EVALUATION OF A CONTINUING MEDICAL EDUCATION SYSTEM INTEGRATED INTO AN ELECTRONIC HEALTH RECORD IN AN ACADEMIC HOSPITAL IN ARGENTINA

By

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A THESIS

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Certificate of Approval

This is to certify that the Master's Thesis of

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"Initial Evaluation of a Continuous Medical Education System Integrated into an EHR in an Academic Hospital in Argentina"

Has been approved

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ABSTRACT

The purpose of this study was to determine the acceptance by physicians of a continuing medical education (CME) system integrated into an electronic health record (EHR). Traditional approaches to CME have not shown improvement in patient health care outcomes. Hospital Italiano de Buenos Aires (HIBA) has implemented a system that embeds CME into the EHR, providing learning opportunities that are integrated into the patient care process. This study explored the acceptability of the system to physicians when they were in the consulting room in the hospital. We interviewed 12 physicians after one or two weeks of using this CME system and we performed a thematic analysis of these interviews. The themes that emerged were: (1) use and ease of use of the system; (2) value physicians gave to the system; (3) educational impact on physicians; (4) respect for the individual learning styles; (5) content available in the system; and (6) barriers that were present or absent for using the CME system. We found that the integrated CME system developed at HIBA was well accepted and perceived as useful and easy to use. Future work will involve modifications to the system interface, expansion of the content offered, and further evaluation.

INTRODUCTION

Lifelong learning can be defined as the continuous building of skills and knowledge throughout the life of an individual.[1] In medicine, continuing medical education (CME) is the manner in which physicians approach lifelong learning with a main focus on professional development.[2] Internationally, there are different approaches to professional development, but basically they can be classified into two approaches. The first approach includes CME systems that give credits to physicians, usually in the form of one hour of educational activity equating to one credit, and where educational activities can be divided into:[3]

1. Live activities, e.g. courses, conferences and others scientific meetings.
2. Internal activities, e.g. journal clubs, peer rounds and teaching.
3. Enduring materials, e.g. books, CD-ROM, or Web-based materials.

The second approach to CME is where there is mandatory recertification or a revalidation process for physicians to maintain their professional licenses.

In Argentina, where this project took place, the re-certification process of physicians' skills or knowledge is currently not required and the exercise of lifelong learning depends on each physician's personal motivation.

The American Medical Association Principles of Medical Ethics states that "a physician must continue to study, apply, and advance scientific knowledge"[4] and, because of rapidly evolving medical practice, today's clinicians are required to be lifelong learners. But the traditional curriculum in medical school does not allow physicians to become good consumers of medical

information. To become lifelong learners physicians will need new methods of learning.[5]

A review published in JAMA in 1999 about CME, found that the traditional approaches to CME, like attending conferences, workshops or rounds did not significantly change the educational outcomes but that interactive and mixed educational sessions were associated with changes in practice.[6] In a more recent systematic review, similar results were found but in addition that educational meetings alone were not likely to be effective for changing complex behaviors. [7]

This research project determined the acceptance by physicians of a CME system integrated into an electronic health record (EHR). Integrating in this initiative consisted of non-traditional approaches to medical education and the use of technology.

In the early 1970s, Knowles described adult learning theory, which affirmed that adults learn in a different manner than children and that they require different educational strategies.[8] The principles described by Knowles are aligned with many of the recommendations published in the CME literature.[9-11] These authors suggest that CME must move from standardized to customized and multi-place content, and from traditional lecture models to interactive learning, respecting individual learning styles and delivering "just in time" information.[12-15] The new model should focus on designing education that is tailored to individual physicians' needs. One approach to achieve this aim is the creation of a practice-learning environment: in this new concept medical education is not a separate activity from patient care, but it is driven by clinical context enriched by a variety of resources that respect individual learning styles.[16]

Using these principles at Hospital Italiano de Buenos Aires in Argentina (HIBA) we developed a system to help physicians integrate their CME with patient care, using the EHR.

