ARTIKEL PENELITIAN

Model of CanReg5 Implementation for Indonesia

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ABSTRACT

Indonesia is in the process towards the advancement of technology in cancer registration. Cancer registration system was built to manage cancer data at the "Dharmais" Cancer Hospital and several regional hospitals. However, the existing system was judged insufficient to support the process of data management across regions in Indonesia. Along with the progress of science and the increased need in cancer medicine, a better tool for cancer registry is needed. CanReg5 software has been selected to support the new cancer registration system. The aim of this study is to develop a system model that automates the process of collecting and analysing cancer data using CanReg5 software for all regions in Indonesia. Several problems have been identified and become issues to be studied. This study is a qualitative research using methodologies that collect data through interviews with all staffs and doctors involved in the cancer registry activity. The results of this study are the generation of network architecture of hospital-based cancer registration with specific security for data transfer, business and technical process of cancer registration, and disaster recovery plan to anticipate the effects of system breakdowns. Estimation of number of staffs related to work responsibilities and estimation of devices required to support the system are provided. Successful implementation of this model would grant a platform for the generation of cancer registration system in such a large developing country with limited resources.

Keywords: *cancer registration, CanReg5, "Dharmais" Cancer Hospital, VPN, Virtual Private Network*

ABSTRAK

Sistem registrasi kanker telah dibangun untuk mengelola data kanker di Rumah Sakit Kanker "Dharmais" dan beberapa rumah sakit di daerah. Namun, sistem yang ada dinilai tidak cukup untuk mendukung proses pengelolaan data di seluruh wilayah di Indonesia, sehingga sistem CanReg5 telah dipilih sebagai perangkat lunak untuk mendukung sistem registrasi kanker yang baru. Penelitian ini bertujuan untuk mengembangkan model sistem untuk mengotomatisasi proses mengumpulan dan analisis data kanker menggunakan CanReg5 di seluruh daerah di Indonesia. Studi ini merupakan penelitian kualitatif dengan menggunakan metodologi pengumpulan data melalui wawancara dengan seluruh staf dan dokter yang terlibat dalam kegiatan registrasi kanker. Hasil penelitian ini adalah model arsitektur jaringan berbasis registrasi kanker rumah sakit dengan keamanan khusus dan rencana pemulihan bencana untuk mengantisipasi dampak dari kerusakan sistem. Perkiraan jumlah staf yang berhubungan dengan tanggung jawab dan estimasi perangkat diperlukan untuk mendukung sistem yang disediakan. Keberhasilan penerapan model ini akan memberikan *platform* untuk pengembangan sistem registrasi kanker di negara berkembang yang besar dengan sumber daya terbatas.

Kata kunci: registrasi kanker, CanReg5, Rumah Sakit Kanker "Dharmais", *Virtual Private Network*, VPN.

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INTRODUCTION

Cancer registries have already become general discussions in the world among cancer researchers and clinicians for solution to resolve cancer problems. The definition of cancer registration is a particular a particular type disease registry with major purposes to: (i) establish and maintain a cancer incidence reporting system; (ii) be an informational resource for the investigation of cancer and its causes; and (iii) provide information to assist public health officials and agencies in the planning and evaluation of cancer prevention and cancer control programs.[1]

Cancer registries need a tool to input, store, check, and analyze their data. Cancer registration data that are collected and coded in a standard way are required to allow the comparison of cancer incidence among various countries. The tool used to input, store, check, and analyze the data needs to be standardized, so that it can be used in every region and country and the data produced can be used globally.

The "Dharmais" Hospital, as the National Cancer Center (NCC) in Indonesia, had implemented CanReg4 to support its cancer registry. However, it was felt that software with additional features to support the local database structure was needed. To fulfill this additional need, *Srikandi* (*Sistem Registrasi Kanker di Indonesia*) software as substitute of CanReg4 has been adopted and applied by the Dharmais and related regional hospitals. However, the operational staffs and doctors still have problems in using this software. In addition, the data structure of *Srikandi* is not compatible with the system used by the World Health Organization (WHO), preventing it to compare the cancer data of Indonesia with those of other countries.

