

Electronic Medical Referral System: a Forum-Based Approach

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Abstract— In the medical field, it is common practice for physicians to refer to and consult one another to complete patients' medical treatment. The transfer of a patient from one physician to another is termed a referral. Medical referrals are not straightforward; a successful referral requires finding an available physician with the proper specialty. The focus of this paper is to understand the workflow of the referral process in Canada's public healthcare system, and propose a health informatics system to move the referral process into electronic form. The solution involves a forum-based approach that provides a common communication medium for healthcare professionals involved in the referral process.

Keywords- *Medical Referral, Health Informatics, Forum, Records Management, Referral Systems, Referral Note.*

I. INTRODUCTION

Modern Canadian medical practice has generally evolved into two main streams of practitioners: general practitioners (GPs) and specialist practitioners (specialists). In most cases, GPs are the first practitioner a person encounters when seeking medical attention – this is especially true in non-emergency situations. The GP therefore must deal with a wide range of medical problems, have a broad knowledge of all areas of medicine, and be able to identify commonly occurring diseases and pathological conditions. A GP is able to isolate a patient's problem, identify the causal conditions, order tests to refine a diagnosis, write prescriptions for treating conditions, and provide general advice to the patient on how to deal with their illness. Being faced with the whole gamut of medical problems, a GP often does not possess the special skills or tools needed for a given sub-discipline of medicine of the technical kind, such as a single needle biopsy or open heart surgery; or the diagnostic kind, such as refining the exact diagnosis of an arthritic condition.

A GP that acquires special technical or diagnostic skills to deal in greater depth with sub-disciplines through years of additional study and apprenticeship becomes a medical specialist. A patient often does not know which specialist he or she should seek out. The most common route to a specialist is therefore through referral from a GP. Exceptions to this do occur in emergency situations, such as cardiac arrest, broken bones, and so on.

The details of the referral process vary from one country to the next. In some countries, a patient may access a consultation with a specialist without referral from a GP, and in other countries the GP is the sole gatekeeper. For example, under the current Australian and Canadian healthcare systems, a patient must obtain a referral from his or her GP to see a specialist. This paper addresses this type of referral process where the GP is the gatekeeper.

In Canada's public healthcare system, the referral process is completed mostly through the use of phone calls and fax machine transmissions. With growing city populations and skyrocketing healthcare delivery costs, there is an urgent need for the adoption of technology to aid in the process of handling the many referrals dealt with daily by healthcare professionals.

Our research group at the University of Calgary, presents the Electronic Medical Referral System (EMRS), designed with a common goal to reduce referral wait times for patients and promote communication between medical providers. We believe a state-of-the-art EMRS will cull the inefficiencies of the current referral process, reduce wait times for specialists, and address cost-cutting issues. The primary task of our EMRS is to aid GPs in accessing and locating an available specialist with a profile that matches the patients' needs as soon as possible.

Our software solution provides records management functionality, communication mediums, scheduling tools, reporting abilities, status alerting, and monitoring capabilities. Healthcare professionals will be able to communicate with each other via the EMRS while managing and monitoring referrals in process. EMRS will provide referral status updates and appointment alerting to involved parties to reduce the chance of missed appointments. Transmission of reports and multimedia files relevant to the referral will also be handled by our proposed EMRS. By managing referrals electronically our system provides the opportunity to generate potentially valuable statistical reports and data mine emerging trends regarding medical referrals.

We will take a look at our system's forum-based approach after detailing the current referral process and its shortcomings.

II. THE REFERRAL PROCESS

A referral may be defined as *the movement of a patient's medical care from one physician to another*. The process used to refer a patient has a significant effect on the utilization of medical resources and the quality of care a patient receives [1].

The GP's execution of the referral is very important to the patient's quality of care. The primary tasks involved in the transfer involve the GP's selection of specialist and the inclusion of an adequate referral note, detailing at a minimum the reason for the referral [3].

