

A SURVEY ON HISTORY OF PRIOR MEDICAL IRRADIATION IN GENERAL POPULATION OF JAPAN

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For study on late effects following medical irradiation, it will be of great importance to know the rate of prior medical irradiation in general population. In this paper medical irradiation rate was studied in population in Aichi prefecture in order to extend its result to that of general population of Japan.

METHODS

One thousand persons were selected at random from the inhabitants in Aichi prefecture with the population of 4,206,282. Since this study was carried out as a part of a semi-national survey on carcinogenesis in man in Japan which was made by the research group under the chairmanship of Dr. S. Takahashi, professor of radiology, Nagoya University School of Medicine, sex and age distribution of materials in this survey was necessary to be coincided with that of the cancer group surveyed formerly in Japan by the research group. The research group had collected 8,923 cancer patients and 11,556 controls from all Japanese hospitals. The present survey was attempted for the purpose

TABLE 1. Age and Sex Distribution of Samples to be Selected

| Sex→ | Male | | Female | | Total | |
|-------|------------------|----------------------|------------------|----------------------|------------------|----------------------|
| | * | ** | * | ** | * | ** |
| Age↓ | Cancer incidence | Number to be sampled | Cancer incidence | Number to be sampled | Cancer incidence | Number to be sampled |
| 0-19 | 0.9% | 0 | 2.8% | 0 | 1.8% | 0 |
| 20-29 | 3.6 | 18 | 5.2 | 26 | 4.4 | 44 |
| 30-39 | 10.6 | 53 | 12.4 | 63 | 11.5 | 116 |
| 40-49 | 28.2 | 141 | 28.3 | 147 | 28.1 | 288 |
| 50-59 | 30.0 | 153 | 27.1 | 138 | 28.7 | 291 |
| 60-69 | 20.9 | 105 | 19.4 | 102 | 20.1 | 207 |
| 70- | 5.8 | 30 | 4.8 | 24 | 5.4 | 54 |
| Total | 100.0% | 500 | 100.0% | 500 | 100.0% | 1000 |

Note: * Cancer incidence obtained by the research group under the chairmanship of Dr. S. Takahashi.

** Number to be surveyed in this study.

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of checking whether these controls collected by the research group are available or not. Therefore the samples selected in this survey have the approximately same sex and age composition as cancer patients in Japan. The actual number of samples selected were shown in Table 1 classified according to sex and age.

Generally it is very difficult to sample directly from a large population such as Aichi prefecture. Therefore a two-step sampling method was taken. First, the municipalities from which persons to be surveyed are selected. From the view point of economic and social relations, we divided these municipalities in Aichi prefecture into four categories, that is, (1) Nagoya City which is one of the Big-Six-Cities of Japan in Aichi prefecture, (2) old cities which had developed already before the Second World War with the population of 100,000 to 300,000, (3) new cities which had developed after the Second World War with the population under 100,000, and (4) towns and villages with the population under 30,000. The actual population in each category above described was 1,591,914, 860,564, 752,455, and 1,001,349 respectively. Therefore sampling number to be selected from these categories was 378, 204, 180, and 238 respectively, which were chosen proportionally with the population. Since the expense was limited, 4 wards from Nagoya City, 2 cities from "old cities", 6 cities from "new cities" and 8 towns and villages from "towns and villages", were selected randomly by the random dice made by the Japanese Standard Association. Final number to be sampled was assigned to these 20 districts, as is shown in Table 2.

