Survey of Teletherapy in Japan

Part II. Distribution of hospitals which installed teletherapy unit(s) and of registered radiologists†

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In the previous paper, the number of units for teletherapy and its tendency in Japan were analysed¹⁾. However, the use efficiency of radiotherapy units depends mostly on the distribution of skillful radiologists and partly of hospitals having the ability. In this paper, the distribution of such radiologists and hospitals are analysed.

In addition to the lists used in the previous paper, a list of hospitals which purchased large cobalt source(s) was offered by the courtesy of Japan Radioisotope Association. The hospitals in this list was almost included in the previous list arranged from the data offered from the companies dealing with teletherapy units, except only several cases which would depend on minor technical errors during making the lists. The list from Japan Radioisotope Association was so useful that the previous list was corrected in a small part. In Table 1, the number of hospitals is demonstrated according to kinds of teletherapy units.

From this survey, the total number of hospitals which have teletherapy unit(s) was estimated as 517 at the end of 1974 excluding Okinawa prefecture where an exact survey could not be performed because of a long period of the occupation. The number of hospitals in question in Okinawa is estimated to be so small that it would not disturb the results.

Among them 120 hospitals (23%) have high energy accelerator(s) and the other 397 (77%) have only cobalt units(s). Of the 120

hospitals equipped with high energy accelerator(s), 82 hospitals (68%) have cobalt unit(s), and consequently 479 hospitals, i.e. 84% of the hospitals which had teletherapy unit(s), have cobalt unit(s).

With regard to the radiologists, Japan Radiology Society has registered 627 radiologists by 1974 as licenced radiologist. The registration system is classified into two sorts. One is due to the evaluation, by the qualification committee members elected by the councilors, of an applicant's personal history on the activity in radiology. This system was prepared as a temporary process which started in 1965 and ended in March, 1971. The other is due to the results of the qualifying examination performed by the committee which started in 1969²⁾. From 1971, this system is only a way to register the licenced radiologists.

The distribution of these registered radiologists is listed in the last two columns of Table 1. All the members evaluated by the examination were collected from the member book of Japanese College of Radiology³⁾. In the case of the radiologists evaluated by personal history, 30 persons were excluded because their addresses could not be available from the member book of Japan Radiology Society⁴⁾.

† 日本における放射線治療の現状について 第2報
放射線治療装置を設置した病院と放射線科専門医
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Table 1 Distribution of hospitals and radiologists (I)

DISTRICT	BETATRON(S)				LINEAR ACCELERATOR(S)				SPECIAL COMBINATION		CO-BALT (S) ONLY	REGISTERED RADIOLOGISTS by	
	(<20MeV)		(≥20MeV)		(<10MeV)		(≥10MeV)						
	with cobalt(s)	with-out cobalt(s)	with cobalt(s)	with-out cobalt(s)	with cobalt(s)	with-out cobalt(s)	with cobalt(s)	with-out cobalt(s)	with cobalt(s)	with-out cobalt(s)		personal history	examination
HOKKAIDO	0	0	2	0	0	0	0	0	1 ³⁾	0	16	10	2
TOHOKU	1	0	3	0	2	1	3	0	1 ³⁾	3 ^{1,2,3)}	36	47	4
KANTO excl. Tokyo	0	0	0	0	1	4	4	2	3 ^{1,2,4)}	0	59	43	4
TOKYO	1	0	1	0	2	4	6	2	3 ^{1,3,4)}	1 ⁵⁾	49	136	13
KOSHIN- ETSU	0	1	0	0	0	1	3	0	1 ¹⁾	1 ¹⁾	17	20	3
HOKURIKU	0	0	1	0	1	0	0	2	0	0	16	18	1
TOKAI	1	0	1	0	2	3	4	1	1 ³⁾	0	50	43	4
KINKI	1	1	5	1	2	2	2	2	2 ¹⁾	0	39	121	1
CHUGOKU	0	1	4	0	1	1	4	0	0	0	35	35	2
SHIKOKU	0	0	0	0	2	1	2	0	0	0	31	19	3
KYUSHU excl.Okinawa	0	0	1	2	2	0	5	0	0	1 ¹⁾	49	64	4
Total	4	3	18	3	15	17	33	9	12	6	397	556	41

1) Betatron(s) (<20MeV) & Linear accelerator(s) (<10MeV),

2) Betatron(s) (<20MeV) & Linear accelerator(s) (>=10MeV),

3) Betatron(s) (>=20MeV) & Linear accelerator(s) (<10MeV),

4) Betatron(s) (>=20MeV) & Linear accelerator(s) (>=10MeV),

5) Betatron(s) (>=20MeV) & Linear accelerator(s) (<10MeV) & Linear accelerator(s) (>=10MeV).

