Factors Influencing the Usage and Effectiveness of Clinical Content Tools of EpicCare at Kaiser Permanente Northwest

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Certificate of Approval

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Abstract

Electronic medical record systems (EMRs) are being increasingly used as a means of reducing medical errors while increasing the quality of care. Kaiser Permanente Northwest (KPNW) has used HealthConnect, the internal branding for the EMR EpicCare (Epic Systems Corporation, Madison, WI) since 1992. The goal of this study was to determine the factors that influence the usage and effectiveness of tools that HealthConnect has to offer to clinicians. Two focus groups from KPNW consisting of 19 departmental leaders and 11 clinical content experts were interviewed. All participants had worked at Kaiser Permanente for at least 10 years and felt comfortable using computers.

Recorded interviews were transcribed, summarized and analyzed for common themes that could help identify factors of interest Three main themes were identified: 1) New and improved clinical content tools were more useful if they were easy to access. 2) HealthConnect tools that interfere with clinicians' workflow were not being used, and were being ignored. 3) Support from the departmental leaders and clinical content experts as well as the employment of different forms of training were highly encouraged.

Introduction

This study focuses on evaluating factors that influence the usage and effectiveness of an electronic medical record's clinical content tools and templates at Kaiser Permanente Northwest (KPNW). The project involved planning, interviewing and analyzing selected department leaders and clinician champions who had been the users of Epic electronic medical record system, also known as HealthConnect, at KPNW.

Background and Significance

American medicine and the health care system have advanced considerably through the years but there is need, as well as room, for improving the quality of care. Some of the problems have been the under use, overuse, and misuse of healthcare services as well as lack of proper decision making. Errors in the healthcare system have caused patients to spend more money on repeating diagnostic tests, treating adverse drug events and insurance costs [1, 2, 3, 4].

In recent years, there have been many different approaches available to help reduce medical errors and improve the quality of care in the health care system. One of these approaches is the use of electronic medical records (EMR) to improve patient safety and provide better accessibility, accuracy, and completeness of clinical information while reducing the cost of health care and undesirable practice variation [5].

Unfortunately, there have not been many usability studies of electronic medical records in clinical settings; however, it is believed that the effectiveness of EMR relies heavily on the rate of acceptance and usage by clinicians in their

daily tasks [5, 6, 7]. With the implementation of EMR systems, clinicians are required to put forth significant effort to change the way of their practice and therefore, not only need to believe that these changes are necessary and beneficial for them, but also need to feel that they themselves play an important part in the implementation [8]. This is why KPNW has focused on gathering feedback from its clinicians in order to improve its EMR usage and effectiveness.

KPNW has more than a decade of experience in developing, implementing, maintaining, and improving their EMR system. This system enables clinicians and staff to electronically document patient encounters, code diagnosis and procedures, maintain problem lists, send patient referrals and messages to other providers, and order prescriptions, laboratory and radiology tests. Clinicians also have access to an extensive results-reporting system, and reference sites (textbooks, journals, clinical practice guidelines) on both the internet and KPNW's intranet.

The implementation of the EMR system was done in two different phases. The first phase was the implementation of the results-reporting system (RRS) which began in 1992. The RRS contains pharmacy data, transcribed reports, discharge summaries, history and physical examination data, operative reports, consultation reports, surgical pathology and cytology reports, and outpatient laboratory results for all members. The successful implementation of the first phase and the high acceptance rate of RRS by clinicians made the implementation of the second phase, EpicCare, easier. EpicCare is an electronic version of the outpatient medical record which automates all information transmission processes

in the outpatient setting. It is also used to document, order, refer, and send messages to other health care providers. The second phase of this project started in 1994 and was completed in 1997. By the end of 1997, all 700 permanently employed KPNW clinicians and 3,000 support staff were using EpicCare [3, 9-11]. In order to better improve the system, the clinical content effectiveness evaluation team (CCEE) decided to collect feedback from clinicians about Epic clinical content tools and templates available to users. Based on previous studies, we hypothesized physicians' previous computer and technical knowledge, methods employed in training and the tools that affect workflow all influence the use and effectiveness of the electronic medical record system tools, both in positive and negative ways.

Previous Studies

Among the recent studies that have been done, there has been relatively little focus on the overall impact of EMR system on clinical users. Most studies have focused on specific functional components of EMR, such as clinical documentation and clinician order entry. However, a study done by Robert H. Miller and Ida Sim present key benefits and barriers to physicians' use of electronic medical record systems [6]. In this study, EMR managers, physician champions, as well as some representatives from EMR vendors, professional medical associations, and IT consulting firms were interviewed. The key benefits pointed out in this study were better chart viewing capabilities, better documentation and reporting, improved and safer ordering process, which can lead to better patient care and can have financial benefits for healthcare

organizations. The barriers mentioned in this study were the high cost of EMR systems, physicians' resistance to change, inadequate support, user challenges with the technology, longer workdays and fewer patient visits. The authors of this study believed that some potential solutions can minimize the effects of the barriers mentioned above. Suggested solutions included better data exchange between organizations and computer systems, more funding and support for EMR system maintenance, and government as well as private funding to provide information to those using or considering EMR systems.