In order to meet the global standardization and as a solution to improve the operation of cancer registration in Indonesia, CanReg5 software will be implemented, first in the "Dharmais" Hospital and then expanded to cancer centres. CanReg5 is open source software developed by Morten Johannes Ervik to input, store, check, and analyze cancer registry data; it has good reputation based on the experiences of several centres in the world in solving cancer registry problems.[2]

The use of CanReg5 has also been endorsed to perform data entry, quality control, consistency checks, and basis analysis of the data, by the International Agency for Research on Cancer (IARC), a special agency of the WHO with a task to coordinate and conduct research on the causes of human cancer, mechanism of carcinogenesis, and to develop scientific strategies for cancer prevention and control.[3] In addition, CanReg5 is equipped with many possible configurations and customizations so that it can be adapted to the needs for data of diagnosis and cancer cases in a certain country. It can be run in both online and offline modes, and has a flexibility to accommodate the variation of capacities of the hospitals. There is a broad spectrum of hospital classes in Indonesia, ranging from the ones with sophisticated medical record system equipped with modern computers, databases, and internet connection, those with only simple medical record system supported by a single simple computer, to hospitals that still uses manual ways without internet connection. There are four types of hospitals in Indonesia, A to D, based on the strength, scope and responsibilities, as classified in the Regulation of the Minister of Health of the Republic of Indonesia No. 340/Menkes/PER/III/2010.[4,5]

In applying CanReg5 to the cancer registry information system in Indonesia, the database of regional hospitals will be linked to the "Dharmais" Hospital as the central server that coordinates the organization of the network. Database exchange from each regional hospital to the central server will be handled separately. Each hospital holds the ownership of the related database.

This study is conducted to gather information of the existing system at the NCC and each type of regional hospitals, and of the technical and human resources. Further, based on the data obtained, a system implementation model will be made as a template according to the characteristics of each hospital type.

To design the system implementation model, the cancer registration system in Korea is used as a platform and adjusted to the existing need and local situations in Indonesia.[6] In Korea, the system for processing the medical databases is centralized. The cases from Training Hospital are saved into the servers. Cancer billing claims and NSO Death data also saved. From the servers, data are processed and disseminated to some Regional Cancer Registry system in some hospitals. Regional hospitals can review the medical record from the central servers; also they can review data from small hospitals involved in this system.

The model to be developed by this study consists of 3 interrelated factors—people, process, and

technology.[7] These factors should be considered to improve the quality of community health services in cancer control programs and research outcomes related to cancer. With optimized cancer registration operating system, the analysis of data and information on patients' cancer data can be done faster with better accuracy.

There are two questions associated with the CanReg5 implementation in hospitals that perform cancer registration in Indonesia: (1) What are the network architecture, security, and business process to implement CanReg5 software as cancer registry operational system? (2) What are the staffing plans and the estimations of devices required to support the cancer registration system?

The scope of this study is to analyze necessary requirements needed to run the cancer registration using CanReg5 software in Indonesia, in a network consisting of the "Dharmais" Hospital as the NCC and the regional hospitals that carry out cancer registration.

The system model designed will serve as the template for the implementation of CanReg5 in every regional hospital in Indonesia. Cancer data will be collected and coded according to the international standard, enabling the comparison and sharing of cancer data among hospitals within and outside Indonesia. Better security in data transfer between related hospitals will be obtained, so that access, theft, and destruction of data by unauthorized parties can be prevented.

MATERIAL AND METHOD

This study was carried out in a method categorized as qualitative research that used non-experimental design and did not perform data manipulation. The study design was divided into four steps to meet business requirements as described in Figure 3.1.

The design templates were adopted from Korea information system model and enriched by information from related international journals.[6] Information for designing the system implementation as well as outlining the architectural plan was obtained by interviewing the operational (cancer registry and IT) staffs of the "Dharmais" Hospital and regional hospitals, and the doctors whose tasks were related to cancer registration. Interview questions were created based on essential elements for developing a cancer registry system. Discussions were expanded from the clients' answers to get more inspiration to get their views, experiences and practical needs in cancer registration activities.