DESCRIPTION OF THE SYSTEM AND THE CONTEXT WHERE IT WAS IMPLEMENTED:

Hospital Italiano de Buenos Aires (HIBA) in Argentina is a non-profit academic medical center with over 1,500 physicians and 4,000 employees. HIBA has a network of two hospitals with 750 beds (200 for intensive care), 500 home care patients, and 24 clinics. It has an insurance plan that covers approximately 200,000 people and has more than 2,200,000 outpatient visits annually from patients from across Argentina and Latin America. In 1998, HIBA began to implement a Healthcare Information System (HIS) that was completely developed in-house and currently collects and leverages clinical and administration information. Within HIS, the EHR is a fully-implemented

Web-based, problem-oriented, patient-centered record with customized functionalities depending on the level of care (outpatient, inpatient, emergency care and home care). The HIBA information infrastructure includes a terminology server that allows the mapping of local vocabularies to SNOMED CT. This terminology server allows for the structured capture of approximately 80% of diagnoses. [17,18]

The HIBA CME system is embedded in the EHR and is based around the concept of an information pearl, which is a short piece of concise and evidence based information that is offered to physicians during patient encounters as a CME strategy. This is a similar concept to the clinical pearls described by Lorin et al., who describe them as small bits of free standing, clinically relevant evidence-based information. [19]

An initial step in this project was the creation of a group to develop a knowledge base to serve as the educational content for the system. Physicians in this group were from the same departments as the physicians who would be users of the CME system. They created items of educational information referred to as "Information Pearls." This content was created in Spanish under the supervision of the HIBA CME committee. In the first stage of the implementation, high-quality evidence from sources such as level A recommendations from the U.S. Preventive Services Task Force (USPSTF) was incorporated into the knowledge base. An example of our knowledge base content (translated here to English) can be seen in Table 1.

Summary	Where and when it will be shown
Recommend that all women planning or capable of pregnancy take a daily supplement containing 0.4 to 0.8 mg (400 to 800 μg) of folic acid.	Summary of the EHR of an adult woman
Recommend screening for colorectal cancer (CRC) using fecal occult blood testing, sigmoidoscopy, or colonoscopy, in adults, beginning at age 50 and continuing until age 75.	Summary of the EHR of all adult patients

Table 1. Example of the information pearls content

Every time a physician accesses a patient record in the EHR, the system automatically presents information drawn from the knowledge base of information pearls, always related to the patient's demographic data and disease characteristics. An example is shown in in Figure 1. Physicians can choose to read the information or just ignore it.
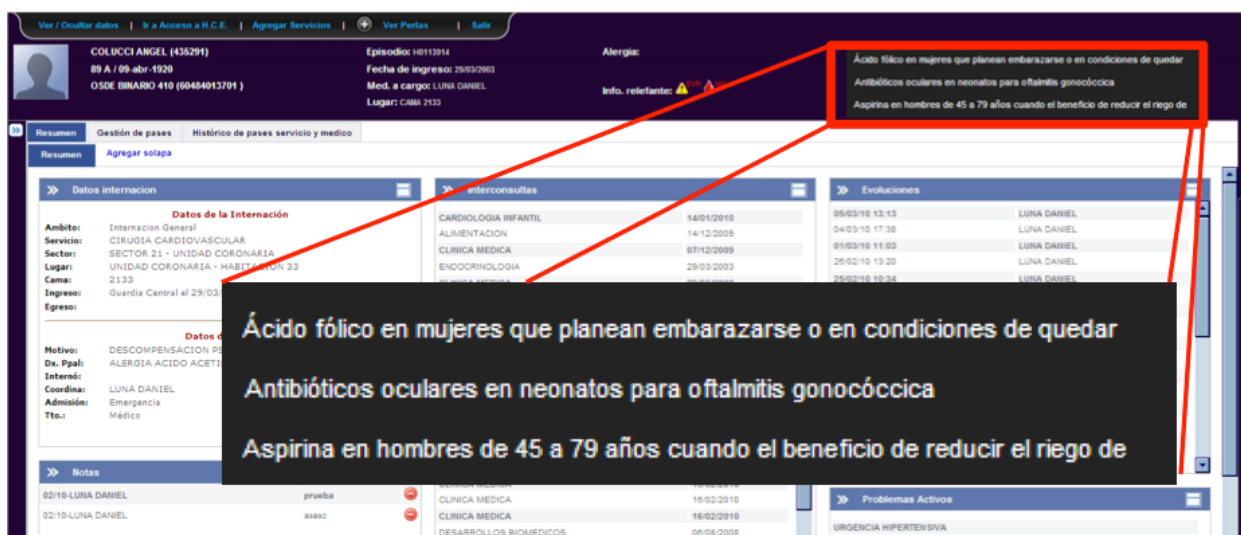
Figure 1. Visualization of information pearls in the summary screen of the EHR.

