jobs (preparation or cleaning up) was higher for nurse leaders than nursing staff.

3.3. Analysis of Jobs by hospital function

3.3.1. Working hours

Table 1 and table 3 show the working hours of nurses in both hospitals. The working hours of nurses in the advanced treatment hospital were longer than those of nurses in the regional general hospital, for time spent on serial tasks as well as on parallel tasks. Nurses in the regional general hospital had a higher ratio of time spent on parallel tasks compared to time spent on serial tasks than those in the advanced treatment hospital.

Table 5 shows the detailed working hours of nurses in both hospitals. The percentage of working hours spent by nurses in the regional general hospital on jobs related to "patient assistance with activities of daily living" was higher than that for nurses in the advanced treatment hospital. This was the opposite case for the percentage of working hours spent on jobs related to "assisting with procedures" and "miscellaneous activities". Jobs classified as "meals," "domestic care," "emotional care," "postmortem care," "physical examination," "medication administration," "explanation/instructing/educating," "collecting patient information," "home care service," "teaching students," "ward secretary jobs," "hospital administrative activities," and "sending messages" took a higher percentage of time for nurses in the advanced treatment hospital than for nurses in the regional general hospital, though the opposite held for the percentage of time spent on jobs classified as "hygiene assistance," "elimination management," "arranging the patient's

■ Table 5. Detailed working hours and percentages for doctors and nurses (advanced treatment hospital and regional general hospital)

	Activity duration	Ratio (%)	Activity duration	Ratio (%)			Activity duration	Ratio (%)	Activity duration	Ratio (%)
Meal	0:00:48	0.1	0:00:35	0.1		Information exchange within healthcare professionals	1:08:23	12.0	1:10:42	13.0
Hygiene assistance	0:13:17	2.3	0:15:10	2.8		Patient Calls	0:01:00	0.2	0:01:45	0.3
Elimination management	0:08:12	1.4	0:17:02	3.1		Home care service	0:00:02	0.0	0:00:00	0.0
Arranging the patient's environment	0:07:27	1.3	0:11:29	2.1		Other	0:02:57	0.5	0:00:00	0.0
Domestic care	0:00:39	0.1	0:00:22	0.1		Subtotal	4:34:56	48.1	4:11:06	46.2
Transporting patients	0:09:11	1.6	0:12:02	2.2		Chartwork	1:24:11	14.7	1:22:38	15.2
Emotional care	0:00:34	0.1	0:00:23	0.1		Teaching students	0:04:25	0.8	0:00:34	0.1
Safety	0:00:00	0.0	0:00:13	0.0		Ward secretary jobs	0:29:26	5.2	0:10:25	1.9
Physical comfort promotion	0:05:06	0.9	0:05:34	1.0		Hospital administrative activities	0:07:22	1.3	0:00:02	0.0
Call for/see off patients	0:00:00	0.0	0:00:00	0.0		Sending message	0:07:29	1.3	0:00:58	0.2
Postmortem care	0:00:05	0.0	0:00:00	0.0		Infection protection	0:05:17	0.9	0:08:40	1.6
Other	0:00:10	0.0	0:00:00	0.0		Walking/waiting	0:58:20	10.2	1:17:27	14.2
Subtotal	0:45:29	8.0	1:02:51	11.6		Other	0:00:00	0.0	0:01:58	0.4
Physical examination	0:06:18	1.1	0:04:10	0.8		Subtotal	3:16:30	34.4	3:02:43	33.6
Treatments	0:11:29	2.0	0:11:08	2.0		Research/study	0:00:39	0.1	0:00:00	0.0
Medication administration	1:10:17	12.3	0:42:32	7.8		Break	0:51:03	8.9	0:47:00	8.6
Physical assessment	0:40:30	7.1	1:10:56	13.0		Other	0:02:07	0.4	0:00:00	0.0
Explanation/instructing/educating	0:34:58	6.1	0:25:53	4.8		Subtotal	0:53:49	9.4	0:47:00	8.6
Collecting patient information	0:39:03	6.8	0:24:01	4.4	Error	Error	0:00:33	0.1	0:00:08	0.0

environment," "transporting patients," "Safety," "improving physical comfort," "treatments," "physical assessment," "exchanging information between healthcare professionals," "patient calls," "chartwork," "infection protection" and "walking/waiting".