RESULTS AND DISCUSSION

This study was aimed to design a system model to implement CanReg5 software as the tool for the cancer registration, as part of the development plan for a national cancer registration system. For national uniformity, this software will be used with minimum requirements as specified in its guidelines. Additional requirements will depend on the need of each hospital, such as the specification of computer peripherals and qualification of staffs.

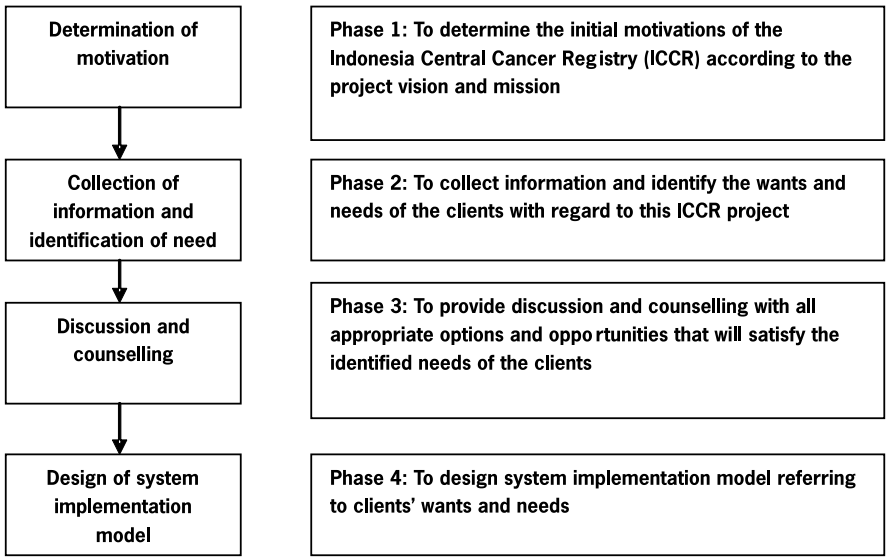

Figure 1: Study design flow

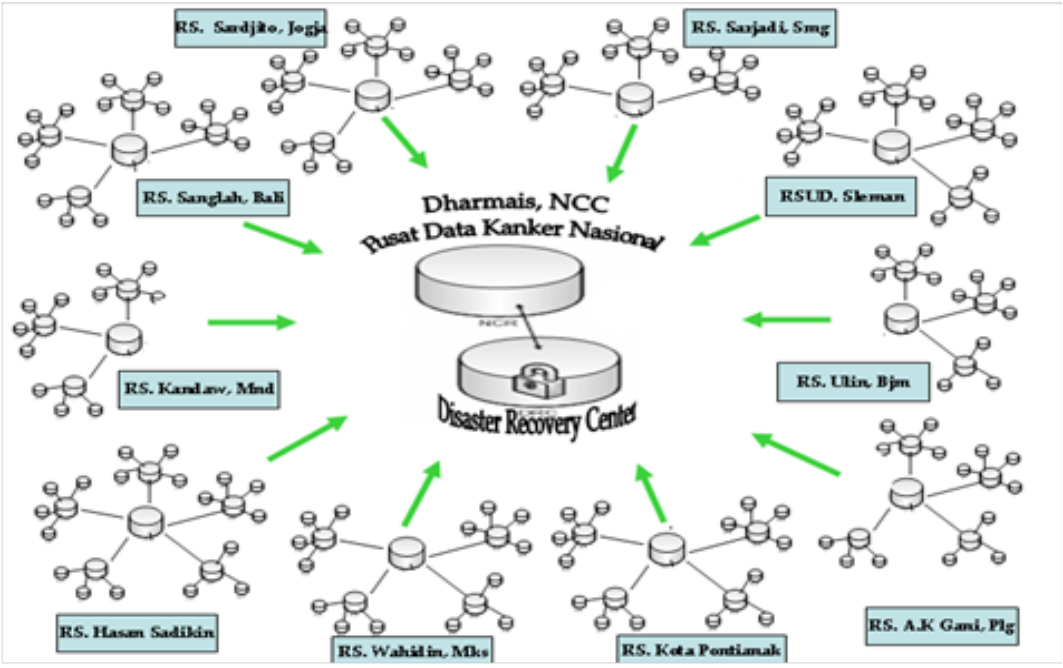

Figure 2: Networking system plan of cancer registration system in ten cities of Indonesia

The design of the system model started by collecting information of the Networking System Plan being built, and the existing elements of the cancer registration system operated in Indonesia.

