

Storing Medical Records of A-Bomb Survivors on Optical Disks

Kenich Yokota, Hisayoshi Kondo, Mariko Mine and Yutaka Okumura

Department of Biostatistics, Scientific Data Center for the Atomic Bomb Disaster, Nagasaki University School of Medicine.
Sakamoto 1-12-4, Nagasaki 852, Japan

Medical records of A-bomb survivors include numerical data and non-numerical data such as handwritten description. We have been storing the numerical data in medical records into a data base. We started to store the non-numerical data on optical disks. We analyzed the significance and usefulness of storing them. The non-numerical data of symptoms can not be evaluated by but can be analyzed with the numerical data. It was concluded that storing non-numerical data in the medical records on the optical disks would be worthy.

Introduction

By the development of electricity and technology, we are able to store various and numerous data in a computer system. Non-numerical data including handwritten description and figures can be also stored in addition to numerical and coded data. We established a data base system and have stored numerical data in medical records of A-bomb survivors.¹⁾ As the medical records of A-bomb survivors contain handwritten description and figures as well as numerical data, we considered them medically important to hold, and have begun to copy and store them on optical disks in order to keep these information for long time and to refer them easily at any time. As the content of the medical records is huge, the significance and usefulness of storing non-numerical data should be evaluated. If their information is insignificant and unusefull, they should not be stored.^{3,4)} We evaluated the value of non-numerical information in medical records of A-bomb survivors to be stored on optical disks.

Materials and Methods

Health examinations for A-bomb survivors are performed periodically twice a year by the law of medical care for A-bomb victims. We have stored numerical data of medical records of health examination into a data base.¹⁾ The data base is applied for the analysis of health for the A-bomb

survivors, and results were published elsewhere.^{4,8)} Medical records are regulated to keep five years by the law. After five years of preservation, the medical records may be thrown away. They are, however, kept more than five years because of their possible potential value. The health examination started in 1957. Since then, a great amount of medical records have been kept in warehouses in Nagasaki City. In 1986, the warehouses were to be destroyed. The medical record, then, were moved to and kept in a prefabricated house at School of Medicine Nagasaki University. But it was not suitable to keep them there because of unsatisfactory condition of preservation.

In 1991, an optical-disk filing system was installed at School of Medicine, which can store non-numerical data, or handwritten description and figures, on rewritable optical disks of a size of 5.25 inches. The system has functions of searching, editing and printing of data which are stored in the optical disks. This system is composed of a main unit, an automatic changer of optical disks, an image scanner and a laser printer. The main unit has 32-bit CPU and two internal optical disk units. An automatic changer of optical disk can keep 56 disks. The resolution of the image scanner is 400 ppi and 64 levels. The resolution of the laser printer is 400 dpi, and the stored information can be printed on a sheet of paper of an A3 size. This system has 20 keys for key-searching and binder-through-searching, and has functions of cabinet-copy and image editing. We set searching keys for ID number of health book, name of person, date of examination and date of birth. Combining these keys we can search any medical record.

We started to copy and store medical records on optical disks. There were about 1,000,000 sets of medical records, including general examination and detailed examination. In fiscal year of 1991, we finished to store 53,150 records of general examination and 49,603 records of detailed examination. We estimated eight years to store all of the medical records.

Results

We analyzed 122 sets of medical records of detailed health examination sampled from those performed in 1971-1980. Of 122 sets of medical records, 53 sets (43%) had information of handwritten descriptions, and other 69 sets (57%) had not any handwritten description (Table 1). In these 53 sets of medical records, 331 descriptions were included. Of 331 descriptions, 107 descriptions (32%) were of symptom, and 224 descriptions (68%) of being non-symptom (Table 2). The symptoms were classified and shown in Table 3 and Fig. 1. Symptoms which showed a large number of cases were physical fatigue (10 cases) and dizziness (10 cases) in the present disease, and hypertension (8 cases) in the past disease. Physical fatigue and dizziness (19%, 20 in 107 descriptions) are not evaluated by, but might be analyzed with the numerical data in the medical records. These information is considered to have values to be stored in the optical-disk filing system.