The initial process of referring, for the GP, is to know whether or not to refer a patient. This decision is based mainly on the GP's confidence level with respect to treating a patient's illness. Other factors involved in the decision-making process include patient demographics such as sex, age, and disabilities. A GP's background, practice, and community also impact the referral decision. With increased levels of education and experience come better decision making, but other factors such as a GP's participation level in the medical community, their practices organization, and the community demographics surrounding their practice all play a role in deciding a referral [1].

The specialist to whom a referral is made in today's system largely depends on who the GP knows, their past experience referring to the specialist, and the medical community's perception of the specialist's ability [1].

In Canada's public healthcare system, referrals are typically mitigated via phone and fax transmissions. Patients typically have little control over the handling of their transfer between physicians. Following is a fictitious scenario of a patient going through the referral process.

III. A REFERRAL EXAMPLE

The patient, 54, was diagnosed with hypothyroidism by her GP at approximately 40 years of age. She has suffered occasional outbreaks of psoriasis and is under the care of a dermatologist.

About 18 months ago, she developed an inflammation of the left eye and booked an appointment with her GP. Upon examination, her GP decided to refer her to an eye specialist and had her medical assistant contact the office of Dr. Ash, an ophthalmologist and eye surgeon. Dr. Ash's medical assistant advised her that the first available appointment would be three months away. The referring GP instructed her assistant to try other ophthalmologists, and after some phone calls, an appointment two weeks away was scheduled with Dr. Go.

Dr. Go examined the patient and determined she had a 5mm orbital proptosis. He ordered a CT scan (head/neck), and an ultrasound of both eyes. These were scheduled by his assistant and communicated to the patient via phone and mail reminders. Results were inconclusive, however, and another specialist, Dr. Cost, a neuro-ophthamologist, was consulted. Dr. Cost ordered further testing, including a CAT scan (full body), MRI, and lumbar puncture. (A biopsy was recommended but the patient declined.) After much deliberation and discussion

among the doctors and patient, no conclusive diagnosis was determined and it was agreed that the patient was suffering from some undetermined inflammation. Dr. Go felt that the patient's eye inflammation might be a result of her thyroid condition and referred her to another specialist – again, Dr. Ash.

Dr. Ash was of the opinion that the patient was suffering from Graves Eye Disease and that no treatment was required – to simply wait and see, as this condition sometimes runs its course and improves over time – usually within 12 months.

The patient's GP decided to refer her to an Endocrinologist. This specialist saw the patient three months later and ordered a TSH receptor antibody test. Six weeks later, the patient was called back to review the results of the test, which dismissed the Graves diagnosis and any thyroid connection to the eye inflammation.

The eye inflammation had been improving gradually after 18 months. Further follow-up appointments were booked. Each physician's assistant had or would contact the patient for each of these appointments. The patient informed each physician of her history of psoriasis, hypothyroidism, and joint pain and is now in the process of getting a referral from her dermatologist to a rheumatologist to determine if her joint pain is a result of psoriasis (i.e. psoriatic arthritis), and possibly connected to the "inflammation" theory regarding her eye.

The above referral example illustrates the requirement for repetitive information exchanges occurring between GP, specialist(s), healthcare professionals, and patient. Often information exchanged is incomplete or inaccurate due to miscommunication [2]. The challenge in establishing contact among parties can result in delays that may affect the patient's treatment and eventual outcome.

The major issue with the current system is the potential for communication breakdown between participants, especially in the above example where several physicians were involved. GPs indicate that their biggest problems with the current system is the time required to establish initial contact, poor response times from specialists, and the time required to create adequate acceptable referral notes [2]. Specialists report their biggest issues with the current system are a lack of timeliness of information from GPs, and a lack of clarity and consistency of referral note content [2]. This lack of standard practice and unclear expectations between GPs and specialists contributes to the shortcomings of the current system.

Often the patient is the one to communicate information between doctors – in the above example, the ophthalmologist specialists were not connected to the dermatology specialist. Current methods of communication, paper notes, telephone calls, and fax transmissions, often break down during the referral process and are difficult to track, record, and retrieve. The current system of referral record keeping is archaic, labour intensive, fallible, and inefficient.