If the physician chooses to read the information, a hyperlink leads to a tab that presents the extended content. In the same section, physicians have access to a linked name of the Web resource that contains the source of the information pearl, the name of the creator and a link to the author's biographical information, as shown in Figure 2. Physicians also have the option of entering comments about the information presented using a secure messaging system. These comments are sent to the CME committee. Depending on how the system is configured, for each summary that the physician reads, he or she can receive CME credits (a minimum of 1 and a maximum of 10) that will be added to their records of their CME program.

Figure 2. Information pearls with link to supplementary information.

Having described the need for new ways of learning, and the system developed at HIBA, in this study we examined the acceptance of the CME system by doctors at HIBA. For this proo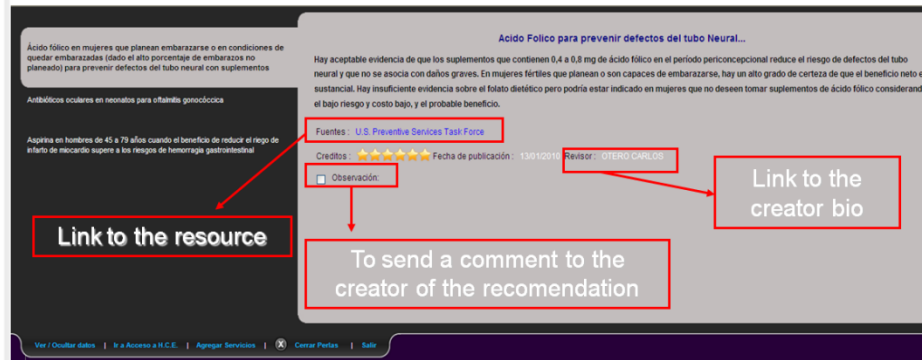f-of-concept study, we evaluated the system with an initial knowledge base of only 21 information pearls available to the CME system.

Continuing medical education (CME): a specific type of education that helps physicians maintain competency and learn about new and developing areas in their field. There is a move from CME to continuous professional development, including medical, managerial, social, and personal skills.

Continuous professional development: a process of lifelong learning in practice

Lifelong Learning: all learning activities undertaken throughout life, and can be formal or informal. The concept is closely linked to continuous education and continuing professional development.

Information pearl: piece of information, developed by a group of physician with an interest in education with the aim of helping physicians in their continuous learning activities. These pieces of information are concise and evidence based.

Electronic Health Record (EHR): a system that systematically collects electronic health information about patients

RESEARCH QUESTION

Will physicians accept the CME system integrated into the electronic health record?

According to Mazmanian et al. there are six levels of possible evaluation strategies in CME. They propose a sequential assessment process, where different outcomes are assessed in each level. For example, if the participants are satisfied with the educational strategy (Level 2) or how they learn (Level 3), the evaluation process progresses to examine changes in physicians performance and patient outcomes.[20]

Level	Outcome	Definition
1	Participation	The number of physicians and others who registered and attended
2	Satisfaction	The degree to which the expectations of the participants about the setting and delivery of the CME activity were met
3	Learning	Changes in the knowledge, skills, and attitudes of the participants; the development of competence
4	Performance	Changes in practice performance as a result of the application of what was learned
5	Patient health	Changes in the health status of patients due to changes in practice behavior
6	Population health	Changes in the health status of a population of patients due to changes in practice behavior

Table 2. Mazmanian CME evaluation model

Since the proposed EHR-integrated information pearls are not only a new technology

implementation or a new approach for learning, the first reasonable step is to assess if physicians will accept this new way of learning. In subsequent phases, the system would be assessed regarding the other questions described in the framework.

STUDY DESIGN

We performed a qualitative study to explore physician perceptions of the integrated CME system. Data was obtained via individual, face-to-face, semi-structured interviews performed between February-March 2012. To increase the validity of the results we also used audit logs of participant use of the system as a means of triangulation to validate what participants said during interviews with the actual use of the system.

SUBJECTS, SAMPLING AND STUDY FLOW

The subjects recruited for the study were Primary Care Physicians (PCP) from the family medicine and internal medicine departments at HIBA. The total number of physicians working in each department is 110 and 250 respectively. With the help of two key informants who gave us access and sponsorship, we performed purposive sampling. We asked our key informants for a list of PCPs who were demographically representative of both departments, in terms of age, gender, clinical experience and familiarity with technology. We assumed that having a demographically diverse sample would allow us to interview physicians with different opinions. When a potential participant was identified, the principal investigator contacted them directly via email or telephone to invite them to participate in the study.

