

Central IT-Structures for Integrated Medical Research and Health Care of Viral Hepatitis - Hep-Net

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Abstract

Hep-Net is a German medical research and health care network dedicated to viral hepatitis. Its many activities include basic and clinical research, training and public awareness, and rely on modern information technology and the Internet. One major component is a central registry for medical data, serum and tissue samples. In order to build this registry, important legal and technological issues needed to be addressed. Specifically, commercially available electronic data capture systems for clinical trials are generally ill suited for this purpose. The framework of the solution described here may be the basis for similar networks dedicated to specific disease entities or other phenomena.

Keywords:

Telematics, Web technologies, Patient privacy

1. Introduction

Viral hepatitis is one of the most common infectious diseases, worldwide. In Germany alone, nearly one million patients suffer from chronic viral hepatitis, an affliction that can lead to serious complications such as cirrhosis and cancer. In order to integrate and improve medical research and health care in the field of viral hepatitis, a network ("Kompetenznetz Hepatitis" or "Hep-Net") connecting medical research groups with physicians in hospitals and practices, was founded in the beginning of 2002 with the help of start-up funding provided by the German Ministry for Education and Research [1]. Its major goal is to enhance communication, both, between specialised research groups and across the tiers of the health care system. It serves the dual purpose of gaining new knowledge about the disease and its treatment, and of accelerating the transfer of new knowledge into the health care process. This is achieved through a wide range of activities carried out by Hep-Net, spanning from public-awareness activities, telephone hot-lines and web-based information resources for physicians and patients to clinical trials, long-term patient registries, and bio-material banks [2].

Many of Hep-Net's activities rely on modern information technology (IT) and, specifically, on the versatility and ubiquity of the Internet. The aim of the efforts described in this paper is to develop central IT structures needed to support the goals of Hep-Net and to sustain its activities. In addition to considerations of feasibility and practicability, special emphasis is placed on issues related to the protection of patients' privacy. The results may be useful for similar research and health care networks focused on other disease entities.

2. Methods

Patient privacy

With few exceptions, the capture, storage, and use of patient-related data in research-oriented settings is subject to regulation at the national and European levels. The common principles laid out in these documents (e.g., the Directive 95/46/EC of the European Parliament and of the Council) specify a number of requirements that must be observed wherever personal data is concerned. Among those that are of particular importance for medical information systems of the kind discussed here are:

- 1) the requirement for unambiguous consent (by the patient),
- 2) the requirement for an explicit, specific, and legitimate purpose,
- 3) the requirement for adequacy and relevance of the collected data items.

Unfortunately (from the viewpoint of a medical research and health care network), the latter two requirements are somewhat in conflict with the goals of long-term patient registries and bio-material banks. The very purpose of such long-term repositories – as opposed to databases for clinical trials – is to collect information and tissue or blood from a sample population at a time when the scientific issue addressed has not yet been precisely defined and the procedures that will be carried out have not yet been fully specified. Hence, when the patient is asked to consent at the time of sampling, the associated risks cannot be assessed. Following a very strict interpretation of the legal situation, this would entirely preclude even the possibility of giving consent. On the other hand, many scientific questions, including, for example, epidemiological issues, cannot be addressed in a practical manner without recourse to available samples collected over a long period of time. In order to resolve this dilemma, a consensus was sought between government officers responsible for privacy issues in public institutions (Beaufragte für den Datenschutz der Länder und des Bundes) and the Telematics Platform for Medical Research Networks (Telematikplattform für Medizinische Forschungsnetze; TMF) representing several research networks in Germany. The result of these consultations is a generic conceptual template for the design and operation of long-term repositories containing patient-related information [3].

Technical requirements

The central IT-systems and organisational structures developed for Hep-Net are based on this template. Out of the many specific issues covered by the generic template, the following bear considerable impact on IT-systems' design. First, registries may not be maintained as strictly anonymous case-repositories – at least when comprehensive datasets are collected – even if one could circumvent the problem of integrating follow-up data. This seemingly paradoxical requirement stems from the fact that the specific use made of the material is not known at the time of the donor's consent and, hence, the donor may not be deprived of the right to have his/her data and samples removed from the registry at any time. In addition, the organisation maintaining the registry must control access to the material for scientific use and must establish appropriate procedures to ensure that the material is used only in compliance with the registry's statement of purpose and to protect the donor from any harmful side-effects of the planned use.

