care. At this time only the clinicians have no limitations to access any information in the patients' EHR except for psychiatry notes.

2. Activate in EPIC-EHR system a more advanced interface function that will allow the system to interface with another EHR system. Patients could receive better quality and coordination. This also eliminates a lot of paper notes received and scanned in the patients' records, and delay patient care because they not all the patients' health information is in the patient chart. Health care providers from multiple specialties and practice settings described frustration because many patients' health information was not shared among the different electronic health records users (Friedberg, Chen, & Van Busum, 2013).

3. Create a universal medical record number in all EPIC-EHR system regardless of the health care organization to avoid documenting in the wrong patient account. Documenting in the wrong patients' medical record is a potential HIPPA violation, and is very common in patients with similar name and date of birth.

4. Standardize the process in EHR to order test regardless of the Laboratory Company and insurance company. Review EHR workflow in ordering the test and create a process that will eliminate extra work for the providers.

5. Create alert functions with chronic conditions or relevant patient health condition that will help reduce sorting out the chart to find information with the potential to miss critical information.

6. Provide training to health care employees of the importance of updating the patients' health maintenance list at all time. When the health maintenance list is updated, physicians can coordinate patient care efficiently without wasting time in looking in other areas of the patients' EHR.

One of the issues identified in the research study that may require further research is the creation of different medical records for the same patients in the various health care organizations that use EPIC-EHR. It is important to do a research study of the implications of patient care when having multiple medical record numbers in the EPIC-EHR system. Universal medical record numbers may facilitate better access to patients' medical records and avoid a mistake in updating health records and coordinating patients' care.

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Appendix A - Physician Survey

1. How are satisfied you with the reliability of EHR is coordinating patient care with other health care providers?

- ○ Extremely satisfied
- ○ Very satisfied
- ○ Somewhat satisfied
- ○ Not so satisfied
- ○ Not at all satisfied
- ○ Other (please specify)

2. The educational resource tool is very helpful in providing instruction of care to patients.

- ○ Sometimes
- ○ Most of the times
- ○ Always
- ○ Do not use
- ○ If not helpful, why? (Please specify)

3. What are some of the barriers that you are encountering from a workflow perspective with EHRs when ordering or documenting electronic prescriptions?

4. How does the EHR maintenance of active medication list help you to improve patients' quality of care?

5. How has the EHR changed the performance of the following tasks?

	More difficult	No change	Slightly easier	Much easier	somewhat difficult	N/A
Allergies information update						
Problem list update						
Medication list update						
Health care maintenance update						

6. How does EHR help you adhere to clinical practice guidelines to provide good quality of care?

7. The health maintenance list is up-to-date every visit?

- ○ Sometimes
- ○ Most of the times
- ○ Always
- ○ Never

8. If you could change one thing about your current EHR system, what would it be?

9. What is your level of comfort with computer technology?

- ○ Very comfortable
- ○ Somewhat comfortable
- ○ Not comfortable

10. What is your title?

- ○ MD
- ○ Midlevels (NP, CNMs)
- ○ RN
- ○ other

What Clinic

Appendix B - Patient Survey

1. Are you able to communicate with your physician via email using electronic health records?

- ○ Yes
- ○ No

2. Have you noticed that the physician is more effective and efficient in addressing your health issue by using the electronic health records during the office visit?

- ○ Yes
- ○ No
- ○ Other (please specify)

3. Do you have access to your records and labs?

- ○ Yes
- ○ No

4. What other functions do you use to coordinate your care via electronic health records?

	Do not response to request	Do not use	It is not helpful	Somewhat helpful	Very convenience and helpful	n/a
View of test results						
Make appointments or request appointment						
Referral Status to other health care providers						
Medication request						
Email directly to provider						

5. What are the Functions do you use to coordinate your care via electronic health records?

6. Provide an example of how electronic health records help you to have a better coordination of care with your doctor or any other health care facility? Please add any negative and positive experience.

7. Sex
   - ○ Female
   - ○ Male
8. Health Care Facilities?
   - ○ CPMC-Health Care Center
   - ○ UCSF
   - ○ Kaiser
   - ○ Standford Lucille Packard
   - ○ Other
9. I authorize to disclose my information but use or do not use:
   - ○ Anonymous- does not use name
   - ○ Use my name
   - ○ Use my last name and title only