Appendix A shows the recruitment letter, in Spanish and English, sent via email or read by phone to the possible participant.

Data in the study was obtained from two sources: (1) audit logs automatically recorded interactions between the participants and the CME system, and (2) semi-structured individual interviews were conducted with twelve physician users. An interview guide was developed by the principal investigator assisted by a qualitative research specialist at HIBA. Questions present in the interview guide covered the principles and concepts of adult learning theory, as well as others such as just in time learning.[8,12]

Appendix B contains the interview guide, in Spanish and English.

The interviews took place during a pilot phase of the system implementation when only those PCPs recruited for the study could interact with the new system. The principal investigator performed all interviews. Every interview started with basic biographical information. To test the subjects' memory of the information presented by the system, the first question in each interview was about the specific information pearl that had been presented to them. Following this step, open-ended questions were used to begin and then specific questions were asked to assess details of the functionality of the system. All the interviews finished with a closure question asking the subject if they wanted to add any other comment about the system. An example of a general question performed at the beginning of the interview was "What is your general impression of the CME system?" An example of a specific question was "Do you think that having contextual information helps to remember a topic?"

After consenting to participate in the study, participants used the system for one to two weeks,

depending on individual schedules, prior to their interview. All interviews were audio taped with consent of the participants and transcribed verbatim.

System usage was defined as the total number and relative frequencies of the participants' use of the system was automatically recorded. Knowing the number of times that physicians interacted with the system allowed us to correlate this information with the data gathered in the interviews.

DATA ANALYSIS

For the analysis we developed a classification schema using the interview guide as a template for the categorization, using spreadsheet software (Microsoft Excel, Redmond, WA) to organize the work and sort the themes that emerged in the interviews. If a new theme emerged from an interview and was not in the initial classification, it was added to the electronic document. The principal investigator and a sociologist with experience in qualitative research performed the analysis of the data gathered in the interviews. A second investigator was introduced in the analysis of the content to allow investigator triangulation to validate data through cross verification from the two researchers. The two researchers reviewed the transcripts for a week working independently. After a week of immersion and analyzing the transcribed interviews, the two investigators got together and developed the final categorization with the emerged themes. As a result, a coding tree was built around the key themes. Within these themes, different levels of codes were constructed. After this the two investigators performed a second round of reviewing transcripts using the last categorization and discussed the final results. We also did member checking, reviewing our results with a subset of our subjects to ensure we had accurately captured meaning.

Categories, Themes, codes, and quotes are used together to guide the summary and interpretation of

the results. Quotes are expressed in English but were translated from Spanish.

RESULTS

DEMOGRAPHICS

All the recruited subjects participated in the study. We interviewed a total of 12 PCPs. Of these, six were from the department of family medicine and six were from the department of internal medicine Of the 12 subjects, six were female and six were male. Seven subjects had more than ten years of work in their specialties, while five had less than ten but at least three years since they completed their residency training. Table 3 shows the characteristics of the subjects.

Total PCPs	12
Family Medicine PCPs	**6**
Females	4
More than 10 years since grad.	4
Internal Medicine PCPs	**6**
Females	2
More than 10 years since grad.	3

Table 3. Participants characteristics

SYSTEM USAGE

During the study, information pearls were shown 683 times to study participants. Of these, subjects accessed the information 97 times (14.2% of the total number of exposures to information pearls).

Participants clicked on the information pearls and accessed at least three different types of content during the study duration. Figure 3 details the number of information pearls shown to and accessed by participants.

Figure 3. Information pearls shown and accessed by participant

We obtained 2 hours and 55 minutes of recorded audio that was transcribed to 12 different electronic documents that were then used for theme analysis. The mean interview length was 13 minutes with a range of 7 - 24 minutes.

A description of themes and selected quotes from participants are described in this section. These themes are summarized in Table 4.

Use and willingness to use the system:

One of the themes related to acceptance was the use of the system and the willingness to use it. We assessed system use with direct questions and answers were validated via audit logs.

