

MetaSurv: Web-Platform Generator for the Monitoring of Health Indicators and Interactive Geographical Information System.

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Abstract

The control of the transmissible epidemics of diseases requires fast and effective tools for data acquisition, analysis, and information feedback to the actors of health like to general public. We present a tool for the fast creation of platforms of monitoring on Internet allowing the collection and the analysis in real time of the epidemic data of any origin with the dynamic and interactive cartographic representation. A Web-based Geographic Information System (Web-GIS) has been designed for communicable diseases monitoring. The Web-GIS was coupled to a data warehouse and embedded in an n-tier architecture designed as the Multi-Source Information System. It allows to access views of communicable diseases. Thus it is a useful tool for supporting health care decision-making for communicable diseases. This tool is based on the 20 years experiment of the Network Sentinels, with the daily participation of the general practitioners.

Keywords:

Multi-Source Information System; Public Health Informatics, communicable diseases, Population Surveillance, Data warehouse, Internet, Geographic Information Systems, Web-GIS, Decision Support Systems, Management, Environmental Health, Environmental Monitoring/instrumentation/methods.

1. Introduction

During one recent past, several striking events in term of public health emerged with a rare impact. The epidemic of SRAS during the winter 2002-2003 has impressed people [1]. The introduction of New Communication and Information Technologies for help the decision-making in health allowed in many cases, and should still allow better in the future, detecting, locating and circumscribing quickly an unusual situation in term of public health [2,3,4].

The information and communication technologies highlighted their extraordinary capacity as early warning system in the field of the public health.

Since 1984, INSERM (the National Institute of Health and Medical Research in France) in collaboration with the Ministry for health developed an electronic monitoring system for contagious diseases [5,6,7]. On a voluntary basis, a sample accounting for approximately 1% of the French general practitioners, electronically transmits descriptions of the cases of 8 defined pathologies diagnosed during their exercise. This continuous monitoring system

made it possible to collect in twenty years, one of the largest data bases of described cases. The demand in term of that kind of systems, allowing the electronic monitoring of the diseases, increases very quickly [8]. Early detection and monitoring systems for other international contagious diseases such as dengue, malaria, brucellosis, and cholera, are being studied. The demand of tools for the installation of systems allowing the remote data acquisition, real-time analysis and the redistribution of information is done increasingly speedily. These systems could show their effectiveness in case of disasters, wars or crises [9,10].

Within this framework, we present a technologic research program entitled MetaSurv. It aims to diffuse among health professionals, the means for the installation of complete monitoring "Sentinel" systems in record time. This device is equipped with graphic and cartographic interactive restitutions of the observed data and accessible on line.

2. Material and Methods

New information system based on n-tier architecture allowed fast and remote access of data sources. SentiWeb, the site of the Sentinels Network [11,12,13], is a typical example of this approach. By means of Internet, morbidity or mortality indicators became available in real time as well as health professionals and public at large. The main idea of the MetaSurv project is to take advantage of the twenty years experience of the sentinel network and the electronic monitoring principle. MetaSurv proposes a strong and highly configurable application in order to adapt to any type of monitoring needs. MetaSurv is very simple to deploy since it is entirely automated, and guides the user step by step. From the creation of a network to data visualization under various representations, the Web interface assists the user to data processing at all steps.

This on line system makes it possible to create very quickly a monitoring network without any special informatics skills. The system regularly profits of the updates without any intervention of users. All operations are supported by a web based interface at: www.scepid.org. Moreover, the fact that it is based on Web technologies, it is accessible everywhere in the world and by means of a simple connection to Internet.

MetaSurv is presented as a Community platform. It should be noted that it makes it possible for lots of users to collaborate within the same unit: the surveillance network. MetaSurv gives the possibility of generating its own surveillance network hosted on a dedicated server. Once the network is created, it is possible for the new administrator, to create as many monitoring modules as he wishes. It is particularly easy to create forms: number of supervised criteria is infinite and numerous types of data are available (Text, all types of number, drop-down list, check box, date). An assistance is available using "Tooltips" in order to precisely inform the sentinel general practitioner. With each creation of surveillance, a model is created that can be modified to be adapted for another new surveillances in order to accelerate the creation of surveillance procedure.

