



Title	Evaluation on mass screening examination for stomach cancer
Author(s)	吉井, 弘文
Citation	日本医学放射線学会雑誌. 1980, 40(7), p. 681-689
Version Type	VoR
URL	<a href="https://hdl.handle.net/11094/19358">https://hdl.handle.net/11094/19358</a>
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## Evaluation on mass screening examination for stomach cancer

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Research Code No.: 512

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Key Words: Mass screening, Stomach cancer, Photofluorographic image

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## 胃 集 検 の 評 価

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(昭和54年12月10日受付)

(昭和55年3月12日最終原稿受付)

1967年、熊本県衛生部による胃集団検診が開始され、その後、熊本県対ガン協会に業務を移管、現在までに20万余の県民に胃集検を実施している。著者らは、当初より間接フィルムの読影を担当しているが、今回、熊本県対ガン協会の協力を得て、1968年以降の精検報告書の内容、発見胃癌の分類、年齢別発生頻度、間接フィルムによる正診率等について検討し、次のような結論を得た。

胃癌の発見率は、0.07%、推定胃癌発見率は、0.10%であった。早期胃癌が胃癌に占める割合は19%で、その内容は、Ⅱc型が大半を占め、次いでⅡc+Ⅲ型であった。進行癌では、ポールマン

Ⅲ型が最も多く、次いでⅡ型であった。

胃集検受診者は、40歳代が最も多く、次いで、50歳、60歳代の順であった。胃癌発見率は、70歳代が最も多く、次いで60歳、50歳代であった。

精検報告書に基づく精検受診率は、68.5%であったが、アンケート調査等によれば、実際の精検受診率は90%以上と推定された。また、精検未受診者とされたもの程、高い罹患率を示した。

間接フィルムにおいて、有所見とされた部位の正診率は82%、推定された診断の正診率は48%であった。

## I. INTRODUCTION

Mass screening examination for the early detection of stomach cancer in our country dates from the proposal of Irie. It became systematic in the latter half of the decade 1955—1964 until at present it is widespread all over the country.

In Kumamoto Prefecture mass screening survey of the general population for stomach cancer was initiated by the Dept. of Health of the prefecture in 1967. The service was subsequently placed under the control of the Kumamoto Cancer Society. A total of more than 200 thousand people have undergone the examination with some results up to the present.

With the help of the Dept. of Health of Kumamoto Prefecture and the Kumamoto Cancer Society, for which the author was in charge of reading photofluorographic pictures obtained during the mass

screening, studies were made of the percentage of subjects undergoing close examination, the type of stomach cancers thereby detected, the incidence of cancer in different age brackets, and the accuracy of diagnosis made on mass screening survey. Some outstanding findings obtained are presented below.

## II. SUBJECTS AND METHODS

Those subjects covered by the mass screening or close check program provided by the Dept. of Health, Kumamoto Prefecture, or the Kumamoto Cancer Society for the years 1968—1975, for whom a complete set of data were available, were used in this study. Based on the data contained in the close examination report submitted by the participating institutions, a questionnaire survey was conducted among the institutions and the subjects so examined. For subjects found to have or suspected of having stomach cancer, roentgenographic pictures and pathological findings contained in the clinical chart for each year were also investigated.

## III. RESULTS

### 1. Results of stomach cancer screening examinations

The results of stomach cancer screening examinations for the 8 years 1968—1975 are summarized in Table I.

Table I. Results of stomach cancer screening examination

Years	1968	1969	1970	1971	1972	1973	1974	1975	Total
No. of cases	13,880	16,711	20,942	22,403	23,342	24,387	35,036	35,078	191,779
No. of close examination (%)	2,190 (15.8)	2,391 (14.3)	2,559 (12.2)	2,702 (12.1)	2,303 (9.9)	2,672 (11.0)	3,796 (10.8)	4,024 (11.5)	22,637 (11.8)
No. of undergone close check (%)	1,678 (76.6)	1,756 (73.4)	1,485 (58.0)	1,949 (72.1)	1,784 (77.5)	1,807 (67.6)	2,551 (67.2)	2,507 (62.3)	15,517 (68.5)
No. of detected stomach cancer (%)	50 (0.36)	35 (0.21)	36 (0.17)	43 (0.19)	31 (0.13)	25 (0.10)	30 (0.09)	32 (0.09)	283 (0.15)
No. of estimated cancer (%)	65 (0.47)	49 (0.29)	62 (0.30)	60 (0.27)	40 (0.17)	37 (0.15)	45 (0.13)	51 (0.15)	409 (0.21)

In 1968 there were a total of 13,880 cases covered by the screening examination program. The number then increased, being 2.5 times as many or 35,078 in 1975. The total number of cases covered for the 8 years amounted to 191,779. The incidence among the total cases covered of those in which close examination was considered necessary was the highest or 15.8 percent in 1968 (2,190 cases) and the lowest or 9.9 percent in 1972 (2,303 cases). The number of such cases was increased with the increase in the total number of people covered, amounting to 22,637 in total for the 8 years with an incidence of 11.8 percent.