Table 1. Fraction of medical records containing information of handwritten description.

Content of records	Records
Containing information	53 (43%)
Not containing information	69 (57%)
Total	122 (100%)

Table 2. Fraction of descriptions in medical record containing handwritten information.

Content of descriptions	Descriptions
Symptom	107 (32%)
Non-symptom	224 (68%)
Total	331 (100%)

Discussion

There are two types of information which can be stored in a computer system; numerical data and non-numerical data. The non-numerical data are categorized into low- and high-density graphic data. The relationship of different types of data is shown in Fig. 2. Numerical data can be stored on magnetic tapes or disks in a computer system and can be applied for statistical process. The low-density graphic data includes handwritten description and figures, the high-density graphic data include X-ray radiogram. Both graphic data can be stored through an image scanner on optical disks. The graphic data necessitate large storage to store their information and have difficulty for analysis, compared with the numerical data. The high-density graphic data may be transferred to the low density graphic data by sketching necessary portion on the X-ray radiogram. Information taken from high-or low-density graphic data

Table 3. Symptoms in handwritten descriptions.

Classification	Symptoms	Cases (subtotal)
Present Disease	physical fatigue	10
	dizziness	10
	mental fatigue	3
	liver disease	2
	anemia	2
	others	23 (50)
Present Symptom	anemia	3
	lower limb edema	2
	impairment of hearing	2
	others	14 (21)
Disease after A-boming	hypertension	8
	hypotension	3
	liver disease	2
	uterine myoma	2
	tuberculosis	2
	appendectomy	2
	others	9 (28)
	Acute Symptom by A-boming	diarrhea
depilation		2
bleeding tendency		1 (5)
Disease before A-boming	beriberi	1 (1)
Medical History of Family	hypertension	1
	hospitalized	1 (2)
Total		107

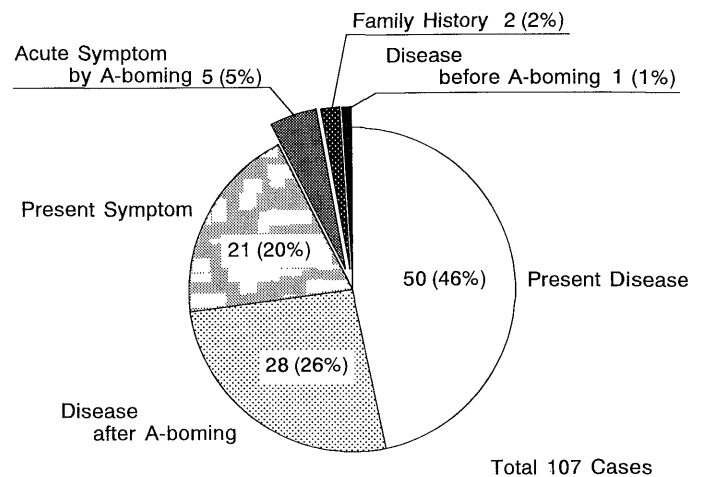


Fig. 1. Fraction of symptoms in handwritten descriptions.

can be coded into numerical data. We have already stored numerical data of health examination results on the magnetic disk, and began to store handwritten data on the optical disk at School of Medicine. Data in medical records being stored on the magnetic disks or on the optical disks are shown in Table 4.