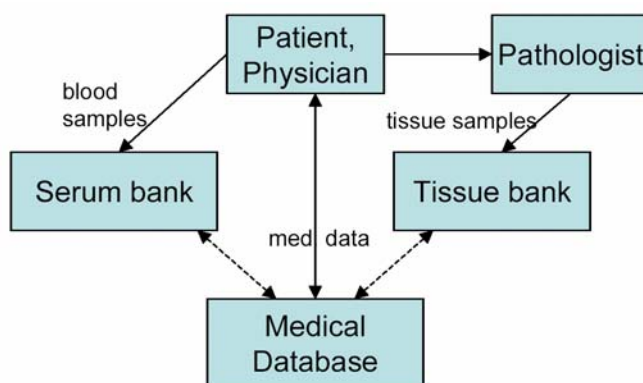
The second major technical requirement is intended to minimise the risk of misuse of the material contained in the registry and states that medical data and patient identification data must be kept at separate locations and under the auspices of mutually independent persons. It should be noted that simply replacing the patient name by some openly used patient

identifier in the medical database and keeping the patient list, i.e. the relation between patient name and identifier, in another place isn't considered an adequate technique. The circulation of such identifiers within the network must be avoided in order to prevent re-identification during the long period that the registry is maintained. Instead, the common key maintained in the patient list and the medical database must be kept secret. A temporary key is generated for entering or retrieving medical data. In this respect, registries differ markedly from data capture systems used for clinical trials.

At present, these requirements aren't met by commercially available software for electronic data capture in clinical trials. Furthermore, due to the integrating nature of Hep-Net, appropriate systems must rely on existing installations of workstations, local- and wide-area networks, and must accommodate local security policies such as those enforced by Internet firewalls. The implementation of the systems for Hep-Net is based on versatile and stable open source software packages (e.g., Linux, Apache) and a commercial database management system (Oracle). As an aside, it may be noted that open source database management software has made significant advances in recent years and might be considered a suitable replacement in future revisions of this registry implementation.

3. Results

The IT requirements of Hep-Net can be divided into three major areas: 1) the Internet presence and web-site, 2) the central Hep-Net patient registry described in more detail below, and 3) systems supporting clinical trials conducted by Hep-Net, such as a web-based central patient randomisation facility [4] and electronic data capture systems.



The central Hep-Net patient registry consists of three parts: a medical database, a serum bank and a tissue sample bank. Fig. 1 illustrates the flow of information and blood/tissue samples. Each of these is operated independently.

The treating and recruiting physician communicates information about the participating patient's medical history, social and economic situation, present condition, examination results, laboratory tests, etc. to the medical database, ideally upon every visit. Participating patients receive a Hep-Net identification card which they are asked to present when visiting any physician, including their general practitioner and specialists. This card improves the reliability of patient identification and is intended to allow on-line access to patient data entered by other participating physicians.

Patients are asked to provide a limited number of blood samples specifically for the Hep-Net registry. These samples are collected by the recruiting physician and forwarded to the central serum bank. Upon processing at the serum bank, the sample is registered on-line with the medical database and relabelled with a randomly generated key, linking it to the clinical data. No further identification is maintained at the serum bank. Tissue samples are

handled in a similar manner, except that samples are explanted only if and when required for diagnostic purposes and are first processed by the co-operating pathologist. The pathologist is requested to forward any remaining material to the central tissue bank where it is registered in the medical database and re-labelled to remove any non-encrypted identification.