3.3.2. Time series distribution of working hours

Figure 1 shows the time series distribution of working hours for nurses in both hospitals. The percentage of working hours spent on "patient assistance with activities of daily living" jobs decreased during the time periods immediately after work started and before the end of work in both hospitals. For both hospitals the percentage of working hours spent on jobs classed as "assisting with procedures" was higher than in the afternoon; the opposite of the percentage of working hours spent on "miscellaneous activities" jobs.

3.3.3. Working hours for direct and indirect jobs

Table 2 and table 4 shows the working hours spent on direct and indirect jobs for nurses in both hospitals. The percentage of working hours spent on direct jobs by nurses in the regional general hospital was higher than that for nurses in the advanced treatment hospital. The percentage of working hours spent on direct (preparation or cleaning up) and indirect jobs by nurses in the advanced treatment hospital was higher than that for nurses in the regional general hospital. The percentage of working hours spent on indirect jobs (preparation or cleaning up) was identical for nurses of both hospitals.

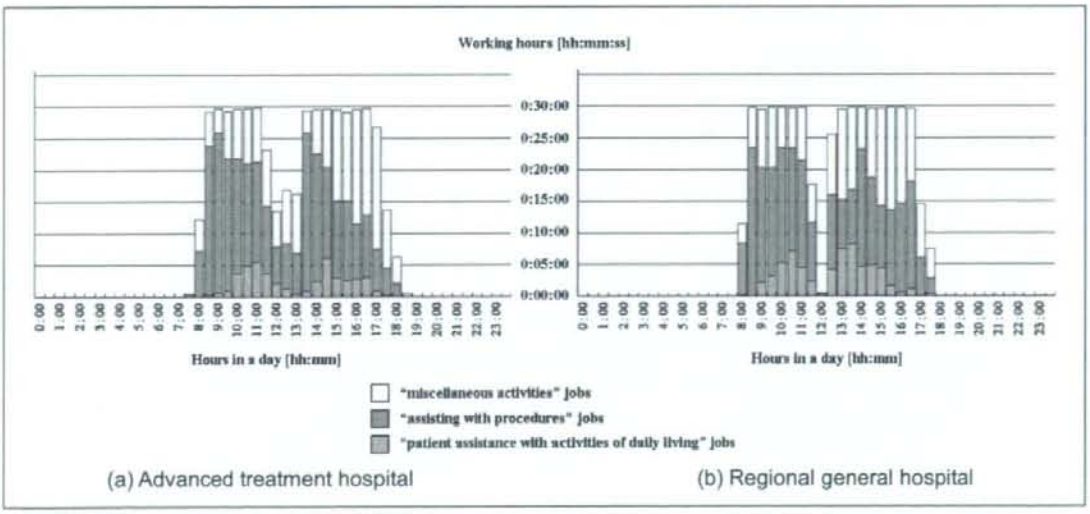
4. Discussion

It is thought that the number of operations when the nurses are not involved, and the length of these operations, contribute to the difference in the ratio of direct and indirect jobs when comparing job types (doctors and nurses). We need to survey the ward of another department and analyze their working hours by job type.

Nurse leaders did not manage patients. According to the analysis results in 3.2 they assisted the doctor's examination of the patient, aided nursing staff, or exchanged information with doctors and nursing staff. Nursing staff primarily cared for the patient.

It is thought that the differences in the nurse's job elements obtained from the analysis result 3.3 are not related to hospital function, but are related to the differences in nursing systems. The percentage of working hours spent on "ward secretary jobs," "hospital administrative activities" and "sending messages" by the nurses in the advanced treatment hospital was higher than for the regional general hospital. In the regional general hospital, with the team nursing care system in place, these three job elements are performed chiefly by the nurse leaders. The percentage of working hours spent on "patient assistance with activities of daily living" jobs by nurses in the regional general hospital was higher than

■ Figure 1. Time series distribution of working hours.
The horizontal axis indicates hours in a day, and the vertical axis indicates working hours.



that in the advanced treatment hospital, similar to that of direct job elements. This is because the so-called nurse leader's job elements are not performed by nursing staff in the regional general hospital.