Acceptability of the system

Use and willingness to use the system

Values

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Respect of the individual specialties learning styles

Incentives

Content as a component

Barriers

Facilitators for the use of the CME system

Table 4. Themes emerged during interviews.

All the participants indicated they used the system. When subjects were asked why they used it, they cited curiosity of the new functionality in the EHR, as well as the request from the investigator as reasons to use the system.

"Just out of curiosity, I started to enter my other patient records to see if there were more and different information pearls"

Almost all participants mentioned that it was very easy to access to the information rapidly. One of the physicians also said it was very useful.

"It was very easy to access… very nice, very easy to read, and very fast"

Another domain related to the use of the system was the recall of the information shown to the participants. For this participants were asked to describe at least one of the pearls that they had read during a patient encounter. All participants could recall the information they read on the system.

Values:

The value participants afforded to the CME system was another factor that emerged in the

interviews. We felt that this factor was related to the acceptability of the new system. One value physicians noted was that reading clinical information from the EHR imparted a sense of trust related to the process of development of the information pearl.

"I think that reading the information there [in the EHR] gives you more confidence knowing that there were previous filters, the information was evaluated and there was a level of supporting evidence".

One of the factors mentioned by participants was the time that they needed to spend searching for scientific information. Having the information in the same screen that they were using was appreciated by the study participants.

"It is good because you can find what you are looking for very quickly, whereas if you need to go to 'Up to Date' [another application] or Pubmed or any other webpage you need to spend more time; this is very fast."

Respect of the individual specialties learning styles:

One of the themes that emerged during interviews was related to the educational impact of the CME system. Almost all the participants viewed the CME system as a helpful tool in their learning activities. One of the subjects mentioned that the CME system was useful but not for him, but did feel that medical residents and students could find educational benefits.

"I do not think I would find much educational value but for a medical resident in their second or third year of training, they would be very thankful for this. For me it would be a refresher for a topic, but I think the information is too general."

Another participant mentioned the fact that the content in the information pearls was congruent with the learning styles of individual specialties

"One thing that seemed important to me is how the material was written, it is not the same as reading Up to Date, this was created locally, and physicians here know and speak the same language as me"

Content:

To avoid any controversy regarding the validity or accuracy of the content, we decided to only include information with a high level of evidence. So the 21 information pearls available for this pilot phase were all class A and B recommendations from the US Preventive Services Task Force (USPTF). But this decision had unintended consequences in that some participants thought the content was too basic, causing them to doubt the usefulness of the CME system as an educational adjunct.

"The system has very basic suggestions for improving my knowledge in general. It has information that I already know, for me it would be more useful if the system could show me pearls with data that is not so simple, not so…. basic"

Another issue related to the content was the repetition of information shown by the system. Participants could see the same information pearl more than once with different patients. This was mentioned by some doctors as a factor for not reading or clicking on the information pearl.

"I am tired of reading the Aspirin recommendation… most of my patients are healthy, and the rest of the pearls I read were too basic"

Barriers:

One of the questions during the interview was designed to capture features that the participants thought were not helpful, or that the system should show in a different way; things that they would like to change. Subjects' comments were typically related to the design of the interface. One participant pointed out that the CME button was not very easy to recognize, and that it was too small. One of the users even mentioned he would like to have something more intrusive to give him advice.

"I don't know… maybe having something more alarming, not the kind of thing that appears in front of you… but something that calls my attention…"

Facilitators for the use of the system:

A positive aspect of the format in which the information was shown was that there was space within the pearl for a link to the original source of the information, e.g., the USPTF Web site. Some doctors also mentioned that they liked having the possibility of printing the material to read after their workday.

We wanted to know if the CME system and the idea of receiving educational information could affect the patient-physician relationship. However, we did not obtain any negative comments about this aspect. Almost all participants thought the system was concise and easy to read, without interfering in their workflows. PCPs at HIBA have been using the EHR for more than ten years and they explained that sometimes they show the information available in the screen to the patient. One of the participants explained how she used the information pearl to emphasize an indication to a patient.

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"I think this is one of the utilities of the system, being able to show the information pearl to a patient. I like patients to see the information they have in the electronic record. I was with a high risk patient and I showed her the pearl".