Methods

This study was performed by using qualitative methods in order to collect, organize, and analyze data that was gathered by interviewing clinicians. The subjects of this study were clinicians working at Kaiser Permanente Northwest (KPNW) and the outcome of the study was a description of enablers and barriers that influence the usage and effectiveness of clinical content tools and templates in clinical settings. The clinicians' suggestions and concerns were also considered as part of the outcome.

The goal for the interview process was to recruit regional and departmental leaders as well as clinicians who were considered a clinical content expert (CCE) in their department. Of the 30 participants, 4 were regional leaders, 15 were departmental leaders, and 11 were clinical content experts. The selection was solely based on the clinicians' role, therefore age, sex, and years of experience did not play a factor in the recruiting process.

Recruiting

Because of limited time to complete this project, the recruiting process was started by creating a list of candidates who were either leaders or clinical content experts. Both group samples were chosen using a convenience sampling method. Due to their busy schedule, clinicians were contacted either by phone or e-mail four to six weeks ahead of the ideal interview date. Before each interview the questions and information about the project were sent to each clinician via e-mail so they would be familiar with the questions. The interviews were done face-to-face or over the phone based on the clinicians' availability and location. With interviewees' permission, interviews were audio recorded to ensure that all the information was captured. Subjects' participation in this project was voluntary, without any mandates or incentives.

Questions

The intention was to have an open ended discussion with the clinicians on themes that reflected the usage and effectiveness of clinical content tools and templates on a broad level, as well as a more specific departmental level. Interviews were started by first asking an ice breaker question about clinicians' familiarity with computer technology and years of work experience at Kaiser Permanente. We decided to ask this question because we assumed that clinicians who had experience with online banking, online shopping, use of digital equipment, and long years of work at Kaiser have less difficulty with using clinical content tools and templates. The outcome of the ice breaker question is presented in the results section. The other specific research questions were:

- How valuable are protocols/practice standards? If valuable, what are the most effective ways to embed them into clinical content?
- What are the most important characteristics/skills that a "Content Expert/Clinician Champion" should have?
- In your opinion, what are the most important characteristics/skills that leadership should have and the critical roles that they should play to ensure the success of clinical content development, deployment, and use?
- What attributes (e.g., fewer clicks) are needed to ensure that Clinical Content is effective and user-friendly?
- Given your experience, what are the top three positive and/or negative factors that influence clinician's adoption of Clinical Content?
- Would you recommend managerial/organizational approaches to improve the usage and effectiveness of clinical content (e.g., individual clinician feedback, incentives, mandates)?

Data Recording

Both telephone and face-to-face interviews were audio recorded. The audio files were then transferred and stored securely.

Analysis

The analysis of audio files was done in three steps by the author [FC]: transcription, organization, and analysis. Transcription was done using computer software. The interviews were typed word by word and the pages of documents were numbered for future references. Great effort was taken to summarize the key points without losing any valuable information. Next, for each interview a

table was created and key points were inserted in to the tables. At the analysis phase, key points from all the tables were grouped together based on their relevance to the themes of interest. The most common key points from each factor, is the outcome and final result of this project.

Results

From the 30 clinicians that were contacted, all 30 participated in this study. The subjects were divided into a leadership or a clinical content expert group based on their roles in their departments. The leadership group consisted of 4 regional leaders, and 15 departmental leaders from 13 different departments. The clinical content expert group consisted of 11 participants from 10 different departments. The remainder of the results section represents the feedback that was gathered from the interviews.

Ice Breaker Question

All subjects were comfortable using computers in their daily lives; they were familiar with online banking, and had purchased products at least once from the internet; some even indicated that they feel comfortable using digital devices such as digital cameras. Most clinicians had been working at Kaiser Permanente for at least 10 years.

Importance of Protocols/Practice Standards

A great deal of the clinical content in the HealthConnect system supports clinical protocols and practice standards. A majority of departmental leaders believed that protocols and practice standards are “very important” and most of the clinical content experts believed that they are “extremely important”. The

least common response from both groups was the unimportance of protocols and practice standards. The following are some of the examples.

- **Extremely/Very Important**

"Protocols are very essential to helping evidence based medicine be carried out. Protocols allow support staff, nurses, pharmacists, and others to help clinicians partner with clinicians to carry out what is intended."