In this study, a constant relationship was observed between job type/class and job elements. This result may change considerably depending on any one factor because this survey was performed in limited settings, i.e., survey schedules were short and there were few respondents.

The relationship between hospital function and job elements was not ascertained because it was not possible to separate them from the other factors. To do this we would need to survey hospitals with different functions yet having similar ward conditions.

5. Conclusion

The job elements required to be performed by each medical staff member was proven to differ according to job type (doctors and nurses) and job class (nurse leaders and staff).

In the comparison between hospitals the difference in job elements was proven to be not due to different hospital functions, but due to the ward system (ward design and nursing system).

Acknowledgments

The authors wish to thank all nursing and medical staff of the hospitals that cooperated in this study. This study was supported by Grants-in-Aid for Scientific Research (as part of B-1-15310119) and the Institute of Statistical Mathematics Cooperative Research (16-2041).

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Current Organ Topics:

Upper G. I. Cancer
食道・胃 癌

Ⅰ. 食道癌
1. 食道癌全国登録の再開にあたり
—問題点と解決法—

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はじめに

癌の全国登録事業は食道癌，胃癌，大腸癌などで行われているが，2003年施行の個人情報保護法に関わる問題や，入力方法の問題などがあり，しばらく中断をしていた。

最近これらが解決され，相次いで再開された。本項では，食道癌の全国登録再開に向けて，日本食道学会の全国登録委員会で解決してきた事項を中心に諸問題を解説する。

1. 食道癌全国登録の歴史

1965年10月に日本食道疾患研究会（日本食道学会の前身）が発足し，1969年10月に食道癌取扱い規約が刊行された。食道癌全国登録委員会は1976年10月に発足し，1976年12月から1976年の症例の登録と同時に1969年からの症例の集計を開始した。1979年3月に1976年の症例をまとめた第1号の報告書が刊行された。1997年から登録データを汎用データベース化して，登録用ソフトを用いる登録方法に変更した。2000年の症例集計を2003年に刊行して以後，全国登録事業が中断した。その理由は，2003年5月30日に公布，施行された個人情報保護法令により，患者の個人情報と医療情報の取り扱いが難しくなったからである[1]。

2. 食道癌全国登録再開に向けた準備

1）個人情報の取り扱い

2007年11月1日に施行された「疫学研究に関する倫理指針」は，疾患の全国登録などの疫学研究を行う際に遵守するべき法律である[2]。「資料として既に連結不可能匿名化されている情報のみを用いる研究」はこの指針の対象とされないことを明記している。そこで，個人情報を連結不可能匿名化するためにハッシュ関数を利用する方法を採用した。

ハッシュ関数とは，与えられた原文から固定長の疑似乱数を生成する演算手法で，不可逆な一方向関数のため，ハッシュ値から原文を再現することはできない。また同じハッシュ値を持つ異なるデータを作成することは極めて困難である。具体的には，通信の暗号化の補助や，ユーザ認証やデジタル署名などに応用されている。今回使用する関数は，アメリカ国立標準技術研究所(NIST)によってアメリカ政府標準のハッシュ関数Secure Hash Standard（SHS）として採用されている[3]。

例えば「しょくどう たろう」という名前は，ハッシュ関数によりハッシュ値に変換すると「c50ec7685bcd91d2ae65503cb6a587ec67338166」という数字とアルファベットが40桁並んだ情報に変換される。これが「しょくとう たろう」と一字違いの名前を変換すると「e0889bf3e4af2991d804b18439dcd22b3f9712f9」という，前者とは全く異なるハッシュ値となり，暗号化される。しかもこのハッシュ値から原文を再現できない点が特徴である。