IV. THE ELECTRONIC MEDICAL REFERRAL SYSTEM

Our group at the University of Calgary, comprised of members from the Faculty of Medicine and Computer Science,

has been meeting along with representatives from Alberta Health Services to explore an EMRS solution for over a year. Following this collaborative process, a consensus has been reached to propose a health informatics system with a forum-based approach that will address the issues faced by all parties in the current referral process.

Early web-based forums date back to the early 90s. From a technological standpoint, web-based forums are applications that manage user-generated content. A sense of virtual community often develops around web-based forums that have regular users sharing common interests. The forum allows users to post messages to one another asynchronously. A forum differs from other online communication mediums, such as chat rooms and instant messaging, in that forum messages are archived in a central location.

A Forum is organized in a directory tree structure consisting of topics, commonly referred to as “threads”. A Thread is defined by a title followed by a description that summarizes the purpose of the discussion. Within each thread is a collection of posted messages displayed in chronological order. A Forum “Post” is a message submitted by a user that includes his/her profile details and the date and time of the post. Users are usually authorized to edit and delete their posts. Also, users of a forum share different access levels that control the visibility of their posted messages.

There are three different classes of Forum users: Members, Moderators, and Administrators. Most users are Members who can post messages to threads. Moderators are responsible for regulating discussions and maintaining forum etiquette. Moderators have access to all posts and all threads in their area of responsibility and answer members’ questions and respond to member complaints. The Administrator governs technical details required to keep the forum site running. They will

assign class roles to users, create threads, and perform archival tasks such as database backups.

A Forum site dedicated to referrals would allow GPs, specialists, and their support staff to communicate openly and in a timely manner. The forum, as an information exchange medium, should alleviate the current break-down of communication occurring between GPs and specialists. The forum also acts as a bulletin board allowing specialists to post their requirements for referral notes, enabling GPs to create and submit acceptable referral notes.

A referral forum allows members to communicate information regarding the referral from start to finish (see figure 1 below). When a GP initiates a referral he creates a thread. A specialist accepts the referral by posting a message to the thread. Subsequent posts may include information exchanges between GP, specialist, and staff. Examples of such postings include: appointments, referral note requirements, and consulting reports.

The EMRS will also help in preventing the reward/punishment scenario [1]. That is, a GP’s decision to refer a patient in such a way to reward or punish a specialist. This type of activity can be prevented if referrals are recorded and data-mined to produce statistics on GPs’ referral trends.

Other envisioned advantages include intelligent matchmaking of GP and specialist based on historical information stored by the EMRS; exposing relevant information to the patient electronically, such as appointment times and test requirements; facilitate discussion between specialists and allow for online consultations; provide a knowledge base for data mining; and generating statistical reports. The EMRS will also provide healthcare workers with directories including contact information, specialty preferences, and specialist wait times.