In the table, TOHOKU district consists of the prefectures of Aomori, Iwate, Miyagi, Akita, Yamagata and Fukushima; KANTO, excluding Tokyo, of the prefectures of Ibaragi, Tochigi, Gumma, Saitama, Chiba and Kanagawa; KOSHIN-ETSU, of the prefectures of Niigata, Nagano and Yamanashi; HOKURIKU, of the prefectures of Toyama, Ishikawa and Fukui; TOKAI, of the prefectures of Gifu, Shizuoka, Aichi and Mie; KINKI, of the prefectures of Shiga, Kyoto, Osaka, Hyogo, Nara and Wakayama; CHUGOKU, of the prefectures of Tottori, Shimane, Okayama, Hiroshima and Yamaguchi; SHIKOKU, of the prefectures of Tokushima, Kagawa, Ehime and Kochi; KYUSHU, excluding Okinawa, of the prefectures of Fukuoka, Saga, Nagasaki, Kumamoto, Ooita, Miyazaki and Kagoshima. HOKKAIDO and

TOKYO mean directly their respective prefecture names.

Because lower energy linear accelerators (under 10 MeV) are almost similar in therapeutic functions to cobalt units, these two kinds of units are classified as one category which is denoted as high energyX(gamma) ray therapy unit, while the other units which have high energy electron therapy functions beyond high energyX(gamma) ray functions are classified as another category. The number of hospitals which have the functions of both categories is listed in the first column of Table 2, while the number of hospitals which have only high energyX(gamma) ray functions is listed in the second column of the table. To simplify the table, the distribution of these hospitals and radiologists among population and areas is

Table 2 Distribution of hospitals and radiologists (I)

	(1)	(2)	(3)	(4)	(5)	(6)	(3)	(4)	(5)	(6)	(4)	(5)	(6)
				$\times 10^6$	$\times 10^6$	$\times 10^4$ km ²	(1)+(2)	(1)+(2)	(1)+(2)	(1)+(2)	(3)	(3)	(3)
								$\times 10^5$	$\times 10^5$	$\times 10^3$ km ²	$\times 10^5$	$\times 10^5$	$\times 10^3$ km ²
HOKKAIDO	3	16	12	3.59	5.38	7.85	0.63	1.89	2.83	4.13	2.99	4.48	6.54
TOHOKU	11	39	51	6.33	9.29	6.59	1.02	1.27	1.86	1.32	1.24	1.82	1.29
KANTO excl. Tokyo	9	64	47	13.91	17.11	2.99	0.64	1.91	2.34	0.41	2.96	3.64	0.64
TOKYO	14	55	149	8.19	11.00	0.21	2.16	1.20	1.59	0.03	0.55	0.74	0.01
KOSHIN-ETSU	6	18	23	3.61	5.14	2.95	0.96	1.50	2.14	1.23	1.57	2.23	1.28
HOKURIKU	3	17	19	2.02	2.77	1.25	0.95	1.01	1.39	0.63	1.06	1.46	0.67
TOKAI	8	55	47	8.52	11.55	2.80	0.75	1.35	1.83	0.44	1.81	2.46	0.60
KINKI	14	43	122	12.77	16.79	2.72	2.14	2.24	2.95	0.48	1.05	1.38	0.22
CHUGOKU	9	37	37	5.15	7.11	3.17	0.80	1.12	1.55	0.69	1.39	1.92	0.86
SHIKOKU	2	34	22	2.87	4.04	1.88	0.61	0.80	1.12	0.52	1.30	1.84	0.85
KYUSHU excl. Okinawa	9	51	68	8.48	12.56	4.07	1.13	1.41	2.09	0.68	1.25	1.85	0.60
Tctal	88	429	597	75.44	102.74	36.48							
Average*							1.15	1.46	1.99	0.71 (0.66)	1.26	1.72	0.61 (0.65)

(1): Number of hospitals where high energy electron and high energy X(gamma) ray therapies could be performed (total of the columns of betatron, linear accelerator (≥ 10 MeV) and special combination in Table 1).