そこで，症例情報を個人情報（氏名，生年月日，カルテ番号，など）と疾患情報（占居部位，深達度，リンパ節転移，など）の二つに分け，個人情報を連結不可能匿名化（ハッシュ化）して疾患情報とペアで登録施設から外部へ出し，すなわち全国登録委員会事務局へ提出し，症例情報を集積する。このハッシュ値を比較することにより，症例の重複チェックや追跡調査が可能となる（図1）。

こうして，個人情報は連結不可能匿名化され，施設ごとの倫理審査委員会での審査は不要となるが，必要に応じて審査を受けることも可能である。

2）研究会と学会の違い

食道疾患研究会では施設会員制度を採用していたため，会員施設に登録を依頼すれば良かった。しかし，日本食道学会では個人会員制度であるため，登録施設の認定が必要である。2007年10月に食道学会会員全員に登

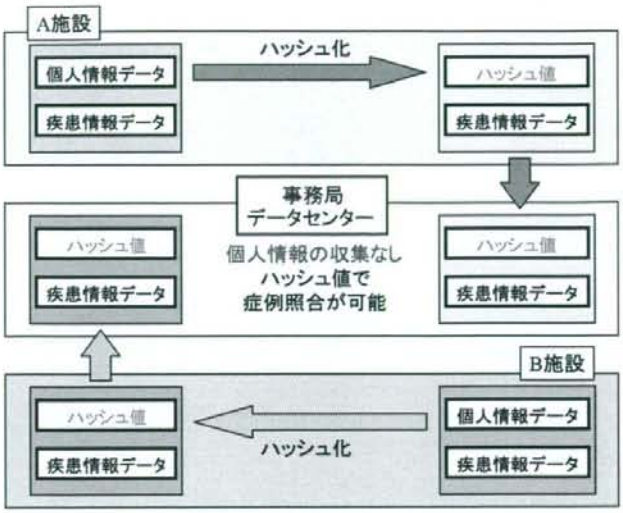

図 1　データの流れと照合

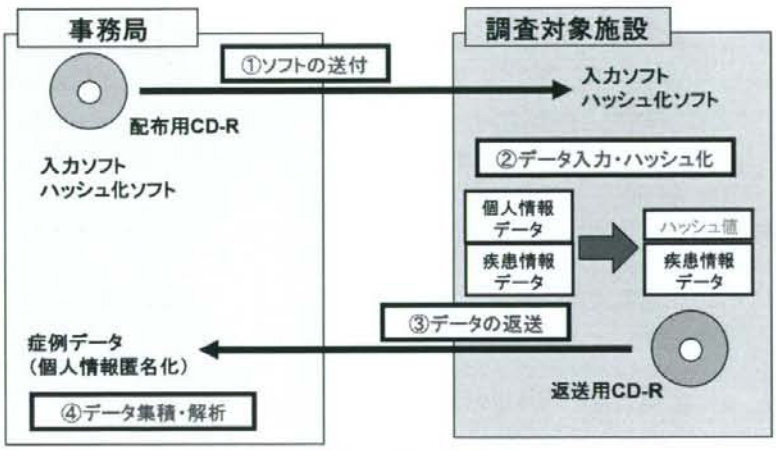

図 2　データ収集方法の概略

録事業への協力の有無，協力していただける場合には登録をする施設単位の調整，すなわち，多数の診療科がある場合に，各診療科がそれぞれ登録施設となるのか，それともすべての診療科をまとめて1つの施設として登録するのかなどを調査した。その結果，456施設が登録事業に協力することになり，2008年2月に全国登録施設認定証をこれらの施設へ送付した。

3）登録項目の見直し

食道癌取扱い規約第9版に準拠した記載に改め，ESDなどの新しい治療手段に関する記載を追加した。一方，全体の入力項目の重要度分類を行い，重要度の低い項目は割愛して，入力項目数の削減を行った。

4）新登録システムの試験運用

委員がその施設の症例を登録して，新登録システムの試験運用を行った（図2）。すなわち，事務局から入力ソフトとハッシュ化ソフトの入ったCD-Rとデータ返送用CD-Rを委員の施設に郵送し，各委員は当該施設の2001年の治療例を入力ソフトを使用して入力し，さらにハッシュ化ソフトを用いて個人情報の連結不可能匿名化を行い，疾患情報とともに返送用CD-Rに記録し，事務局へ返送する作業を行った。その結果，CD-Rの郵送のトラブルは発生しなかった。次に，入力ソフトとハッシュ化ソフトはともに正常に作動した。登録症例は事務局で集計しComprehensive Registry of Esophageal Cancer in 2000と同様な解析を試み，新たに作成した解析用のプログラムも正常に作動した。