"… to pharmacists at least in state of Oregon and Washington we need to have set protocols … they also add a lot of latitude but they do need to be set out for the clinicians to sign to allow us to work. So [we] also need to be very evidence based without those protocols. I don't think pharmacists would be as effective with patients because we have to run everything past the clinicians before we could recommend a therapy change so that would hamper our timeline, [and] also hamper the number of patients that we could care [for] and we [won't] also eat up valuable physician time by asking for you [to] know every little change …."

"Standardizing practices is very valuable, but it is not the only thing that drives the practice. If you can't find the tool, it will not be helpful."

According to one of the leaders protocols and standards are most effective when:

1) Clinical content tools of HealthConnect are placed in the workflow at the appropriate times.
2) Such standards and protocols are accepted as required practice.
3) Proper training on such tools.

- **Not important at all**

Some clinicians believed that protocols and practice standards were too complex and difficult for them to use because of their complex algorithms. Some believed that protocols were helpful depending on the situation but anything that interrupts their workflow was not considered useful.

"… protocols for the counseling staff is not the same necessarily sort of the flow chart algorithmic protocol that you are speaking ,of like, say for urinary tract infection … we do have certain regulatory requirements in both states to provide care in certain fashion. To do [a] certain screening, certain assessment, certain treatment planning and that is all very mapped out, so those protocols, if you will, are very important to us; but it's not in the same fashion as a quick several boxes and arrows … It is a kind of difficult question

to answer, so I guess overall the best answer is, protocols as I think your defining, are not that important for us."

Embedding Protocols and Practice Standards into Clinical Content

According to our interviewees, the most effective way to embed protocols and practice standards into clinical content is to have them linked to internet, intranet, and departmental websites using web links. The next focus should be making sure that protocols and standards do not interrupt clinicians' workflow. Some clinicians also suggested clinical content tools that may be suitable for protocols and practice standards.

- **Use of Web Links**

Most clinicians were interested in having web links available in order to link protocols to internet. Although, there were some web links already available, the clinicians were interested in having protocols linked to the internet for all diagnosis. They wanted to be able to click on the links instead of having them pop up on the screen or be taken to website automatically without wishing to do so.

"At the present time what we do is to use SmartText, Pre-Printed Orders, and [we] envision that we can create some linkages to either our webpage, which isn't very well supported, or linkages that would bring things up so the people can be reminded to do the right thing. It's unclear how well that's [going to] work with HealthConnect in [the] future."

- **No Interruption in Workflow**

Clinicians were not interested in seeing new tools that were interrupting their workflow. They believed that embedded protocols should guide them towards the right path instead of distracting them from what they had in mind. According to them, protocols and standards should be accessed only when desired and should have some flexibility in usage.

> "I just don't want outside interference, and I feel like I need to get something done, and I have a certain line of thought …. I don't really want the computer to try modify my practice. I would like it to tell me if I am about to make a dangerous mistake like mixing incompatible drugs or drugs, that a patient is allergic to … if I am going to get interrupted with three extra clicks anytime that I want to prescribe a non-formulary drug [it] makes no sense, because I only do it when I need to."

> "I think that the hyperlinks (web links) would be the best way to embed them into clinical content for the ease of use, if the clinician should want to use it; but not make the clinician to have to use it [so] that doesn't pop up in their face, but they could access it …."

Two clinicians mentioned that clinical content tools used for protocols and standards should be seamless, meaning that decision support tools should be without clinicians realizing them. Such seamless tools made the clinicians feel like they were more efficient when using the tools.

- **Suggested Clinical Content Tools**

Some clinicians suggested clinical content tools that can be or have been useful in embedding protocols and practice standards. For example, one of the departmental leaders believed the most effective way was to have an intrusive alert that could interact with the clinicians. He also suggested health maintenance reminders that automatically pop up when a chart is open on the computer. One interviewee suggested creating ambulatory order sets for new diagnosis in order to better use the clear EBM in clinical content tools.

Contributing Factors and Barriers influencing the Usage of Embedded Protocols

Positive Factors

- **Appropriate use and design of clinical content tools.**

According to one of the leaders, the new clinical content tools were much easier to use compared to the old ones. For example, ambulatory order sets were faster and they enabled clinicians to view all the best practice alerts at once. Clinical content tools could be easily used for ordering complicated drug protocols instead of having to manually enter in all the labs. Finally, workflow and time could have both positive and negative effects. Thus, placing the tools in the workflow at the appropriate time could greatly improve usage.

- **Support and communication**

Most subjects believed that no matter how useful and helpful the tools were, they would not be effective unless the clinicians were convinced to use them. Expectations were needed to be set by all the departments in terms of clinical content tool usage. The clinicians were needed to be trained, educated properly, and be informed about the available tools. A good example was the radiology department where the norm was to communicate and educate each other, which according to its leader, had been a great advantage for the department.