Secondly, persons to be surveyed were selected from the principal poll books of 20 districts. Each district has more than 20 poll books usually. Therefore we took a systematic sampling method by only one poll book chosen

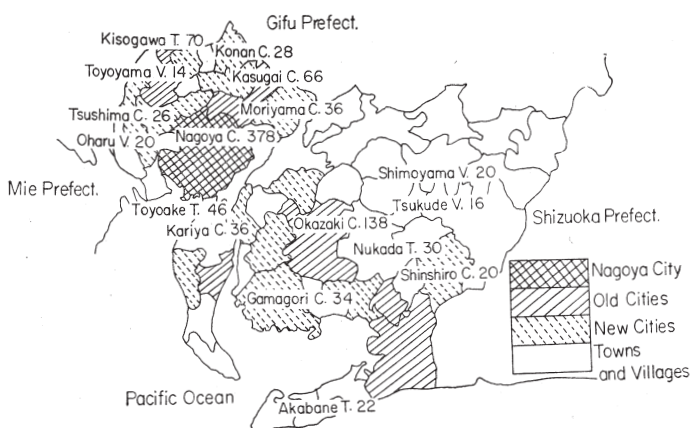


FIG. 1. Map of Aichi Prefecture

Small areas bounded show the limits of cities, towns, and villages. Numericals represent number to be surveyed in the respective district.

TABLE 2. Assigned Numbers to be Sampled from 20 Districts

| Categories | Districts | Number to be sampled (assigned) | | | |
|--------------------|-------------------|---------------------------------|--------|-------|-----|
| | | Male | Female | Total | |
| Nagoya City | Kita Ward | 63 | 63 | 126 | 378 |
| | Naka Ward | 48 | 48 | 96 | |
| | Atsuta Ward | 37 | 37 | 74 | |
| | Minato Ward | 41 | 41 | 82 | |
| Old Cities | Okazaki City | 69 | 69 | 138 | 204 |
| | Kasugai City | 33 | 33 | 66 | |
| New Cities | Tsushima City | 13 | 13 | 26 | 180 |
| | Kariya City | 18 | 18 | 36 | |
| | Gamagori City | 17 | 17 | 34 | |
| | Moriyama City | 18 | 18 | 36 | |
| | Konan City | 14 | 14 | 28 | |
| | Shinshiro City | 10 | 10 | 20 | |
| Towns and Villages | Toyoake Town | 23 | 23 | 46 | 238 |
| | Toyoyama Village | 7 | 7 | 14 | |
| | Kisogawa Town | 35 | 35 | 70 | |
| | Oharu Village | 10 | 10 | 20 | |
| | Nukada Town | 15 | 15 | 30 | |
| | Shimoyama Village | 10 | 10 | 20 | |
| | Tsukude Village | 8 | 8 | 16 | |
| | Akabane Town | 11 | 11 | 22 | |
| Total | | 500 | 500 | 1000 | |

at random from all poll books in the same district. Thirdly, questionnaires requested whether or not have prior medical irradiation were sent to 1,000 persons thus selected. Three times of pressing letter was sent to non-responded persons. After 3 months 869 available responses were obtained (Table 3).

TABLE 3. Response to Survey

| | | Number | Percentage |
|--------------------|---|--------|------------|
| Total sent | | 1000 | 100 |
| Useless response | Mailed back* | 22 | 2.2 |
| | Persons directed dead | 2 | 0.2 |
| | Incomplete response (no answer to pressing letter) | 2 | 0.2 |
| | Total | 26 | 2.6 |
| Available response | | 869 | 86.9 |
| Non-response | | 105 | 10.5 |

Note: * The letter was mailed back with a tag explaining its nondelivery. This is due to change of address without notification to the Election Administration Committee and to the post office.

RESULTS

In this paper "having irradiation history" means "having prior medical irradiation more than three years ago". As described before this study was

carried out as a part of survey of carcinogenesis in man in Japan. The research group (Chairman: Prof. S. Takahashi) has taken a retrospective survey consisted of the comparison of the rate of prior medical irradiation between in cancer patients and controls. The research group has regarded that irradiation received only more than three years ago may have a relation to carcinogenesis. Therefore we also took a standard of irradiation followed them.