3．全国登録再開

全国登録再開にむけて諸問題を1つずつ解決して，つ

いに2008年3月18日から2001年治療症例を対象として登録を開始した。入力ソフトとハッシュ化ソフト入りのCD-Rと返送用CD-Rを登録認定施設に郵送するとともに，日本食道学会のホームページにwebサイトを立ち上げた[1]。現在参加施設からの登録を待っているところである。

おわりに

全国登録再開に関わる問題点とその解決法について述べた。こうした事業の成功は登録施設の先生方の協力にかかっている。日本の食道癌治療の実態を整理して，今後の診療に結びつけるために，この事業を是非とも成功させたい。

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National Structure of Radiation Oncology in Japan with Special Reference to Designated Cancer Care Hospital

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Abstract

Background. The structure of radiation oncology in designated cancer care hospitals in Japan is investigated in terms of equipment, personnel, patient load and geographic distribution, compared with other radiotherapy facilities.

Methods. The Japanese Society of Therapeutic Radiology and Oncology (JASTRO) conducted a questionnaire about a national structure survey of radiation oncology in 2005. In the current study, the structures of 326 designated cancer care hospitals and the other 386 radiotherapy facilities were compared.

Results. Designated cancer care hospitals account for 45.3% of all radiotherapy facilities. Patterns of equipment and personnel in designated cancer care hospitals and others are as follows; linear accelerators/facility: 1.2 and 1.0, dual-energy function: 73.1% and 56.3%, three-dimensional conformal radiotherapy function: 67.5% and 57.2%, intensity-modulated radiotherapy function: 30.0% and 13.9%, annual patients/linear accelerator: 289.7 and 175.1, ^{192}Ir remote-controlled after-loading systems: 27.6% and 8.6%, and average number of full-time equivalent radiation oncologists/facility: 1.4 and 0.9 ($p<.0001$). There were significant differences in equipment and personnel between both types of facilities. Annual patient loads/full-time equivalent radiation oncologist of both groups were 252 and 240. Geographically, the number of designated cancer care

hospitals was associated with population and the number of JASTRO-certified physicians was associated with the number of patients undergoing radiotherapy.

Conclusions. The Japanese structure of radiation oncology in designated cancer care hospitals was more mature than that in the others in terms of equipment, although a shortage of manpower still exists. A serious understaffing problem in radiation oncology should be corrected in the future.

Mini-abstract

The Japanese structure survey of radiation oncology showed significant differences in equipment, personnel, patient load and geographic distribution among designated cancer care hospitals and other facilities.

Key words

14 Radiotherapy, 25 Medical Engineering, 03 Epidemiology

INTRODUCTION

In Japan, the Cancer Control Act was implemented in 2007 in response to patients' urgent petitions to the government. This law strongly advocates the promotion of radiotherapy (RT) and the increasing number of radiation oncologists (ROs) and medical physicists. As the same time, the Ministry of Health, Labor and Welfare began the accreditation of "designated cancer care hospitals" with the aim of correcting regional differences in the quality of cancer care and strengthening the cooperation among regional cancer care hospitals. The Japanese Society of Therapeutic Radiology and Oncology (JASTRO) has conducted national structure surveys of radiotherapy facilities in Japan every 2 years since 1990.[1] The structure of radiation oncology in Japan has improved in terms of equipment and their functions in accordance with the increasing number of cancer patients who required RT. The public awareness of the importance of RT is gradually expanding due to this law. We have introduced Patterns of Care Study (PCS) in Japan as of 1996 and have disclosed the significant differences in the quality of radiotherapy by the type of facilities and their caseloads.

In this study, the structure of radiation oncology in designated cancer care hospitals in Japan is investigated in terms of equipment, personnel, patient load and geographic distribution, as compared with those of other radiotherapy facilities in Japan.

