Examination Portability

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SUMMARY – Truly global radiology would exist if patients could visit any European physician without their CDs or films. It would be possible for patients to go to a hospital or a clinic in any European country and have their examinations done in a different country, analyzed and eventually compared with the examination done at that hospital. This paper analyzes two national projects that should be documented and analyzed: Scotland with a national archive with radiology images and Finland which is implementing a system that will create an online personal health record of the citizen with all health-related information. This possibility would improve quality in European radiology and create a true network of images and knowledge that can be the seed to improve efficiency by reducing costs and exposure to radiation and increasing knowledge sharing among European radiologists/neuroradiologists. We present here the idea of a network between three centers in three different countries that can be the start for a global project.

Introduction

Information technologies are currently being used as a way of improving procedures, leading to a higher efficiency in workplaces and easier lives for people. The healthcare sector has not fallen behind this digitization wave, and a growing number of hospitals and other practices are using digital systems to store patient records, prescribe medications, and among many other things, to produce and store results for a wide range of examinations across several medical specialties. This digitization has had a significant impact on radiology facilities, where previously film-intensive examinations are now increasingly implementing picture archiving and communications systems (PACS) to become completely digital, with all the benefits that it brings in terms of availability for both patients and physicians, storage space, reduced costs, and of course by allowing for new practices like remote reporting, specialist consulting, second opinion and e-learning.

However, most hospitals (or groups of hospitals under the same administration) are undergoing this digitization process on their own, with little to no integration between the systems of hospitals under different administrations. Despite a better situation than in the past, this does not reap all the benefits that current technology allows. The current information age demands integrated systems, used by all service providers in a geographical area, so that an image produced from a radiologic examination done in any hospital or imaging center in that area may be easily accessed by any practitioner who needs it to diagnose the patient, wherever he is.

There are some national projects where radiology images from all radiology facilities are sent, right after they are taken, being immediately accessible by every physician who needs them and turning this examination portability a real concept. However, this solution is far from ideal. The ideal solution would be to create a European digital radiology archive, where examination portability would be a reality at European level.
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Material and Methods

The most straightforward solution to implement radiological examination portability in a given region is to contract a PACS vendor to deploy its PACS (and maybe also its RIS) system in every hospital in that region, while also managing image storage. Several commercial solutions are available from major PACS vendors. Integrated PACS/RIS installations with storage management have been successfully applied in enterprise, cross enterprise, regional, and even the national archive in Scotland. This solution presents the additional benefit of having the same tools and interfaces in every imaging facility, enabling the mobility of medical personnel among facilities, as the cost of learning how to use a new system is eliminated.

But when hospitals already have different PACS systems in production, installing a new PACS and RIS system to be able to connect to the centralized archive may impose somewhat redundant costs. Furthermore, hospitals may have different preferences for different PACS vendors, and it may be difficult to impose the same PACS system for every hospital, mainly if the costs of such system are not borne by some state authority. If that is the case, we need to make the systems of different vendors communicate. But integrating the many systems from many different vendors that are in production at every hospital in a given region (especially if the region is as large as Europe) is a cumbersome task, which will require a lot of time and money. This kind of integration is largely facilitated when we have a standard on which we can rely. In that way, PACS systems only have to be adapted to comply with that standard. The best alternative is to use the IHE (Integrating the HealthCare Enterprise) integration profiles, namely the Cross Enterprise Document Sharing for Images (XDS-I.b) profile. Many PACS systems are now ready to work with IHE integration profiles and new tests are conducted every year in European and American Conectathons, a testing event organized by IHE to test interoperability between different PACS systems that sees the participation of almost all PACS vendors.

This profile defines standards for sharing documents and images, based on DICOM, EbXML, HL7 CDA, among other widely accepted standards and detailed technical frameworks, and testing tools are available to PACS vendors in order to facilitate adaptation of the systems to comply with IHE integration profiles.

In XDS-I.b the Imaging Document Source, anyone who wants to share an examination with all the users in the examination portability network uploads a DICOM manifest (with information about the DICOM files that are to be available, together with their storage location) along with metadata (description of the information that is to be shared) to the document repository that in turn registers it in the document registry. An imaging document consumer wishing to access any study queries the document registry and retrieves the DICOM manifest from the doc-
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Figure 3 Actors and transactions of the XDS-I.b integration profile.