Classification according to age, sex, and irradiation was detailed in Table 4. There was a tendency to have more prior medical irradiation rate in males than in females in each age class. In males 39 or 9.03% have prior irradiation of 432, and 18 of 437 or 4.12% in females. According to categories of municipalities, persons in the new cities tended to have more prior irradiation rate, however this is of no statistical significance. Of the new cities, persons living in Moriyama and Gamagori Cities have a relatively high rate of irradiation. These two cities locate near Nagoya City. Of the irradiated persons, 47 received flourosopic examination of the gastrointestinal tract, and 10 received radiation therapy. Radiotherapy was applied to 2 of eczema, 1 of naevus, 2 of favus, 3 of cervical tuberculous lymphadenitis, and 3 of other diseases.

TABLE 4. Classification of Available Response According to Age, Sex, and Irradiation

| Age | Non-irradiated | | | Irradiated | | | Total | | |
|-------|----------------|--------|-------|--------------|--------------|--------------|-------|--------|-------|
| | Male | Female | Total | Male | Female | Total | Male | Female | Total |
| 20-29 | 17 | 27 | 44 | 1 (5.56) | 1 (3.57) | 2 (4.35) | 18 | 28 | 46 |
| 30-39 | 38 | 53 | 91 | 7 (15.56) | 0 | 7 (7.53) | 45 | 53 | 93 |
| 40-49 | 108 | 115 | 223 | 8 (2.90) | 5 (4.17) | 13 (5.51) | 116 | 120 | 236 |
| 50-59 | 127 | 115 | 242 | 14 (9.93) | 9 (7.26) | 23 (8.68) | 141 | 124 | 265 |
| 60-69 | 76 | 83 | 159 | 6 (7.32) | 3 (3.49) | 9 (5.36) | 82 | 86 | 168 |
| 70- | 27 | 26 | 53 | 3 (10.00) | 0 | 3 (5.36) | 30 | 26 | 56 |
| Total | 393 | 419 | 812 | 39 (9.03) | 18 (4.12) | 57 (6.56) | 432 | 437 | 869 |

Note: Values in the parenthesis show the percentage of irradiation rate (We call it the irradiation rate.).

CRITICS

The response rate in this survey is extremely high from the view point of a common sense of such a statistical survey. However, results were obtained in disregard of 105 non-responses. To check this weak point, two trials were undergone. First, we checked whether or not there are any differences in irradiation rate between in persons immediately responded and in persons responded after two or three time of pressing letters. Fig. 2 shows irradiation

TABLE 5. Municipalities Category and Irradiation Rate

| Sex→ Category↓ | Non-irradiated | | | Irradiated | | | Total | | |
|-------------------|----------------|--------|-------|---------------|--------------|---------------|-------|--------|-------|
| | Male | Female | Total | Male | Female | Total | Male | Female | Total |
| Nagoya City | 154 | 158 | 312 | 9 (5.52) | 6 (3.66) | 15 (4.59) | 163 | 164 | 327 |
| Old Cities | 78 | 82 | 160 | 7 (8.24) | 3 (3.53) | 10 (5.88) | 85 | 85 | 170 |
| New Cities | 68 | 73 | 141 | 12 (15.00) | 6 (7.59) | 18 (11.32) | 80 | 79 | 159 |
| Towns and Vill. | 93 | 106 | 199 | 11 (10.58) | 3 (2.75) | 14 (6.57) | 104 | 109 | 213 |
| Total | 393 | 419 | 812 | 39 (9.03) | 18 (4.12) | 57 (6.56) | 432 | 437 | 869 |

TABLE 6. Classification of Irradiated Persons According to Fluoroscopy or Radiotherapy

| Sex→ Irradiated when↓ | Fluoroscopy of G. I. tract | | | Radiotherapy | | | Total | | |
|--------------------------|----------------------------|--------|-------|--------------|--------|-------|-------|--------|-------|
| | Male | Female | Total | Male | Female | Total | Male | Female | Total |
| 3-5 yrs. ago | 9 | 5 | 14 | 0 | 0 | 0 | 9 | 5 | 14 |
| 6-10 yrs. ago | 8 | 6 | 14 | 1 | 0 | 1 | 9 | 6 | 15 |
| 11-15 yrs. ago | 9 | 2 | 11 | 0 | 0 | 0 | 9 | 2 | 11 |
| 16-20 yrs. ago | 2 | 2 | 4 | 0 | 1 | 1 | 2 | 3 | 5 |
| 21-25 yrs. ago | 1 | 0 | 1 | 1 | 0 | 1 | 2 | 0 | 2 |
| 26-30 yrs. ago | 2 | 0 | 2 | 2 | 0 | 2 | 4 | 0 | 4 |
| Over 30 yrs. ago | 1 | 0 | 1 | 3 | 2 | 5 | 4 | 2 | 6 |
| Total | 32 | 15 | 47 | 7 | 3 | 10 | 39 | 18 | 57 |