The significance and usefulness of the information included in medical records is for the health care of patients and for the epidemiologic study. Physicians can obtain information in the medical records easily from the data

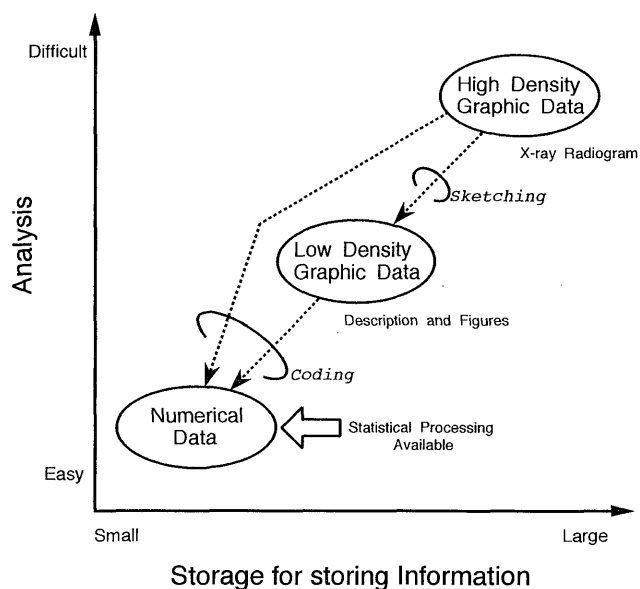


Fig. 2. Relationship of different types of data.

Table 4. Being stored data.

Methods	Data
Numerical data on the magnetic disks	Examination codes and values, Date of examination, ICD codes, Exposed radiation dose, Sex, Date of birth, etc.
Handwritten data on the optical disks	Present symptom, Present disease, Past disease after A-bombing, Medical history of family, Acute symptom by A-bombing, Disease before A-bombing, ECG, X-ray sketch, etc.

base and from the optical-disk filing system, when all information is stored in these systems. Medical records, however, become huge, and it must be evaluated their value as medical information and to store them when their value is admitted.²⁾ Physical fatigue and dizziness were frequent in A-bomb survivors (Table 3). These diseases can and should be analyzed with reference to numerical data which were already stored in the data base. It would be concluded that the storing the non-numerical data in the medical records in the optical-disk filing system is worthy.

References

- 1) Mori, H., Mine, M., Kondo, H. and Okumura, Y.: Medical database for the atomic-bomb survivors at Nagasaki University. *Acta Med. Nagasaki* 37:52-65, 1992.
- 2) Kaihara, S., Koyama, T., Irie, G., Hirakawa, A., Otsuki, M., Fukushima, M., Yasui, S., Kamde, M., Kiiikuni, K., Mori, C., Satomura, Y., Sakai, S., Ohashi, Y., Takeda, Y., Kato, J. and Nose, Y.: Style of medical informatics and division of medical information. *Med. Inform.* 5:168-179, 1985.
- 3) Nakashima, H., Tadano, J., Shigeta, I., Orani, S., Urakawa, K., Kubota, S. and Yamamoto, S.: Problems of optical disk storage for medical record managemet. *Med. Rec. Admin.* 4:32-36, 1992.
- 4) Nakamura, T., Mori, H., Mine, M., Kondo, H. and Okajima, S.: Long-term trend of hemoglobin decrease in stomach cancer. *Med. Inform.* 7:29-38, 1982.
- 5) Okajima, S., Mine, M. and Nakamura, T.: Mortality of registered A-bomb survivors in Nagasaki, Japan, 1970-1984. *Radiat. Res.* 130:419-431, 1985.
- 6) Mine, M., Okumura, Y., Ichimaru, M., Nakamura, T. and Kondo, S.: Apparently beneficial effect of low to intermediate doses of A-bomb radiation on human lifespan. *Int. J. Radiat. Biol.* 58:1035-1043, 1990.
- 7) Mine, M., Okumura, Y., and Kishikawa, M.: Mortality of atomic bomb survivors in Nagasaki. *Acta Med. Nagasaki* 36:199-205, 1991.
- 8) Mine, M., Okumura, Y., Kondo, H. and Mori, H.: Effects of A-bomb radiation on survivors. *Acta Med. Nagasaki* 37:116-119, 1992.