Incentives:

One of the physicians mentioned that receiving an extra incentive could help in the adoption of the CME system. Awarding physicians CME credits that they can then use for the specialty recertification process or at least as an internal incentive within their department would be appreciated by them

DISCUSSION

The findings from our study help us to understand how a CME system embedded in an EHR can be accepted by PCPs and used during the patient encounter. All physicians recruited for this study used the system and almost all of them agreed in its usefulness as a strategy to promote continuous learning. Participants appreciated the manner they receive the information, but they mentioned some limitation in the content presented by the system.

Physicians in our study also mentioned the ease of use of the new system. They mentioned a perception of usefulness in the system as an educational strategy. These two factors can facilitate the adoption of the system as it has been described in the Technology Acceptance Model (TAM). This theory states that an information system will be used if the user perceives value in the system and ease of use.[21]

The use of technology in medical education is well described[22] but the use of a clinical system to provide clinicians with contextual information with the aim of continuing medical education is not. There are scientific reports in the literature about the effectiveness of clinical decision support systems, but when the learning effect was assessed, positive results were not found[23] An important point to mention is that those systems were not designed to support CME, they were meant to change behaviors, but not necessarily to change knowledge. In our study, the CME system was designed to improve knowledge.

We can compare the use of our system with a similar implementation with physicians accessing educational and patient information during clinical care. Rosenbloom et al. found a 0.07% rate of accessing the information,[24] a much lower rate than the one we found in our study (14.2%).

An important aspect to mention is that in our study all participants were asked to use the system, potentially overestimating the long-term use of the system. A long-term evaluation is needed to estimate whether this level of use would persist.

One of our findings suggested that some physicians preferred to receive the information at the time they added a new diagnosis or problem in the problem list or while ordering a test. This is in line with the context-aware information tools described by Del Fiol et al. and the use of Infobuttons with physicians' information needs.[25]

Another important fact mentioned by our participants in the study, which has been previously described in the literature is the benefit of having a system that respects the specialty learning styles. This was found by Tunis et al. in a paper published in 1994.[26]

LIMITATIONS

One of the main limitations of this study was the short period of time of physicians using the system. As the study was designed as a proof of concept of the CME system we developed, we would need to evaluate the real use of the system for a longer period of time for more definitive assessment of usage.

We only assessed one institution, an academic center, and tested the system only with already trained physicians, i.e. we excluded medical residents. We only performed the evaluation in the ambulatory setting, so we do not have information about the function of the system in the inpatient setting. Another limitation is that we only evaluated two medical specialties while there are more than 40 different medical departments at HIBA. However, these two medical specialties are the ones that account for most of the visits with more than 55% of all ambulatory consults.

The content available in the system was another limitation, with only preventive care type of information pearl with high level of evidence. We will need to perform another evaluation with more specific and advanced content in the system.

As a qualitative study there are some limitations implicit in this methodology, however, we tried to diminish them by the use of different strategies to rigorously enhance trustworthiness like reflexivity, triangulation, saturation and member checking.[27]

FUTURE WORK

As were proposed by the study participants, we will need to make some modifications to the system, e.g., adding new and more diverse types of content. Having updated and useful information in the knowledge base of the CME system is a challenge on which we need to focus in order to improve physicians' perception of the system.

One of the new evaluation strategies will be to test the system in other settings and with other types of clinicians. We are working with a group of physicians to implement the system in the inpatient setting, exposing the system not only to attending physicians but also medical residents. We are also evaluating adding more medical specialties. As another needed change to the system, we will need to establish a latent time during which the information pearl is not seen once it was read. As it was suggested in the CME evaluation model we will have to perform an effectiveness evaluation, aiming to determine if it changes physician knowledge, which is the ultimate objective of the system.

CONCLUSION

The delivery method of CME system developed at HIBA was well accepted and study participants perceived it as a useful and easy to use. We will need to perform several modifications with special focus on the clinical content available in the knowledge database. We will also have to extend the scope of the evaluation to get different users' perspectives and insights.