The system plan of cancer registration being built is structured following a 'Rural-Regional' model described as the 'Networking System on the National Cancer Registration in Ten Cities' (Figure 2). In this model, each regional hospital is responsible of a certain rural area, where data are collected, compiled, initially analyzed, and sent to the cancer centre ("Dharmais" Cancer Hospital). By this model, duplicating or missing data can be avoided, ownership of data can be maintained, and regular data collection from the area can be controlled. This model offers an advantage that the pattern and cancer incidence of each region can be understood. The data collected can be utilized for the development of health plan, including disease mapping, development of intervention program, and distribution of equipments and medicine. The progress of each regional hospital can be monitored, and capacity building of the regional hospitals can be planned.

Information of the existing resources is also needed to assess strength of the cancer registration activity operated in Indonesia. In this study, six important elements needed for the development of cancer registry system have been formulated as depicted in table 1. Among all hospital types, Standard Operating Procedure (SOP) of cancer registry was found only in the "Dharmais" Cancer Hospital as the National Cancer Center (NCC), while Organizational Structure and Job Description were found in Central and Type-A hospitals.

Disaster Recovery System, which is an important element for data maintenance, was in existence in all hospital types. This was the good implication of the trainings that have been conducted to regional hospitals' staffs for the implementation of CanReg4 and *Srikandi* software.

Table 1: Essential elements of cancer registry according to hospital type

Elements for Cancer Registry	Hospital Type				
	Central Hospital*	Type A	Type B	Type C	Type D
Cancer registry SOP	+	-	-	-	-
IT Architecture and infrastructure	+	+	+	+	+
Organizational structure and job descriptions	+	+	-	-	-
Staff qualification	+	+	+	+	+
Staff experience and education	+	+	+	+	+
Disaster recovery system	+	+	+	+	+