The number of those who actually underwent close check was the smallest or 1,678 in 1968 and the largest or 2,551 in 1974. The incidence of these people was the lowest or 56.2 percent in 1975 and the highest or 77.5 percent in 1972. The total number of cases subjected to close examination for the 8 years was 15,517 with a mean incidence of 68.5 percent.

The reported total number of stomach cancers detected was the smallest or 31 in 1972 and 1975

and the largest or 50 in 1968. The incidence of cases of stomach cancer detected was the highest or 0.36 percent in 1968 and then decreased down to the bottom or 0.09 percent in 1975. The total number of stomach cancers detected for the 8 years was 283, with a mean incidence of 0.15 percent.

The number of stomach cancers detected as estimated from these figures was the largest or 65 in 1968 and the smallest or 37 in 1973, a total of 409 stomach cancers being estimated to have been detected for the 8 years. Much the same held true for the estimated incidence of stomach cancer detected, which was the highest or 0.47 percent in 1968 and the lowest or 0.13 percent in 1974 with a mean of 0.21 percent.

## 2. Types of stomach cancer detected

There were a total of 283 stomach cancers reported during the 8 years, as shown in Table I. The breakdown of these stomach cancers is given in Table II. For 142 of 283 stomach cancers detected and reported, the diagnosis was established either macroscopically or pathologically by means of biopsy or surgery or on the basis of the subsequent clinical course in the absence of diagnostic efforts other than

Table II. Classification of type

		Type	No. of cases (%)
Early cancer		I	1
		II a	1
		II a+ II b	1
		II a+ II c	2
		II c	17
		II c+ III	4
		III	1
		Total	27 (19)
Advanced cancer	B	I	9
		II	26
		III	44
		IV	22
		Similar type to early cancer	9
		Others	5
		Total	115 (81)
		Total	142 (100)

roentgenography. This represents 0.07 percent of the total persons covered by the screening program. Of these 142 stomach cancers, 27 (19 percent) were early cancers, including 17 of type II c, 4 II c+ III, 2 II a+ II c and 1 others. The remaining 115 (81 percent) were advanced cancers inclusive of those similar types early cancer. Of these, 44 were of type B III, 26 B II, 22 B IV 9 B I, 9 similar types early cancer, and 5 others.

In 141 cases other than those with an established diagnosis of stomach cancer, there was either no abnormalities or gastric ulcer or other conditions were present.

## 3. Age and sex distribution of examinee and patients with stomach cancer detected

The age and sex distribution of those who took the mass screening examination for stomach

Table III. Age and Sex distribution

Age	No. of cases			No. of detected stomach cancers (%)		
	Man	Female	Total	Man	Female	Total
—39	9,787	9,550	19,337	8 (0.09)	4 (0.04)	12 (0.06)
40—49	51,324	34,046	85,370	26 (0.05)	16 (0.05)	42 (0.05)
50—59	34,252	25,244	59,496	33 (0.10)	12 (0.05)	45 (0.08)
60—69	11,201	11,958	23,159	24 (0.21)	10 (0.08)	34 (0.15)
70—	2,175	2,242	4,417	8 (0.37)	1 (0.04)	9 (0.20)
Total	108,739	83,040	191,779	99 (0.09)	43 (0.05)	142 (0.07)

cancer is shown in Table III. Persons in their forties predominated for both sexes, amounting to 51,324 for the male and 34,046 cases for the female, with a total number of 85,370 cases or 45 percent of the testee as a whole. The number was decreased with age: there were a total of 59,496 cases in the fifth decade including 34,252 males and 25,244 females; and 23,159 cases in the sixth decade including 11,201 males and 11,958 females. Cases in the seventh decade were much smaller in number of 4,417, of which 2,175 were males and 2,242 females. Males in their forties or fifties were about 1.5 times as many as females in the corresponding age bracket. Males in their sixties, seventies or older were essentially the same in number as females in the corresponding age group. No significant difference existed between sexes as to the number of cases below 40 years of age: 9,787 males and 9,550 females with a total of 19,377.

The number of stomach cancers detected in different age brackets of persons is shown in Table III. In the male, a total of 99 stomach cancers were detected, of which 33 were in persons in their fifties, 26 in their forties, 24 in their sixties and 8 each in their seventies or above and in their thirties or below. In the female, a total of 43 stomach cancers were detected: 16 in persons in the fourth decade of life, 12 in the fifth decade, 10 in the sixth decade, 4 in the third decade or below and 1 in the seventh decade or above. The incidence of stomach cancer detected was found to double with an increment in age of about 10 years, apart from an incidence figure of 0.09 percent in persons under 40 years of age: 0.05 percent in the fourth decade, 0.10 percent in the fifth decade, 0.21 percent in the sixth decade and 0.37 percent in the seventh decade. In the female, no substantial difference was observed between age groups as to the incidence of stomach cancer detected: 0.08 percent in the sixth decade, 0.05 percent in the fourth and fifth decade, and 0.04 percent in the third decade or below and in the seventh decade or above. The male-female ratio of the incidence was approximately 2:1.