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Recruitment email letter in Spanish:

Estimado Doctor:

El presente coreo electronico es para ofrecerle la posibilidad de participar en un estudio para evaluar una nueva funcionalidad en la historia clinica electronica (HCE). Durante la consulta clinica la HCE le ofrecera informacion basada en evidencia que sera especifica a las caracteristicas del paciente con el que usted se encuentra. Usted podra elegir leer la informacion o no. Luego de 2 semanas de utilizer el sistema lo volvere a contactar para cooordinar una entrevista para que pueda explicarme cuales son sus opinions con respecto al sistema. La entrevista no durara mas de 20 minutos y la informacion que me brined sera no identificada

Muchas gracias por su colaboracion

Damian Borbolla, MD

Recruitment email letter in English:

Dear doctor,

I am sending this email to offer the possibility of participating in an evaluation study of a new functionality in our electronic health record (EHR).During the patient encounter you will have the possibility of reading evidence based information specific to your patient. You can choose to read the information or not. After two weeks of using the system I willcontct you again to coordinate an interview where you will explain me what are your thoughts about the system

Thank you very much for your collaboration

Damian Borbolla, MD

Interview guide in English

1. Please could tell me something about one of the information pearls you read?

2. Did you use the CME system?

3. Can you remember the motivation to open and read the information pearl?

4. Do you think that the information your read was relevant to daily practice?

5. Do you think that the information provided by the pearls can help you to solve an information need?

6. Do you think that CME system is useful as a continuous medical education strategy?

7. Do you think that using the system during patient encounters can affect patient-physician relationship?

8. What are you thoughts about the system in general?

9. Do you have any proposals for change, something to improve in the system?

Interview guide in Spanish

1. Por favor podria comentar alguna de las perlas de informacion que haya leido y recuerde?

2. Uso el sistema?

3. Recuerda que lo motive a abrir y leer la perla de informacion?

4. Le parecio que la informacion era relevante para la practica diaria?

5. Le parece que la informacion proporcionada por las perlas resuelve un problema o cubre una necesidad de informacion?

6. Le parece que puede utilizarse como herramienta de educacion medica continua?

7. Le parece que el uso del sistema puede tener algun impacto en la relacion medico-paciente?

8. Que le parecio el sistema en general?

9. Tiene alguna propuesta de cambio, algo para mejorar?

A<small>PPENDIX</small> C:

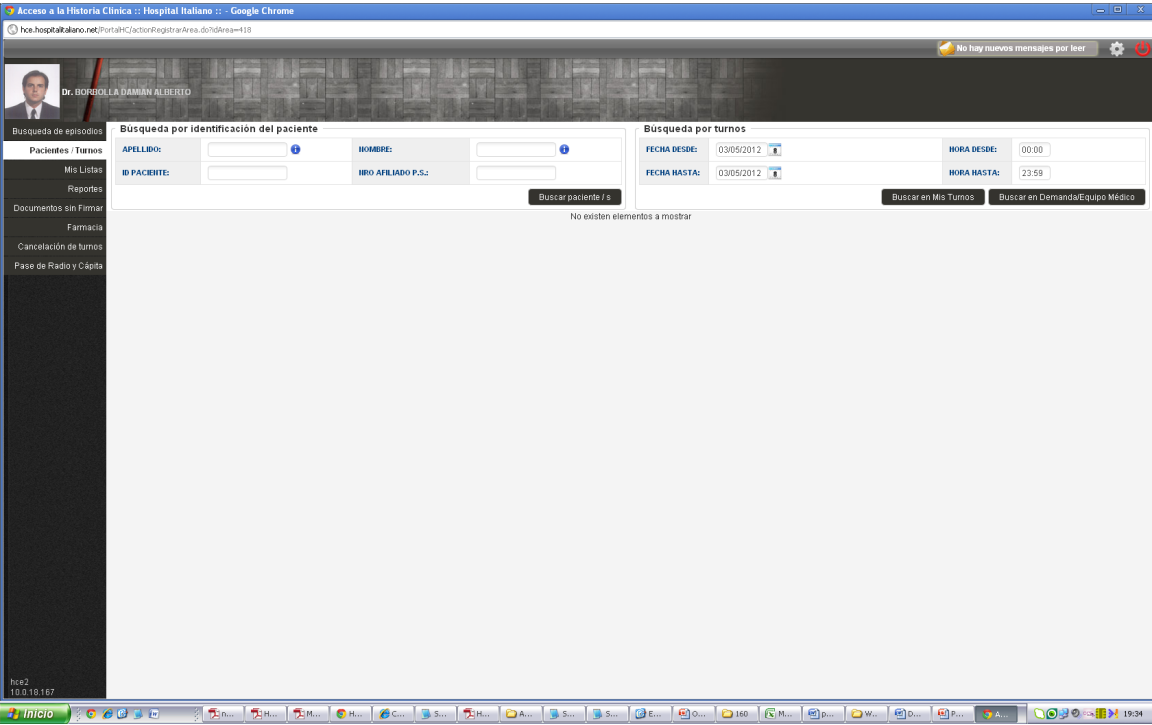**HIBA electronic health record and CME system screenshots**