Legends: (+): supported; (-): not supported; *: "Dharmais" Cancer Hospital

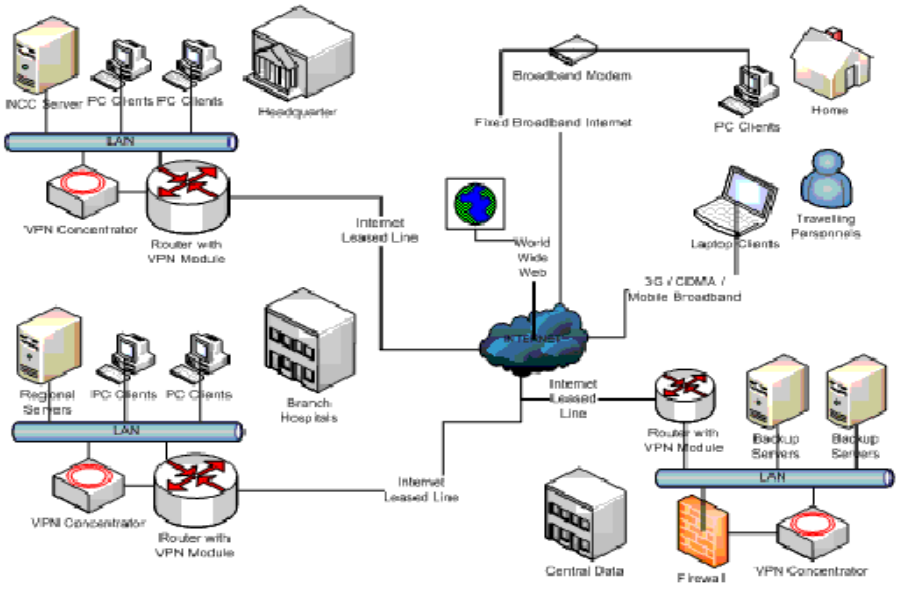

Figure 3: Proposed network architecture of cancer registration system

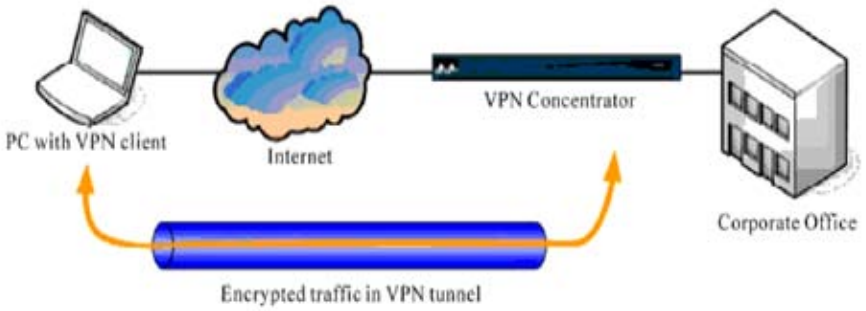

Figure 3: VPN security model

This design is not intended to build a new system, but to use the existing human and technology resources, improve its function, and upgrade to a cancer registration system that will be integrated to the Networking System Plan. The system designed will be a network incorporating users that can be individuals or hospitals, both in on-line and off-line modes.

A unique part of the cancer registry system in this design is the presence of Virtual Private Network (VPN) technology (figure 3). This technology uses concentrators that will provide connection from headquarter to all branches, including to doctors and staffs who are working at home or travelling. VPN concentrators have encryption and authentication techniques to protect the data transfer in private Internet system. They are built to create a remote-access or site-to-site VPN.

This VPN system will be developed through decentralization of servers that will be installed in every regional hospital involved in this system. Each hospital can be linked to headquarter for mutual data access, making it easier for headquarter to lead and control each member.

The cancer registry system in this design would economic benefit by utilizing less office space, reducing total expenses incurred by having hospital workers on site. Headquarter can communicate with its branches over highly secure, confidential and reliable connection regardless of the location of the offices. In this system architecture, the management should apply a policy that valid data is transferred only in the VPN system or by offline method. It is prohibited to transfer cancer data through personal e-mails because the data can be hijacked or forwarded to other recipients.

To integrate the VPN in the online cancer registry system, the researcher proposes a security data flow as shown in figure 4.

Basically, VPN uses tunneling process to transport the encrypted data across the Internet. Tunneling is a process of data encapsulation by encryption during message delivery. Every user in this system can exchange and transfer data via online and will be protected from being hijacked by unauthorized people. That is why the data transfer method via VPN is more secure than via online or e-mail hosting, because VPN has an inbuilt encryption system to secure the data integrity during transfer.

The diagram shown in figure 4 describes the process of cancer registration at all hospital types, with or without connection to the VPN system, in on-line or off-line modes within the network. Every hospital type must follow the algorithm as a rule in data transfers.

In the current data processing, which is still done manually, after data entry in regional hospitals, data in hardcopies are sent to the "Dharmais" Cancer Hospital to be re-inputted using CanReg5 and then verified by cancer registration staffs. After several steps including data analysis, the data will be disseminated to regional hospitals. Thus, by manual system, it takes time longer to send data to the "Dharmais" Cancer Hospital/NCC and send back the results to regional hospitals. These processes need staffs that bring the data to the hospitals.

The strength of this new online system is that the data and its analysis results do not require special staffs and spend more time to send, because all data are automatically centralized and saved to database servers. Courier services are not needed, because all processes will be run electronically through private and secure connection. It will save more money and time by this new system model.

It should be remembered that there is no perfect system. VPN system can be down anytime. To prevent the delay, there should be offline data transfer method in case of trouble in the VPN system. The offline data transfer is done by formally assigned staffs. The data must be encrypted to prevent data theft during transfer. At the destination, the receiving staffs should have software to decrypt the data.