MATERIALS AND METHODS

JASTRO carried out a national structure survey of radiation oncology in the form of a questionnaire in 2005 between March 2006 to February 2007.[2, 3] The questionnaire consisted of questions about the number of treatment machines and modality by type, the number of personnel by job category, the number of patients by type, and the site. The response rate was 712 of 735 (96.9%) from all actual radiotherapy facilities in Japan.

The number of facilities certified by the Ministry of Health, Labor and Welfare as designated cancer care hospitals by the end of fiscal 2007 was 351. Of the total 351 facilities, 47 were the designated prefectural cancer care hospitals and 304 were designated regional cancer care hospitals. Three hundred and fifty-three facilities including National Cancer Center Hospital and National Cancer Center Hospital East were included in this group as designated cancer care hospitals. Seven facilities did not send back this survey data, and 20 facilities did not have departments of radiotherapy at that point in the survey. The structures of 326 designated cancer care hospitals and the other 386 radiotherapy facilities were then analyzed. SAS 8.02[4] (SAS Institute Inc., Cary, NC) was used for the statistical analysis. The statistical significance was tested by means of a chi-square test, Students' t-test, or an analysis of variance (ANNOVA).

The Japanese Blue Book guidelines[5] were used as standard of comparison with the results of

this study. These guidelines showed the guidelines for structure of radiation oncology in Japan based on PCS data.[5, 6] The standard guidelines for annual patients load/external beam equipment were set at 250-300 (warning level 400), and those/full-time equivalent (FTE) RO at 200 (warning level 300), and those/FTE RT technologists at 120 (warning level 200).[5, 6]

RESULTS

The current situation of radiation oncology in designated cancer care hospitals and the other facilities in Japan

Table 1 shows the numbers of new patients and total patients (new plus repeats) requiring RT in 2005 in designated cancer care hospitals and the others in Japan. Designated cancer care hospitals account for 45.3% (333/735) of all radiotherapy facilities. The numbers of new patients and total patients in the all radiotherapy facilities in Japan were estimated at approximately 162,000 (156,318*735/712) and 198,000 (191,173*735/712), respectively. In designated cancer care hospitals, the corresponding numbers of patients were approximately 99,000 (96,558*333/326) and 121,000 (118,548*333/326), respectively. The number of patients in designated cancer care hospitals accounts for 61.1% of the number of patients in all radiotherapy facilities in both new patients and total patients (99,000/162,000 and 121,000/198,000). The average numbers of new patients/facility were 296.2 for designated cancer care hospitals and 154.8 for the others, respectively ($p<.0001$). In the average numbers of new patients/facility, the corresponding data were 363.6 and 188.1, respectively ($p<.0001$).

Table 2 shows the equipment patterns, staffing patterns and patient load in designated prefectural cancer care hospitals and designated regional cancer care hospitals. There were

significant differences in the average number of linear accelerators (linacs)/facility, the ownership of the intensity-modulated radiotherapy (IMRT) function of the linac, the average number of patients/facility, the average number of patients/linac, the number of ^{192}Ir remote-controlled afterloading systems (RALSs), and the number of computed tomography (CT) simulators in both types of facilities (both: $p<.0001$). The IMRT function does not necessarily mean its actual use in 2005 but its availability as the equipment. The average numbers of FTE RO/facility were 3.1 for designated prefectural cancer care hospitals and 1.2 for designated regional cancer care hospitals ($p<.0001$). The average numbers of JASTRO-certified physicians/facility were 2.1 and 0.7 ($p<.0001$).