(2): Number of hospitals where only high energy X(gamma) ray therapy could be performed (total of the columns of linear accelerator (< 10 MeV) and cobalt only in Table 1).

(3): Number of registered radiologists (total of the last two columns of Table 1).

(4): Number of persons who have the right for election.

(5): Number of total population.

(6): Size of area.

*Numbers in parentheses are those excluding TOKYO and HOKKAIDO.

calculated as the rate to the total number of the hospitals of these two categories in each district. The number of registered radiologists is listed in the third column of Table 2 which corresponds to the addition of the last two columns of Table 1 in each district.

From Table 2, the number of registered radiologists is 1.15 persons per hospital having teletherapy capacity in average of Japan. The average numbers in each district are ranged from the minimal number of registered radiologists per hospital in question in SHIKOKU (0.61) to the maximal number in TOKYO (2.16).

As to the population, two kinds of statis-

tical reports were used. One was the whole population in Japan⁵⁾ and the other was the population of adults who were registered as having the right of election⁶⁾. The tendency of the distribution of hospitals having radiotherapy ability is almost the same in these two groups of population and the average number of population per hospital in question in Japan was 1.46×10^5 adults or 1.99×10^5 persons and the number in each district distributes between the maximum of such hospitals in SHIKOKU (0.80×10^5 adults or 1.12×10^5 persons per hospital) and the minimum in KINKI (2.24×10^6 adults or 2.95×10^5 persons).

The average population covered by one

registered radiologist was 1.26×10^5 adults or 1.72×10^5 persons as an average in Japan. The number in each district distributes between the most concentrated number of radiologists in Tokyo (0.55×10^5 adults or 0.75×10^5 persons per radiologist) and the minimal concentration in HOKKAIDO (2.99×10^5 adults or 4.48×10^5 persons per radiologist).

The area covered by hospitals having teletherapy capacity shows two exceptional cases of HOKKAIDO and TOKYO⁷⁾. In HOKKAIDO one of such hospitals is covering 4,130 km² as an average which is about 140 times of that in TOKYO where one hospital in question covers 30 km². The average area per hospital having teletherapy unit(s) in Japan is 710 km² (660 km² when HOKKAIDO and TOKYO are excluded).

By these tables the number of hospitals having therapy unit(s) is not so small but, on the contrary, the lack of radiologists is of an extremely emergent problem. Although there are about 1,200 radiologists in Japan including the registered radiologists⁴⁾, only two radiologists are available even if these radiologists are all employed only to the hospitals having therapy unit(s). However, the duties of radiologists are now covering a large area of radiology such as X-ray diagnoses, nuclear medicine and, for younger radiologists, inpatient care for training. If the jobs for radiotherapy were considered about 15% of the daily works of experienced radiologists, 6 times of the present registered radiologists should be prepared to cover only therapeutic duties, considering that only one radiologist is needed for therapy division. But in reality 2 or 3 persons are needed to cover the division. Furthermore many hospitals with no therapy units should also need experienced radiologists for procedures in X-ray diagnoses, nuclear medicine and others.

As the result, this survey suggests that

not only diagnostic radiological procedures but also many parts of therapeutic radiological procedures are being performed without radiologists. Judging from the need to perform pertinent procedures for patient's care from the viewpoint of radiological procedures, because the advantage and disadvantage of radiation to human should be correctly discussed, the present status of the extreme lack of radiologists should be considered not only in the standpoint of the radiologists themselves but also from the wide ranged national viewpoint.

I wish to extend my thanks to the companies described in the previous report and Japan Radioisotope Association for sending me their data of radioisotope users for this survey.

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