Kompetenznetz Hepatitis

Ersterfassung Hepatitis B

Study-Nurse:
Elfriede Musternurse
02.Mai.2003

Patient: 9WK-MAV-UDW
Geburtsjahr: 1999

Datum der Vorstellung: 08.04.2003

2. Mögliche Infektionsrisiken

Drogengebrauch?	<input checked="" type="radio"/> ja <input type="radio"/> nein <input type="radio"/> nicht ermittelbar
Geschlechtsverkehr mit häufig wechselnden Partnern?	<input checked="" type="radio"/> ja <input type="radio"/> nein <input type="radio"/> nicht ermittelbar
Homosexuelle Kontakte?	<input checked="" type="radio"/> ja <input type="radio"/> nein <input type="radio"/> nicht ermittelbar
War die Mutter bei Geburt des Patienten Virusträgerin für HCV?	<input checked="" type="radio"/> ja <input type="radio"/> nein <input type="radio"/> nicht ermittelbar
Kontakt mit Personen, die HCV-Träger sind?	<input checked="" type="radio"/> ja <input type="radio"/> nein <input type="radio"/> nicht ermittelbar
Sexualpartner	<input checked="" type="radio"/> ja <input type="radio"/> nein <input type="radio"/> nicht ermittelbar
Wohngemeinschaft	<input checked="" type="radio"/> ja <input type="radio"/> nein <input type="radio"/> nicht ermittelbar
Andere	<input type="radio"/> ja <input checked="" type="radio"/> nein <input type="radio"/> nicht ermittelbar welche?
Berufl. Kontakt zu Patientenmaterial (z.B. im Labor o. Krankenhaus)?	<input checked="" type="radio"/> ja <input type="radio"/> nein <input type="radio"/> nicht ermittelbar
Anderer Kontakt (z.B. bei der Polizei)	<input type="radio"/> ja <input checked="" type="radio"/> nein <input type="radio"/> nicht ermittelbar
Operativer (inkl. kieferchirurgisch) oder invasiv diagnostischer Eingriff?	<input checked="" type="radio"/> ja <input type="radio"/> nein <input type="radio"/> nicht ermittelbar

Fig. 2 - Screen shot of medical database

Hep-Net currently supports web-based on-line data entry (see Fig. 2) as well as paper-based data capture. The information submitted on paper forms is subsequently entered into the database at one of several regional offices maintained by Hep-Net.

During the first year after the initial launch in October 2003, 53 hospitals and 91 practices have registered as active participants in Hep-Net. One hundred of those have recruited at least one patient. These participants have recruited a total of 1178 patients, including at least one follow-up in 575 cases.

4. Discussion and conclusions

Medical research and health care networks such as Hep-Net must rely on powerful central IT-structures in order to achieve their goal of integrating the two areas, research and care. One major component of these structures is a central patient registry containing medical data, serum and tissue samples. For this, modern information technology – in particular the Internet – provide a powerful basis. On the other hand, both the Internet technology and the general principles upon which patient registries are constructed incur risks for participating patients that needed to be considered.

Commercial electronic data capture software for use in clinical trials is widely available. Although there are many similarities between registries and clinical trials, building a registry with this type of software proves more difficult than one might expect. Major requirements such as the separation of medical and identifying data are not supported. Furthermore, clinical trial data is more rigidly structured and is recorded uniformly at prescribed time points. By contrast, registry data generally calls for much greater flexibility.

Until significant developments occur in clinical trial software, its use for registries will be limited.

The Hep-Net registry for patients with viral hepatitis is one of several similar registries that are currently being installed in Germany and that are dedicated to specific disease entities. Current projects aim to create similar structures at the European level. For example, the European Network of Excellence "ViRgil" (for vigilance against viral resistance) is the first European surveillance network capable of addressing current and emerging antiviral drugs resistance developments. Perhaps, a common trait of these recent network registry projects as opposed to the well established cancer registries lies in focussing on a more specific disease while simultaneously entertaining many concurrent activities such as supporting basic and clinical research, promoting the development of guidelines, providing information for physicians and patients, and increasing public awareness. Until now, the efforts within Hep-Net regarding patient registry have been directed toward building the registries, addressing many legal and practical issues. Current and future projects analysing the compiled data will reveal the effectiveness of the approach.

4. Acknowledgment

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5. References

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