Negative Factors

One of the leaders cited lack of proper training had been one of the barriers for not using clinical content tools in order to follow protocols and standards. According to this clinician,

> "Northwest clinicians were actually trained not to use them (SmartSets), because we started using Epic in early days when they were called QuickSets instead of SmartSets and they were quickly called SlowSets because they would lock up the computer for a minute while they were loading the list …."

He continued by saying,

"… but now that it is much faster and we think we built useful SmartSets, we have not yet taken the time to go to clinician and say hey check out this tool, look at what you can do in this; this is actually faster than trying to do it the old way."

- **Access to tools**

Another problem that clinicians were facing was difficulty in finding the tools that they were looking for in HealthConnect. For example, finding guidelines had been difficult because they were sometimes under links or names that could not be found. Some had difficulty finding clinical content tools that were built for their department.

- **Time and workflow**

As mentioned before, time and workflow could be both positive and negative factors. There had been times when the clinicians were not familiar with new and updated tools which could interrupt their workflow or increase their work time. There were cases where clinicians had to change patients' medication because of new standards and guidelines. Because of this, convincing patients to change their preferred medications took time.

- **Excessive number of alerts and reminders**

Some leaders believed that there were too many, sometimes unnecessary, alerts and reminders. According to a clinician, "there is a lot on that screen", and "there is a need to prioritize what is most important and identify workflow interruptions". Another clinician believed that some of their work becomes routine, therefore they did not need to look at the

same alerts and reminders over and over again. Having too many pop up alerts and reminders were causing clinicians to ignore them as a whole.

- **Lack of support and updates/too many changes**

One of the challenges had to do with not having enough support and funding for protocols and standards. For example, according to one of the leaders, staying on top of evidence based medicine, keeping it current, presenting the information, and incorporating it into decision making were some of the problems they had been facing in his department. Another clinician believed that case management can solve some of these problems, but funding had been an issue.

> "I guess part of it [barrier] is, just recently on changes that we want to have done and part of it is going to the national product that there is a bigger need to look at time frames, and longer time frames to get things done."

Leadership and Clinical Content Expert Skills and Characteristics

In the next two sections we will look at the most common feedback that we got from clinicians on the characteristics and skills that leaders and clinical content experts should have in order to make sure that clinical content tools are developed, deployed and used successfully in departments.

Leadership Roles and Characteristics

The most common leadership skills according to our interviewees are,

- **Technical knowledge**

One characteristic of a leader is someone who is a user him/herself and is credible for knowing the system well, who believes in the product and can respond well to the problems the system might have and a technically

knowledgeable leader is familiar with development, evaluation and upgrade of the tools.

"Well, they have to be a user for one thing; they have to really know what [it] is like too, they have to have practical knowledge for the actual program and use of the program in a clinical setting. It has to be broad based knowledge."

- **Good communicator**

Leaders should be able to communicate well with different groups such as physicians, nurses, IT personnel and other staff in order to get appropriate support when it is needed. They need to communicate with the clinicians about what tools are available and ask how they can make the clinicians' job easier.

- **Awareness and adjustability**

A leader needs to have an understanding of challenges that people who work for him/her face. A leader should be willing to give the users time to learn new tools, methods and skills.

"The leadership has to understand the time restrains of the clinician and try to incorporate that in the design of the product."

- **Get necessary resources**

Asking clinicians to use the clinical content tools without providing any infrastructure support or resources is not possible. Clinical leaders should provide necessary resources so the departments can work easier and more efficiently. A good example of a necessary resource mentioned by many leaders is to get all department staff trained and updated on changes. Departments constantly go through changes, maintenance, and update, therefore educating the clinicians has been a top priority.

"… leadership is nice, but getting the job done is a resource issue that is not being supported electronically and it's not being supported as effectively as it could be conceptually."

"… and if we would spend a little time getting educated it probably would save us a lot of time in the long run, so that is, one major priority is to sort of increase the facility of the MDs with the system and to build customized tools to help everybody do what they think they need to do to get through their encounter."

Clinical Content Expert Roles and Characteristics

- **Good Communicator**

It is important to have someone who can communicate well with other clinicians and speak the language of the technology in an understandable way. For example, according to one of the leaders, their department has a lot of older clinicians who have difficulty with new technology, therefore having a group of younger generation clinicians communicating with them is very helpful. A good communicator has to be a good listener in order to understand the challenges and problems that the clinicians face in their daily work. A clinician with this quality is willing to listen to complaints, criticisms, as well as give feedback to clinicians on the usage of technology and clinical content tools.