Thus, we believe a central national server would be possible to implement with the right commitments from the state (it was implemented in Scotland, so at least for countries of similar size there should be no unsolvable technical difficulties). Nevertheless at a European level a more realistic solution would be to retrieve the images, whenever they are needed, from the national, regional, or even individual hospital data centers.

Another key issue in the implementation of examination portability is patient identification. One must find a way to make sure the right studies are being associated with the right patients. The obvious solution is to use a number that is both unique (two persons may not have the same number) and universal (every beneficiary of the health system has one). To implement its national radiology archive Scotland had to create a new number: the Community Health Index (CHI), which acts as a primary identifier in the system. A European card that meets the two conditions specified above does not currently exist. The creation of such a number involves great commitment from the European and National health authorities, and it is likely that its creation at a European level will be difficult.

An easier alternative is to use national health numbers, although this is not straightforward. Some countries may not have unique universal health numbers (different subsets of the population may have health numbers in different formats, depending on their health system, and consequently the uniqueness of a given number may not be ensured). However it is still easier to create a unique patient identifier within a country, as Scotland did, than at a European level. Then patient identification in the European system could be accomplished by preceding the national health number with a two letter country code, like the ISO 3166-1 alpha 2 country codes that are the ones used (with a few exceptions) as Top Level Domains in the Internet Domain Name System (PT for Portugal, ES for Spain, IT for Italy, and so on).

Some alternatives exist, although each has its own drawbacks. National citizen numbers may be used. However, an alternative must be found for patients who although residing in the European Union, and therefore, using the health systems in Europe, do not have European Citizenship. Cell phone (with country code) or International Bank Account Numbers could also be a possibility, although again, they are not universal, as not everyone has a cell phone or a bank account.
As a last resource, if none of the alternatives above can be implemented, finding the right patient could then be done with the help of IHE Patient Identifier Cross-referencing (PIX) and/or Patient Demographics Query (PDQ) profiles. A protocol created in the framework of the Artemis project, called Patient Identification Protocol (PID protocol) may also be used. This protocol resembles the joint use of PIX and PDQ but introduces new privacy concerns. This integration profile can help in patient identification by crossing referencing individual hospital’s patient numbers with a master patient number or by using demographics (name, birthday, address, among many others) to identify the examinations associated with a given patient.

Privacy is also a major issue in building such a system. And when we go for a European project, we have to take into account that privacy and electronic data access laws differ among European countries. It is not the purpose of this paper to review all privacy laws in force in Europe, but we believe the way Finland solved this problem should be enough to comply with all regulations in the European Union. On a first level, patients may choose what information they want to be visible in the archive. On a second level, doctors must obtain patient consent before accessing the patient health record. All accesses are logged and visible to the patient, and if the patient detects suspicious activity (accesses that he did not authorize) he may file a complaint and penalties may be imposed on infringing physicians.

Finally, the success of such an archive will be highly dependent on the participation of all hospitals and clinics with radiology facilities, both public and private. The best way to ensure that is to create legislation that compels the use of the European Network of Examination Portability, as Finland did with its archive system. With such legislation, hospitals know that their efforts to comply with the requirements and to enter the network will pay off, as all other hospitals will also be joining, which will allow for the realization of the benefits described in the previous section.

Technical Test

To test the technical feasibility of the portability system we conducted a technical test with the help of Siemens HealthCare. A patient did three examinations in three different hospitals in three different countries. The examinations were then sent to a middleware. It was possible for three doctors, one in each hospital in which the test was conducted, to access the examinations promptly.

Results

Although this kind of portability is yet to be implemented at a European level, there are some national projects that deserve to be mentioned, and should be viewed as examples for a future European project.

One such project is the Scottish National Radiological Archive that serves a population of five million and handles 3.8 million new radiological studies every year. Right after a patient is scanned the images are uploaded into the central data centers (two redundant datacenters ensure data safety and availability). The managed storage of the project is two petabytes.