Based on interviews with staffs from each hospital type, and considering the workload and availability of personnel, estimated number of staffs to run the online cancer registration system can be calculated as shown in table 2.

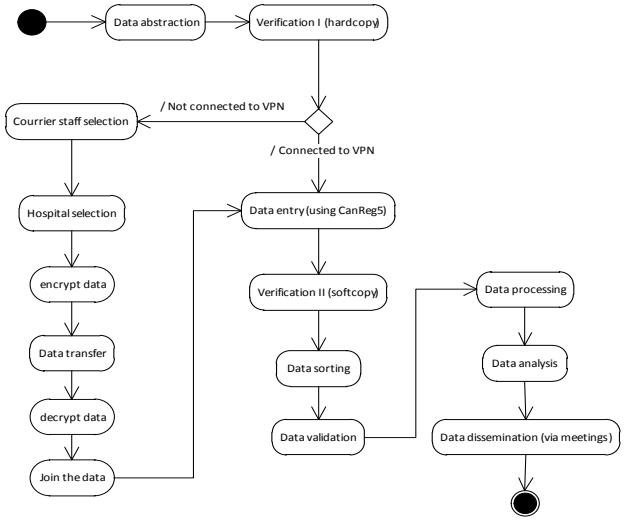

Figure 4: Cancer registry business process

Table 2: Number estimation of staffs to run the online cancer registry system

No.	Staff Position	Central Hospital*	Hospital Type A	Hospital Type B	Hospital Type C	Hospital Type D
A	Sub Section Head of Cancer Registration	1 MH	1 MH	1/2 MH	1/4 MH	1/4 MH
B	Administrative Coordinator	1/2 MH	1/2 MH	1/2 MH	1/3 MH	1/3 MH
C	Verifier Coordinator and Registrar	1/2 MH	1/3 MH	1/3 MH	1/4 MH	1/4 MH
D	Verifier	1/2 MH	1/3 MH	1/3 MH	1/4 MH	1/4 MH
E	Registrar	4 MH	2 MH	1 MH	1 MH	1 MH
F	Follow-Up Support	1 MH	1 MH	1 MH	1/2 MH	1/4 MH
G	Data Manager	1/2 MH	1/3 MH	1/3 MH	1/4 MH	1/4 MH
H	Coordinator of IT and information	1/2 MH	1/2 MH	1/2 MH	1/3 MH	1/4 MH
	Total	8.5 MH	5.9 MH	4.4 MH	3.1 MH	2.8 MH

Legends: (MH): Man-Hour(s); *: "Dharmais" Cancer Hospital

Estimation of device quantity is needed to give information about resources that will be used to implement cancer registration system in every regional hospital in Indonesia. Table 3 shows the estimation of devices to support CanReg5 implementation at each hospital type.

Table 3: Estimation of device requirement to run the online cancer registry system

Nodes	Devices required	
	Hardware	Software
Central Hospital	6 PCs 1 VPN concentrator	6 Windows XP 3 MS Office 3 Anti-Virus
Hospital Type A	4 PCs 1 VPN concentrator	4 Windows XP 2 MS Office 2 Anti-Virus
Hospital Type B	2 PCs 1 VPN concentrator	2 Windows XP 1 MS Office 1 Anti-Virus
Hospital Type C	1 PC 1 VPN concentrator	1 Windows XP 1 MS Office 1 Anti-Virus
Hospital Type D		
Data Backup Center (one in each province)	1 Backup Server 1 VPN concentrator	1 Windows Server 1 Firewall 1 Anti-virus

CONCLUSION

The results of this study are the generation of network architecture of hospital-based cancer registration with specific security for data transfer, as well as business and technical process of cancer registration. Disaster recovery plan to anticipate the effects of system breakdowns was introduced through Virtual Private Network (VPN) technology.[8] Estimation of number of staffs related to work responsibilities and estimation of devices required to support the system are provided. Successful implementation of this model would grant a platform for the generation of cancer registration system in such a large developing country with limited resources.

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