"… willing to take advice and constructive criticism, good or bad, I suppose from your users. Because they always have an idea of how it should work…"

The same clinician continued by saying,

"… also good communication skills, especially written communication skills. There is nothing worse than trying to clean up a bad letter or bad phrase you know grammar wise [is] making the language confusing or even having the information written for [the] wrong skill level of audience."

"… listen to the users and decide how to make their product better otherwise it is going to get quickly outdated and surpassed by competitors or whatever. So I think giving everybody a chance to give some input on what they think should do is valuable …."

- **Knowledge about the tools/Computer savvy**

Many of the clinicians believed that a clinical content expert should have knowledge about clinical content tools and the use of computers in clinical settings. This person should be a user him/herself and be familiar with updates and technological features that are being developed for clinicians. A CCE should be familiar with the process of care not just in his/her own practice. They should understand how other users may use the tools.

"… they should have a passion to understand the dynamics of the system and how it can be used for the patient and the clinician …"

"… a clinical champion [clinical content expert] should have practical knowledge of normal clinicians' workflow and how they use the computer and the tools, the electronic tools and they have to actually have some clinical knowledge to develop SmartSets."

- **Understands the obstacles**

One of the characteristics of a CCE is to understand and try to solve the challenges that clinicians face when using clinical content tools in their daily work. The outcome of such challenges and obstacles might be resistance from the clinicians in using the clinical content tools. Clinical content experts should expect some resistance but continue promoting what they believe is best for the clinicians.

- **Motivator/Enthusiastic**

Enthusiasm would help a CCE motivate people to use EMR tools that are available to them. According to one of the leaders, there are a high number of clinicians who get nervous when it comes to using computers. CCEs should help them overcome this anxiety.

"… they [clinical content experts] really have to be a good salesman, people have to be shown that their life is going to be better by adopting this new technology."

"… they have to be very enthusiastic about the product and technology in general, and be willing to share that enthusiasm …."

- **Someone from the department**

Having experts who practice in the same department has two advantages. First, they are familiar with the clinical environment of that department. Second, there is better communication between the CCE and other clinicians. An expert from the same department knows enough about the tools that his/her department needs and can fulfill those needs by being an enthusiastic leader. This person is able to get members of the department involved in the development and the use of clinical content tools without forcing their own agenda. Based on one of the content expert's experience, clinicians tend not to use the tools if they are not involved in developing them.

"… they [clinical content experts] have to develop [the] computer not for the way they practice, but for the way the majority of people practice so they can't be self-centered when they are developing the clinical content."

"I think they [CCEs] should be practicing so they are used to heavy workflow and know what time restraints are …"

"… I think it works best if they are a member of a clinical team and are available in the needed department …"

Factors Influencing Clinicians' Adoption of Clinical Content

Positive Factors

- **Training and Promotion**

Proper training that will educate everyone to the same level and make them interested in using the tools. Clinicians needed to have hands-on training instead of them learning the tools on their own. Clinicians should be shown data on how the tools can make their jobs easier. Someone, preferably from the department, should promote the tools and let the clinicians know about new features and updates. Also, such a person should test the tools with them and take their suggestions for future improvements.

- **Efficiency and Accuracy**

Clinicians need to believe that the tools are making their practice more efficient, thus they have to fit clinicians' workflow and appear at the right time. Tools can help reduce the chance of forgetting items. They need to be updated regularly so they stay accurate. With the help of clinical content tools, communication among the clinicians becomes standardized. One of the leaders suggested having active gridlines so clinicians would have interactive documents where they can order drugs, schedule lab orders in advance, and get patient instruction tools with one click.

"… it is easier to do when you have templates, you tend to forget things less that is if you got a triple asterisk field there you have to fill [it] in before you can close the chart, you ask it."

- **Ease of Use**

Clinicians should be able to access the tools easily, meaning they should be easy to find with few number of clicks. The tools also need to be as simple as possible. According to one of the content experts, new upgrades have eased the usage of tools.

- **Time**

The tools have to be quick themselves and according to one of the content experts they should help gather data on patients faster. The quickness of the tools is one way to save both the patient and clinician's time which motivates clinician to adapt to the tools.

"Clinicians should be convinced that [it] is a time saver. It has to feel like it is a time saver, not just be a time saver."

"If it is going to take me more time I am not going to do [it] and if it is going to take me less time I am going to do it… unless it saves time on getting through the opening to closing the chart, it is not going to be well adopted in my opinion because I think that is what really drives the doctors' habits. How can I get this done quickly and good enough to be good enough …."

Negative Factors

- **Difficult to Use**

Clinicians will not adapt to clinical content tools if they are difficult to use, difficult to find or turn out to be complex and long in which it takes several steps to complete a task. This situation could be worse for clinicians who are nervous in using computers in their daily work. According to one of the CCEs, there is information overload, meaning clinicians have to make too many decisions on the same patient or there are too many screens in front of the clinicians for the same kind of information. Many clinicians found some of the clinical content tools too complex. For instance they did not find ambulatory order sets useful when patients have two or more medical complaints because it gets too complicated to combine more than one of these order sets together. One clinician believed that ambulatory order sets are generally a problem for

primary care because they are too specific or do not have enough information so they never "hit things right".