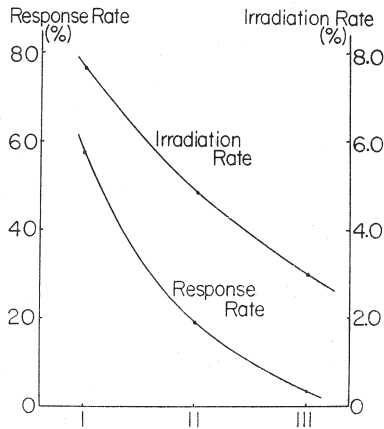


FIG. 2. The relationship between the length of intervals until totalling and response rate and irradiation rate. The irradiation rate tended to decrease in persons responded not immediately. If further longer interval would be taken the irradiation rate might have been down to zero.

rate and response rate according to the length of intervals from posting of questionnaires to arriving of answers. The later answers, the lower irradiation rate. Therefore if more times of pressing letters were sent and intervals were taken further longer, the irradiation rate should be rather slightly decreased. In an extreme case, the irradiation rate may become down to 5.7 per cent.

On the other hand there was no bias in sex and age distribution between in persons immediately responded and not immediately responded.

Secondly, not responded persons were checked by questionnaires, in which (1) reason of no answer, (2) any comment to this survey, and (3) presence of prior medical irradiation, were requested. Ten persons were randomly selected among 105 not responded persons. Of 10, 3 lived in Nagoya City, 3 in the old cities, 2 in the new cities, and 2 in the towns and villages. And also 4 were male and 6 were females. As results were summarized in Table 7, there were no cases refused the answer intentionally.

TABLE 7. Analysis of Non-responded Persons

| | Items | Number |
|--------------------------|--|--------|
| Reason of no answer | 1. By pressure of work | 3 |
| | 2. Forgotten | 4 |
| | 3. Loss of post card for answer | 0 |
| | 4. Troublesome to write | 1 |
| | 5. Never answered to all surveys | 0 |
| | 6. Other reasons | 0 |
| | 7. No description of reason (unknown reason) | 2 |
| Comments for this survey | 1. Valuable | 4 |
| | 2. Of no significance | 0 |
| | 3. Unwelcome favor | 0 |
| | 4. Troublesome | 1 |
| | 5. Cannot understand the purpose of survey | 1 |
| | 6. No comment | 4 |
| Irradiation | 1. Have prior medical irradiation | 0 |
| | 2. No prior medical irradiation | 10 |

Therefore, our results obtained from only 869 available responses is considered to be adequate. It is concluded that the background level of prior medical irradiation in general population is considered to be 6.56 per cent from both fluoroscopic and therapeutic sources, and to be 1.16 per cent from only therapeutic source.

SUMMARY AND CONCLUSIONS

Questionnaires were sent to 1,000 persons selected randomly from general population in Aichi prefecture of Japan, to know the rate of prior medical irradiation. Among the usable response (869 or 86.9 per cent), 57 or 6.56 per cent have a history of prior medical irradiation over three years ago. The irradiation rate was a little higher in males than in females. Little difference of irradiation rate were recognized in the difference of age. An analysis of nonresponses showed no particular bias in this survey. Results obtained in this survey also showed that the control group adopted by the research group of human cancer induced by medical radiation had no statistical biases for getting reliable inferences on radiation-induced carcinogenesis in man.

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