The facility and equipment patterns and patient load/linac in designated cancer care hospitals and others

Table 3 shows the RT equipment patterns and related function in designated cancer care hospitals and the others. In designated cancer care hospitals, 397 linacs, 7 telecobalt machines, 17 Gamma Knife machines, 46 ^{60}Co RALSs, and 91 ^{192}Ir RALSs were actually used. In the others, the corresponding data were 368, 4, 31, 18, and 28, respectively. The ownership of equipment in designated cancer care hospitals, excluding telecobalt machines and Gamma Knife machines, was significantly higher than those in the others (linac: $p=0.0002$; others: $p<.0001$). In designated

cancer care hospitals, the linac system used dual-energy function in 291 systems (73.1%), three-dimensional conformal radiotherapy function (3DCRT) in 268 (67.5%), and IMRT function in 119 (30.0%). In the others, the corresponding data were 207 (56.3%), 194 (52.7%), and 51 (13.9%), respectively. The functions of linac showed significant superiority by approximately 15% greater in designated cancer care hospitals than in those in the others ($p<.0001$). The patient loads/linac were 289.7 for designated cancer care hospitals and 175.1 for the others ($p<.0001$). Figure 1 shows the distribution of annual patient load/linac in designated cancer care hospitals and the others. Eighteen percent of designated cancer care hospitals and 6% of the others were subject to treatment that exceeded the warning level of the Japanese Blue Book Guidelines[5] of 400 patients/linac. However, average patient load/linac in the other hospitals was smaller than the guideline level.

Table 4 shows the RT planning and other equipment patterns. X-ray simulators were installed in 79.1% of designated cancer care hospitals and 61.7% of the other radiotherapy facilities. CT simulators were installed in 63.5% and 48.4%, respectively. A noteworthy difference was found in the rate of X-ray simulator and CT simulator installation between designated cancer care hospitals and the others ($p<.0001$). Only a very few facilities owned magnetic resonance imaging (MRI) for RT department, although the computer use for RT recording was pervasive in both designated cancer care hospitals and the others.

The staffing patterns and patient loads in designated cancer care hospitals and the others

Table 5 shows the staffing patterns and patient loads in designated cancer care hospitals and the others. In Japan, 50.3% of designated cancer care hospitals and 31.9% of the others had their own designated beds, and ROs must also take care of their inpatients. The total numbers of FTE ROs were 471.3 for designated cancer care hospitals and 303.2 for the others. The average numbers of FTE ROs/facility were 1.4 and 0.9, respectively ($p<.0001$). The patient loads/FTE RO were 251.5 and 239.6. Figure 2 shows the distribution of annual patient load/FTE RO in designated cancer care hospitals and the other radiotherapy facilities. Twenty-four percent of designated cancer care hospitals and 11% of the others treated more than 300 patients/RO, which exceeded the warning level of the Japanese Blue Book Guidelines.[5] Figure 3 shows the percentage of distribution of facilities by patient load/FTE RO. The largest number of facilities featured a patient/FTE RO level in the 150-199 range for designated cancer care hospitals and in the 100-149 range for the others. The second largest numbers featured 200-249 and 50-99, respectively. The facilities which have less than 1 FTE RO still account for about 45.1% of designated cancer care hospitals and 75.4% of the others.

The total numbers of RT technologists were 889.9 for designated cancer care hospitals and 744.6 for the others. The average numbers of RT technologists were 2.7 and 2.3, respectively ($p<.0001$). The patient loads/RT technologists were 133.2 and 97.5, respectively ($p<.0001$). Figure 4 shows the distribution of annual patient load/RT technologist in designated cancer care

hospitals and the other radiotherapy facilities. Fourteen percent of designated cancer care hospitals and 8% of the other radiotherapy facilities treated more than 200 patients per RT technologist, exceeding the warning level of the Japanese Blue Book Guidelines.[5] Figure 5 shows the percentage of distribution of facilities by patient load/RT technologist. The largest number of facilities featured a patient/RT technologist level in the 80-99 range for designated cancer care hospitals and the others. The second largest numbers featured 100-119 and 60-79, respectively.

There were 65.0 full-time (and 17.1 part-time) medical physicists for designated cancer care hospitals and 52.0 full-time (and 13.0 part-time) for the others. There were 156.0 full-time (and 8.0 part-time) RT quality assurance staffs for designated cancer care hospitals and 100.8 full-time (and 5.0 part-time) for the others. Finally, there were 476.8 nurses and clerks for designated cancer care hospitals and 430.2 for the others.