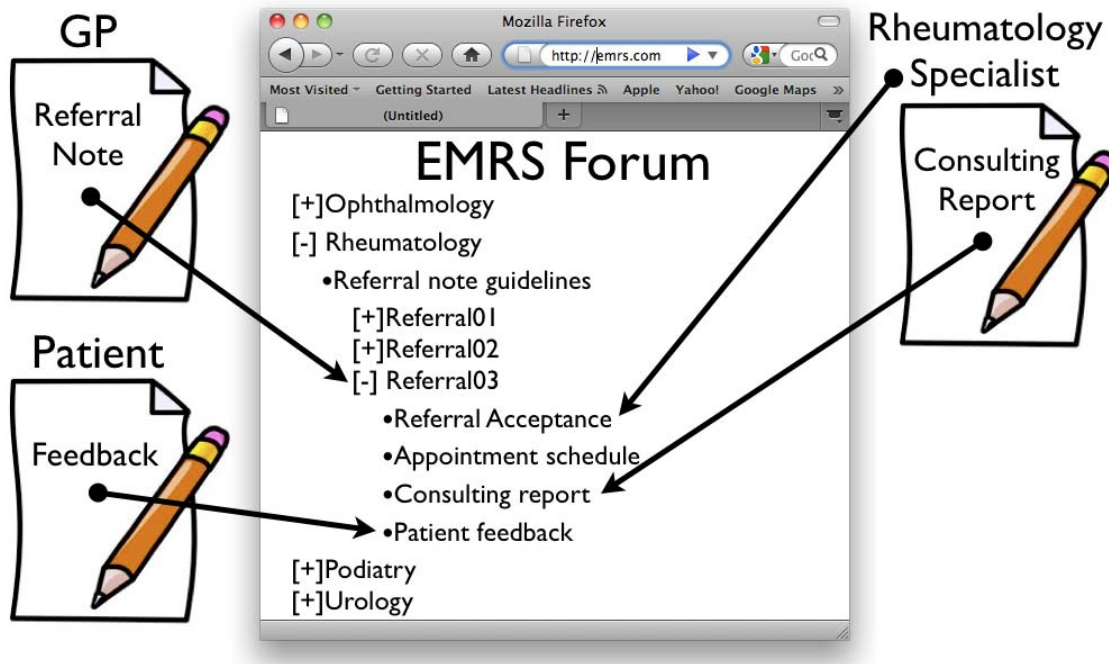


Figure 1. EMRS referral process flow.

Privacy policies guarding patient and physician could be improved by the EMRS, ensuring that members access only information they require to perform their role in the referral process. For example, a GP or specialist may need to see all the information in a patient's referral, but healthcare staff may only need to be aware of scheduling information. The EMRS would allow these kinds of privacy settings to be made.

Following are two screenshots of our EMRS. Figure 2 displays an example referral thread with several messages posted between GPs and various specialists involved in the referral case example used in section III of our paper.



Figure 2. EMRS referral thread.

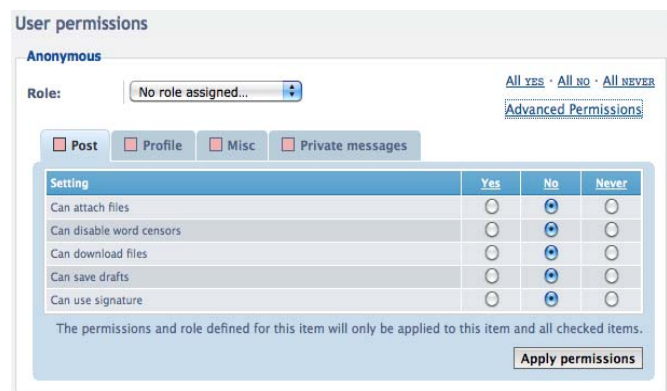


Figure 3. EMRS user permissions control

Figure 3 illustrates a subset of basic permission settings the EMRS administrator can control to achieve privacy policies.

V. CONCLUSION

Both GPs and specialists agree that the biggest problems in the current referral process are due to breakdowns in the lines of communication. It is easy to see why when fax and telephone transmissions are the primary communication methods used in referral information exchanges.

Our research group believes an EMRS structured as a web-based forum will increase the quality and efficiency of communication. These benefits should in turn alleviate communication error and redundancy.

Web-based forums are used in a variety of professional disciplines to exchange information and gather intelligence. For example the US Security Exchange Commission (SEC) operates a forum to discuss financial regulatory issues. Politics, sports, news, and technology are popular forum subjects that receive thousands of visitors a day.

The openness of a forum provides flexible workflows, disseminating current information to all parties involved in the referral process. The intelligence gathered from recording referrals could provide automated guidance to GPs seeking a specialist's attention. Physicians could use the system not only to exchange patient information for referral purposes, but also to share ideas on diagnosis, prognosis and treatment.

VI. FUTURE WORK

Our research group has developed an EMRS forum application. We are currently in the testing and documentation phase. On the horizon we hope to see our application implemented for testing at medical centres in Calgary, Alberta, Canada.

Our group anticipates producing a technical article detailing the EMRS in the near future. After first-round tests of our application are complete, we intend to publish a discussion of our results along with feedback from the medical community evaluating the EMRS.

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