"Up to date SmartText and SmartSets are often unavailable, inaccurate, or relatively inconvenient to use."

"The Sinusitis SmartSet, I don't use them. They are cumbersome and I don't know, I have tried a few of them when you get down to the medication and all that stuff it just becomes cumbersome…."

- **Interrupting the Workflow**

Chances of clinicians getting used to the tools are low if they interrupt or slow down their workflow. Some clinicians complained about too many unnecessary alerts and reminders, as well as alerts coming up at the wrong time or for the wrong person. Many physicians believed that some alerts were not accurate because they were completely outdated and did not comply with current practice. They also believed that patient information was not entered correctly and therefore had triggered the wrong alert and reminder to appear in the system.

"… it takes time to look at every alert and then decide whether you want to follow that alert or disregard it; you know I think probably more than three would be too much if it was, if [it] potentially was appearing on every patient … people get desensitized after you are getting so many alerts that you just don't want to read anymore …."

Some were not happy about the number of steps or clicks it takes to complete certain task.

"Fewer clicks, definitely every click is a second; and then you have to wait in-between for it to go there."

"You know when I first started with KP HealthConnect, I didn't think clicks were that important; they really are. Have people who count them, they can tell you if the entire encounter takes 20 clicks or 18 clicks; it's incredible!"

Clinicians' workflow is interrupted in many different ways, but the top two concerns were when a computer freezes while a clinician is using it and, the inability to find the right diagnosis, medications, or procedures when a keyword is entered in the search boxes.

- **Time**

Clinical content tools might save clinicians' time but if they are not convinced that they do so then they will not adopt these tools. Clinicians also try to avoid using tools that are very slow to use. The likelihood of clinicians adapting to such tools lowers if the tools slow down clinicians' work or if it takes too much time to input patient information into the computers using these tools.

- **Training**

According to one of the leaders, there had been cases where a trainer would give too much information to clinicians during a training session or he/she would add confusion instead of clarifying things. On the other hand a clinical content expert believed that the lack of training in the previous years had been one of the reasons why clinicians may not adapt to the tools. For some leaders, the main challenge was finding time to train all the clinicians in their departments. Many of them had to learn some of the HealthConnect tools without any training due to lack of available support.

> "… I think we just don't get training to do it; people say here is how you turn the computer on and off, go to it; they don't come in and say this is how you can build a SmartSet or this is how you can call me and I can come down and build it for you. [It] does not seem to me like there is a lot of available support for that type of thing…."

Some believed that even after training there was a slow learning curve, thus it was taking time for clinicians to adapt to updates and changes.

- **Refuse to Change**

There are always some clinicians who use their own routines and refuse to change by using other useful tools. Some clinicians' bad habits forced them to use the computer and the tools inefficiently. Some might have poor computer skills, making it difficult for them to adapt to new tools, updates, and upgrades.

Managerial/Organizational Approaches

We asked both leadership and CCE interviewees whether they recommend any managerial and/or organizational approaches, such as mandates and incentives, in order to improve usage and effectiveness of clinical content tools. Most clinicians from the leadership group believed that having mandates in departments could create resistance in some or all medical groups. Some of the leaders suggested different approaches to combat this issue. One suggestion was to have a person in charge of creating custom tools; tools which clinicians can specifically request.

> "If I say I want a SmartSet that is built, and I have it all written down on paper exactly what I want it to do, somebody has got to come here and make the computer do it, and I think that is the stretch right there to get that done. You know if I get on the phone right now trying to get somebody in here to do that, I am not sure how many different people I have to call just to figure out who to call. So it's not clear to me how I would get that done."

Some leaders suggested educating the clinicians and showing them the values of clinical content tools. For instance, one clinician recommended having brown bag lunches on how using clinical content tools can improve the medical practice. Another approach is to have experts who can spend a few days with physicians and show them how they could have used other tools for the patients they have visited already. In one department, physicians were showing resistance to a SOAP note taking tool, but after its value and importance were shown to them, all of them were happy to use this tool.

> "I really think the way to approach it would be to have someone in the administration say, 'you know you really should use these; they are efficient and they guide you in right direction, as a department we think it should be done that way'. Number two is that the people who develop them can go out to clinicians and say, 'it is much more efficient if you do it this way', and 'let me show you why', and actually train the clinicians and show them that it is more efficient …."