Workstations have been installed in the hospitals where nearly 20,000 authorized doctors may access the system. With a common user interface, they have access to the same functionalities and can view all the radiology examinations stored in the system regardless of where they were generated. Radiologists may also access the system at home, using a virtual private network. Data are downloaded in a fast smart way (first, compressed images are displayed to find major abnormalities. Then the rest of the data start downloading with highest priority for the areas the physician is looking at).

Primary patient identification in the system is done through the Community Health Index (CHI), a unique number that was created specifically for this project. Only examinations associated with a valid CHI are entered into the system.

Finland also recognized the benefits of having patient information stored and readily accessible. It is now building an archiving system for the healthcare data of all its 5.3M citizens (eArchive). The system, which is estimated to reach 500 Petabytes of storage in the next decade, is valued at approximately € 20m and will serve 300,000 professionals within the Finnish public healthcare and pharmacies as well as private medical clinics.

The eArchive will allow for information exchange among healthcare providers. It will have all the information produced by local health records, as well as coded core information (diagnosis, medication, procedures, medical risks), medical record texts, nursing information, laboratory and pathology test results,
radiology and endoscopy images (although in the first phase of implementation a more limited set of information will be available).

Citizens over 18 years of age will be able to access the information stored in their personal medical records as well as limiting the type of data available to physicians. The system is expected to enhance data protection beyond the standard of paper archives as an electronic consultation of a record leaves a mark on a log, which citizens may access to monitor who is consulting it and can file a request for clarification in case of unauthorized data consultation.

The eArchive is legislated to be mandatory by 2011, together with electronic prescriptions (ePrescription). The ePrescription program is expected to bring economic benefits of around €10 m in the coming decade, in addition to speeding up the processing of prescriptions, reducing errors and making the reimbursement system more efficient. The benefits of the eArchive are also expected to be significant, although harder to quantify.

Discussion

Examination portability would ensure that doctors anywhere in the portability region (even from home), with the appropriate access rights, can view images and reports from patient's radiological studies anywhere. Fast and reliable access to current and past radiology images is crucial to provide the most accurate diagnosis, to quickly ask for a second opinion or to decide on a transfer. And to have that fast access to the radiology studies, nothing is better than having the examinations at the distance of an internet connection. Most hospitals with digital imaging systems now give the images to the patient in a CD format that can be taken when he goes to a different doctor. However, for a multitude of reasons (an unscheduled doctor visit due to an emergency being a striking example), CDs may not be available when they are needed. There can also be some compatibility issues, or difficulties in handling the images in the viewing software that comes with the CD. This can lead to an unnecessary repetition of an examination, to a request for the patient to come back another time with his past examinations, or even to a report or a diagnosis being produced without taking into account past examinations, which may result in an inferior diagnosis to what would otherwise be possible if the physician had access to all the relevant information. The image archive, with radiological studies always available where they are needed will therefore allow for better and faster patient care, through a faster and more accurate diagnosis, faster access to specialized medical attention and treatment, which ultimately will lead to greater satisfaction on the part of the patient, which is a primary motivational force for the physician. If an examination is avoided due to consultation of past examinations available in the archive, patients also benefit from the lower dose of radiation and they save the cost of doing the additional examination. As state financed healthcare systems are the rule in Europe, each examination repetition saved is a direct financial benefit for the public healthcare system, which can be an incentive for the adoption and financing of such a portability system. Indirect benefits for the state also come from the better health levels of citizens and the consequent gains in productivity.

These benefits are valid even for intra-country archives. But if this portability is implemented on a European level, these benefits will be available to the travelling patient and one may also expect additional benefits accruing from the collaboration of radiologists across countries. A portability system also presents unique opportunities for research projects, when the right infrastructure is put into place.

Conclusion

It is technically possible to create a European network of examination portability. However, there are key implementation issues that need to be tackled for this project to become a reality, and for that, a great commitment of European Authorities is required. A multidisciplinary European taskforce should be put in place to work with hospitals, patients, physicians, equipment and software suppliers, governments and European institutions in order to study the best way to implement examination portability. Participation of the European Society of Neuroradiology in this task force would be of great importance. Furthermore, it could contribute to the creation of a discussion forum with the objective of disseminating and discussing this idea with all interested agents so that in a few years, with the help of legislation that should be put into place to mandate the use of the system, this project can become a reality, improving healthcare in mobility for all European residents.
References


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