MetaSurv gives to the initiator of a monitoring project, tools making it possible to create and manage a network. We consider that the initiator of the project is likely to motivate sufficient number of medical practitioners to carry out his monitoring. The inscription procedure of practitioners by themselves on the site is the mean to establish and initiate the network. From this time, when the forms and the associated data base tables are generated, the monitoring can be started if there is a valid network in term of representativeness. Consequently, the system proposes to the administrator to forward a pre-written email announcing the setting up of new on line monitoring. The administrator only has to enter the name of the address book of the contacts he wants to participate in the monitoring network.

Once the system is installed and configured and health care professionals are registered to take part in the monitoring project, medical data can be collected via a protected Web interface and be stored in the data base. The use of the "sentinels" system does not require any particular knowledge in data processing. The recruitment of doctor Sentinels wanting to take part in a monitoring is probably one of the major points in the installation of a monitoring. This aspect largely exceeds the limits of this article; however it is important to be aware of the coherence of the sentinel network and the assiduity of these members for the participation in a monitoring. The management of such a network is a heavy task. The MetaSurv project has a large amount of functions facilitating the interactions with the system's users: news, forum, interactive repertory of personal cards, possibility of sharing documents, as well contextual help, automatic mailing generator are available to help the administrator to keeping the network coherent and giving information feedback.

MetaSurv offers several tools enabling access to a synthetic representation of information stored in the data base, as well as tools of early epidemiologic alert [13]. This site is in particular equipped with a geographical information system allowing the diffusion of maps.

This functionality allows the cartographic visualization of the space distribution of the cases reported during one period. These representations allow studying the epidemics spreading dynamics.

Any user can obtain epidemiologic information starting from a query interface common to all types of visualization. Data resulting from this query is presented as tables, graphs (curves and histograms) or charts (representations in space) and interactive maps in "choroplethe", or isocontours. It gives thus either more precise information or another mode of representation according to the context. It is possible to download the monitoring data into files compatible with all spreadsheet software. In the other way, there is an importation procedure to integrate data in MetaSurv.

It runs on a LAMP architecture (Linux, Apache, MySQL, PHP). The geographical maps, charts, and all representations are produced by using Macromedia Flash technology which is used as a technological basis for interactive graphs generation.

3. Results

Most of the functionalities validated in this project were used for the establishment of the SARS site of WHO <http://oms.u444.jussieu.fr/>.

The interactive map generation system was selected because of its friendly interactive interface, its flexibility, its fast execution, and its reduced cost as well.

This system is currently used to generate the maps of the "Sentinel Network" <http://www.sentiweb.org/> and to manage the sentinel general practitioners address list using the module "PaGeom" of geographical accesses system to the data.

Other sites use these functionalities as MapoFlash <http://www.scepid.org/mapoflash/> and GripSite <http://www.scepid.org/gripsite/> site of Influenza like Illness experimental epidemiology

4. Discussion

The INSERM Research Unit, U707 "Epidemiology, Information systems and Modeling" proposes through the MetaSurv project, a tool which allows the installation and application of epidemiologic monitoring in any part of the world. It is easy to use and allows dynamic and interactive cartographic representations. This approach not only makes it possible to

create, manage and maintain monitoring (collection of information to the redistribution on a large scale of analyses on this information) but it also has several functions for the installation and animation of the networks participating in the process of monitoring. Our twenty years experiment in "Sentinel Surveillance" exhibits that this point is a crucial aspect of the monitoring system because an active participation of Sentinels general practitioners is an indispensable condition for this process. The permanent observation of the evolution in time and space of certain pathologies incidence such as influenza for example, also makes it possible to evaluate the adopted preventive policy (for example closing schools, mass vaccination, or use of antivirals). This tool meets a need for development and improvement of monitoring systems. Computers clearly modified the approach for the monitoring of environment and health. The use of the Internet is probably (currently) an optimal solution. "Sentinels" Systems must be reinforced in the near future, since they proved to be effective tools for the detection of epidemics, and the monitoring to the contagious diseases. As well, they can be employed for epidemiologic goals, but also for the entomological monitoring or to monitor any environmental indicator. This product is on line. It is operational immediately and requires a few minutes to set up any professional's network. Accessible at the address: <http://www.scepid.org/metasurv>

5. Acknowledgments

This research was funded by a grant from STIC-Santé-Inserm 2002, n°A02126ds, and by Paris 6 University. We thank students of Compiègne University of technology (UTC) and Troyes University of technology (UTT).

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