Some leaders believed that managerial and organizational approaches are useful, but suggested that getting people more involved in developing the tools, convincing clinicians to use the tools, getting feedback from them, and improving their workflow are better ways to improve use and effectiveness of the tools.

From the few clinical content experts who answered this question, most of them recommended managerial approaches. For example, in the Department of Addiction Medicine they had managerial and team approach in order to ask clinicians to do something that was required or regulated. In Urgent Care, there were certain patients who had not been seen all year due to difficulties in updating chronic illness diagnosis. According to the CCE of this department, that was when managerial approach was needed to solve such an issue.

> "I think that's where the quality management teams would come into play, as well as kind of getting the office managers and nursing staff kind of involved in team kind of support of best practices."

One CCE believed that managerial and departmental approaches depended on the department. Managerial approaches would be most effective in a department like Pediatrics where most of their encounters are well child or similar visits, or a department like Specialty Care where most of the focus is on one problem. According to this CCE it is more difficult to have this kind of approach in Family Practice and Internal Medicine.

Effective On-going Educational Methods

Leaders and clinical content experts were aware that each clinician had different skills and learning capabilities therefore, different methods of training were required in order to make sure that all the clinicians were familiar with clinical content tools and templates. According to one of the leaders, each method of training reaches only ten percent of people, so there is a need for at least four or five methods of training. Educational methods depend on the message, the intended audience, and the availability of messengers. Another clinician believed that any kind of training will work if there could be a mindset present that encourages everyone to learn from their peers.

> "… you have to do a variety of modes of education and communication because everybody does different things. We just try to repeat it about four or five times."

Most of the clinicians from both groups believed that if resources were available, the most effective way of training the clinicians was one-on-one or face-to-face training; otherwise an effective method had been department/module meetings. All of the interviewees agreed that the least useful educational method

for clinical content tools was e-mail. Most of them wished to have refresher trainings more often than annually. Below are the interviewees' opinions on training methods that we had suggested during the interviews.

- **Newsletter**

  Most leaders believed that newsletters were getting ignored because clinicians did not spend time reviewing them, therefore they were not appreciated. On the other hand, most CCEs believed that newsletters were useful. One of the physicians found short and specific newsletters very useful. Another clinician hoped to have them as hard copy instead of receiving them via e-mail so they could be kept as future reference.

- **Brown Bag Lunch**

  The answers we received from most of the leaders on brown bag lunches differed from most of the clinical content experts. Most leaders believed that brown bag lunches could be useful and helpful if social interaction and sharing ideas were part of them. The leader of the Urology Department found this method of education the most effective way in that department. The leader in Family Practice believed that brown bag lunches were not attempted because of work demand, also, those who needed this kind of trainings more than others did not have the time to participate because they were figuring out ways on how to use the system. It is interesting to note that the CCE from the same department had a very good experience with this kind of training but most of the CCEs did not find them as useful, mainly because it was hard to get everyone to attend

them. For example, in the department of Occupational Medicine they had scattered medical offices, therefore it was not possible for them to have brown bag lunches.

"I think the brown bag lunches are a great idea, but they traditionally don't have very good turnout. People are in some way too busy, so you get the same small group of people each time, and so you are educating the same small group over and over again."

- **Department/Module Meeting**

Both the leadership and the CCE group believed that department/module meetings were both helpful and useful. A couple of leaders suggested having a combination of brown bag lunches and module settings so two or three clinicians could work on one computer while they were having lunch. Another leader suggested promoting similar meetings by clinical content experts. One CCE found the meetings most useful if the trainees were involved in intensive training with ten or less people per meeting. Each department had weekly or monthly meetings based on their needs. In the department of Gastroenterology they had a working outlay and infrastructure with someone in charge of training.

- **E-mail**

Most leaders thought of e-mail as the least useful educational tool. They were doubtful that clinicians would read them because they are usually too long, with too much information. Some leaders believed e-mail can be a powerful tool but must be reiterated and to the point. One of the leaders suggested Q&A format e-mails. Some of the CCEs had experienced using e-mail as an educational tool, but they did not mention if they liked or

disliked it. One CCE suggested using e-mail for urgent matters such as downtime instead of a tool for ongoing training.

- **Tip of the Day**

There were mixed feelings about reading a Tip of the Day. Some clinicians liked them because they are short and concise, some clinicians ignored them, some skipped them because they got old after a while, and some would like to see them improved. They see tips that come up too many times, which causes clinicians to start ignoring them. One CCE believed that a Tip of the Day is most effective for new regions, but that they get repetitive after a couple of years.

- **Yearly Refresher Training**

Both the leadership and CCE group found yearly refresh training useful because it helps them learn new ways to use the tools, and it updates them on new changes made in HealthConnect. Some clinicians liked to have more frequent training refreshers. One leader suggested that yearly refresher training should not be mandatory because in his/her opinion it can waste the time of clinicians who did not need this kind of training. According to most interviewees, training needs to be interactive with enough computers so everyone can participate. According to some clinicians, yearly refresher trainings were very useful for newly hired clinicians with no previous experience with HealthConnect.