The distribution of primary sites and palliative treatment in designated cancer care hospitals and the others

Table 6 shows the distribution of primary sites and palliative treatment in designated cancer care hospitals and the others. The most common disease site was the breast in designated cancer care hospitals and lung/bronchus/mediastinum in the others. Head/neck, esophagus, liver/biliary tract/pancreas, gynecologic, hematopoietic/lymphatic, and skin/bone/soft tissue cancers were

treated more at designated cancer care hospitals than at the others (skin/bone/soft tissue cancer: p=0.0223; others: p<.0001). The other hospitals treated more patients with brain metastasis (11.2% all new patients) than designated cancer care hospitals (p<.0001).

The geographic patterns in designated cancer care hospitals and the others

Figure 6 shows the geographic distribution for 47 prefectures of (a) the number of radiotherapy facilities arranged in order of increasing population by all prefectures in Japan and (b) the number of JASTRO-certified physicians arranged in order of increasing the number of patients undergoing RT by all prefectures in Japan.[7] The average number of radiotherapy facilities per quarter ranged from 7.2 to 32.9 in all radiotherapy facilities in Japan. In designated cancer care hospitals, those numbers ranged from 4.7 to 11.2. There were significant differences in the average number of facilities per quarter in both all radiotherapy facilities and in designated cancer care hospitals (both: p<.0001). The average number of JASTRO-certified physicians per quarter ranged from 2.8 to 24.5 in all radiotherapy facilities in Japan. In designated cancer care hospitals, those numbers ranged from 2.8 to 14.0. The average number of JASTRO-certified physicians per quarter had significant differences in both all radiotherapy facilities and designated cancer care hospitals (both: p<.0001).

Discussion

The number of patients in designated cancer care hospitals accounts for 61.1% of the number of patients in all radiotherapy facilities in Japan, accounting for both new patients and total patients, although designated cancer care hospitals account for 45.3% of all radiotherapy facilities. About 62 % of all radiotherapy facilities have less than 1 FTE RO, while about 45% of designated cancer care hospitals have less than 1 FTE RO. In Japan, the majority of facilities still rely on part-time ROs, especially in the facilities other than designated cancer care hospitals. The percentage distribution of facilities by patient load/RO in designated cancer care hospitals proved to be largely similar to that of the United States in 1989.[8] However, the facilities which have less than 1 FTE RO still account for about 45% of designated cancer care hospitals in Japan. In the United States, all facilities are supported by a full-time RO. The percentage distribution of facilities by patient load/RO in the other radiotherapy facilities was largely similar to that of Japan in 1990,[8] so a shortage of ROs will remain a major concern in Japan. As for medical physicists, their numbers in Japan are still smaller than those in Europe and the United States. They are working mainly in metropolitan areas or academic facilities such as a university hospital or a cancer center. At present, there is no national license for a medical physicist in Japan. Those with a master's degree in science or engineering or radiological technologists with enough clinical experience can take the

Japan Radiological Society (JRS)-certified examination to become medical physicists. In Japan, a new educational system is developing to train specialists for cancer care, including medical physicists, medical oncologists, oncology nurses, and palliative care doctors. A sufficient number of RT technologists are ensured, as compared with radiation oncologist and medical physicists. However, RT technologists are busy, because they are also partly playing the role of medical physicists in Japan.

In terms of distribution of the primary site for RT, designated cancer care hospitals treated more head and neck cancer patients, while the others treated more lung, trachea, and mediastinum cancer patients. Furthermore, more patients with brain or bone metastasis were treated in other hospitals. These results imply that designated cancer care hospitals which treated more curative patients have better structures than other hospitals.

On a regional basis, the number of radiotherapy facilities and the number of designated cancer care hospitals were strongly associated with population (correlation coefficients were 0.95 and 0.83). These results proved that designated cancer care hospitals were properly in place. However, in some regions where there was a large population, the ratio of the number of designated cancer care hospitals was not sufficient because many university hospitals were not certified by the Ministry of Health, Labor and Welfare as designated cancer care hospitals. There were two prefectures where the number of radiotherapy hospitals is extremely small in the Q4 region of figure 6 (a). They were