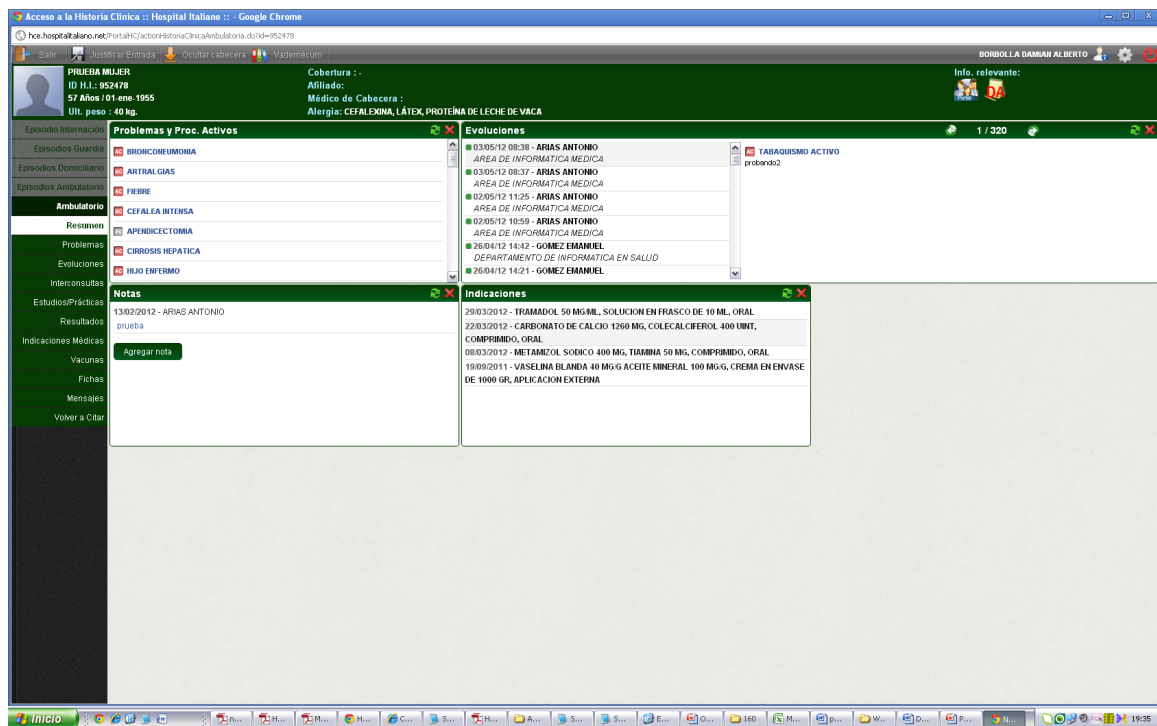Image 1. Main screen HIBA's EHR.
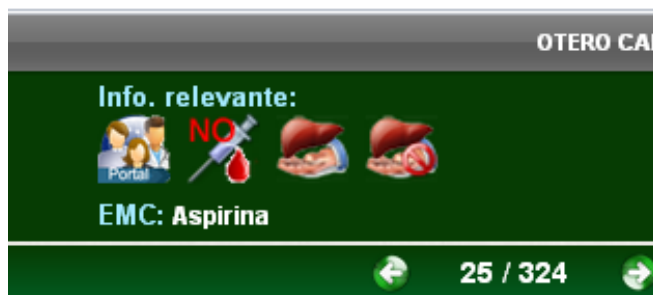
Image 2. Summary screen

Image 3. How an information pearl is visualized in the summary screen

Aspirina cuando el beneficio de reducir el riego de infarto de miocardio supere a los riesgos de hemorragia gastrointestinal

Se encontró buena evidencia de que la aspirina disminuye la incidencia de los eventos coronarios en pacientes con riesgo aumentado de enfermedad cardiovascular y de que aumenta la incidencia de sangrados gastrointestinales (aumenta la incidencia de eventos hemorrágicos). El balance entre beneficios y daños es favorable en pacientes de alto riesgo de eventos coronarios .

Fuentes : USPSTF

Creditos : ★★★★

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☐ Realizar comentario:

Registrar

Image 4. Information pearl