- **Web-based Training**

Most clinicians believed that web-based training can be helpful but it needed some improvement. Content specific, and interactive web-based training were some of the requested improvements. A CCE believe that web-based training only targets those who are computer savvy and know how to use the web well. According to another CCE, web-based training should be used for add on training and skills; it is not possible to learn most of the EMR on-line.

"… as long as the web based training is easy to get to and very quick, that's fine, get rid of the bells and whistles. It looks nice but it just slows people down with annoying noise. It is giving web based training a bad name."

Some clinicians found it hard sit down for a long time, go through the training and deal with the glitches that come along.

- **Lecture**

Many of the clinicians from the leadership group would like to see this kind of training in the form of CME (continuing medical education) sessions. Two of the leaders showed satisfaction with Kaiser's CME session called "Pots of Gold". In this type of training usually four different departments are present and they talk about specific topics. At the lectures, the trainer shows the clinicians how to use the tools.
Not many CCEs commented on this type of training but poor attendance was a common issue mentioned by the CCEs.

- **One on One Training**

Even though one-on-one or face-to-face training was not one of the options given in the interview questions, almost all of the clinicians believed it to be the best training method. The only challenge recognized

by many of the interviewees was the difficulty of having one-on-one training in departments with limited resources because of its cost and time consumption. One suggested option was to have clinical content experts of each department spend a few hours to half a day in the department sitting down with individual clinicians in order to help them use the clinical content tools more efficiently.

Discussion

Based on the results of this study, we were able to find several positive and negative factors that influenced the usage and effectiveness of clinical content tools of HealthConnect at KPNW.

Positive Factors

The importance of following evidence-based medicine protocols and practice standards was noted by our subjects. They believed that clinical content tools such as alerts and reminders, SmartTools such as SmartSets for new diagnosis, and Weblinks could greatly support and improve evidence-based medicine and practice standards and protocols. Even though these tools require more improvement and updates, most interviewees admitted that most of these tools were easier to use compared to previous years. The common tools that were used by these physicians were the ones that were making their daily work in the department more efficient and less time consuming.

Negative Factors

Our findings suggest that clinical content tools should be accessible to clinicians' without interrupting their workflow. Our subjects mentioned that there

are times when the tools are not easy to find, or they appear at times when they are not needed. The interviewees were mainly concerned about the redundant routine alerts and reminders they received.

Support and Training

We are listing support and training separately because these two factors can play both positive and negative roles in physicians' adaptations to EMRs. Our interviewees suggested that departmental leaders who ask for users' feedback and participation in designing some of the tools as well as offering incentives in using the system, can greatly affect how physicians approach and use HealthConnect clinical content tools. Also, knowledgeable and convincing clinical content experts can demonstrate the importance of these tools to the users. Because of regular changes and updates to the system more support and guidance is expected from the clinical content experts.

Training is another factor that can greatly influence how well clinicians use and understand clinical content tools. There are different methods of training and there are ongoing debates on which method is the most effective [7]. Our results show that one-on-one training is the most effective method, but the lack of time and funding do not always permit having this type of training. According to our results, other effective methods of training were more frequent department/module meetings and yearly refresher trainings. Our subjects also indicated that sharing too much information at once with the trainees can confuse the users by overloading them with information.

Limitations

Our study has some limitations. First, our data was collected by interviewing a small group of departmental leaders and clinician experts from one region of Kaiser Permanente. In many cases we were not able to interview both the clinician expert and department leader of the same department. Interviewing both roles from the same departments could have enabled us to compare the opinions, feedback, and suggestions of two people that work in the same department. Since our population was from KPNW, we cannot generalize our findings and assume that other regions of Kaiser Permanente are the same as KPNW. Second, our interviewees consisted of group of clinicians who had been working at KPNW for at least 10 years and because of their role and experience with HealthConnect, it is possible that they were more comfortable using the system and its clinical content tools than others. This study did not include clinicians who might have had varying levels of computer skills and familiarity with HealthConnect system.

Conclusion

The results of this study clearly show the positive and negative responses of those who had been part of managing and designing HealthConnect and its clinical content tools at KPNW. Our results can be used to assist the improvement of HealthConnect (EpicCare) at KPNW and perhaps other regions of Kaiser Permanente. This study shows the significance of systematic and long-term evaluation studies of the Electronic Health Record. Future studies require interviewing greater number of clinicians from different regions of Kaiser

Permanente in order to truly discover common important factors that influence the usage and effectiveness of clinical content tools of EpicCare.

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