#### 4. Results of close examination

In 1975 there were a total of 35,078 cases undergoing mass screening examination for stomach cancer. Of these, 4,024 (Table I) were considered to have a condition justifying close examination. Of these, 2,507 or 62.3 percent actually took a close examination. The distribution of diseases thereby disclosed in these cases, as contained in the close examination report or revealed by our subsequent survey, is shown in the right column of Table IV. According to the close examination report, there were 1,703 pathological cases with a morbidity rate of 67.9 percent, including 32 stomach cancers, 243 gastric ulcers, 24 gastric polyps, and 1,404 others. No abnormalities were demonstrated in 794 cases (31.7 percent). The results of our survey of 1,713 cases exclusive of the above-referred 794 cases are

Table IV. Result of close examination (1975)

No. of cases	35,078	
No. of close examination	4,024	
No. of undergone close check (%)	2,507 (62.3%)	
	Report	Survey
	No. of detected (%)	No. of detected (%)
Stomach cancer	32 (0.09)	20 (0.06)
Estimated	51 (0.15)	32 (0.09)
Gastric ulcer	243 (0.69)	163 (4.64)
Gastric polyp	24 (0.07)	19 (0.05)
Others	1,404 (4.00)	122 (0.35)
Total	1,703 (4.85)	324 (0.92)
No abnormality	794	374
No pathological significans	/	356
Total	794	730
Unknown	10	659

shown in the left column of Table IV. As seen, there were 20 cases of stomach cancer, 163 cases of gastric ulcer, 19 cases of gastric polyp and 122 cases of other conditions. Diseases requiring treatment were present in 324 cases with an incidence of 12.9 percent, which is much lower than in the close examination report. No abnormalities were present in 374 cases (14.9 percent). In 356 cases (14.2 percent) abnormal findings such as scarred gastric ulcer were obtained but proved to be of no pathological significance. Adding similar cases contained in the close examination report, there were a total of 1,524 cases showing no evidence of abnormal condition, the incidence being 60.8 percent. No information was available in 659 cases (26.3 percent).

#### 5. Percentage of persons failing to take close examination

In 1975, 1,517 persons or 37.7 percent of 4,024 persons considered to require close examination were reported to have failed to take it. A survey was carried out in arbitrarily selected 574 cases in order to determine the incidence of those persons who failed to undergo close examination. The

Table V. Percentage of persons failing to take close check (1975)

No. of cases	35,078	
No. of close examination	4,024	
No. of undergone close check	2,507	
No. of failed to close check (%)	1,517 (37.7%)	
No. of survey	574	
No. of respond to questionnaire (%)	489 (85.2%)	
No. of undergone close check (%)	440 (76.7%)	
Diagnosis of close check	Stomach cancer	4
	Liver cancer	1
	Gastric ulcer	39
	Gastric polyp	7
	Others	145
Total		196

results obtained are shown in Table V. 489 (85.2 percent) of these 574 persons responded to the questionnaire. Of these, 440 had undergone close examination, the incidence being 76.7 percent of non-responders were regarded as having failed to take the examination. Close examination revealed stomach cancer in 4, liver cancer in 1, gastric ulcer in 39, gastric polyp in 7, and other pathological conditions in 145 cases: 196 cases in all with a morbidity rate of 34.4 percent. Calculating from these figures the estimated number of stomach cancers detected in 1,517 cases failing to undergo close examination, then a figure of 11 is obtained. The sum of these 11 cases and 20 cases disclosed by our survey (Table IV) was estimated to be the figure for the year 1975. As might reasonably be expected, this figure corresponded well to the estimated number of stomach cancers detected (20) as calculated from the following values for pertinent parameters: 4,024 persons requiring close examination, 2,507 persons (62.3 percent) actually undergoing the examination and 20 stomach cancers detected in these cases.

Also, 1,163 persons or 76.7 percent of these 1,517 persons were calculated to have taken close examination. Hence, a total of 3,670 persons, i.e., the sum of these 1,163 and 2,507 persons included in the close examination report were estimated to have undergone the examination, with an incidence of 91.2 percent.

#### 6. Accuracy of diagnosis made during mass screening examination

A study was made of the location of lesion disclosed on close examination in relation to the site of abnormality as seen in photofluorographic pictures taken during mass screening survey. Used for this purpose were selected cases of stomach cancer, gastric ulcer or gastric polyp as diagnosed on that occasion in 1974 or 1975. The results are shown in Table VI. Those cases were excluded, in which a correct diagnosis of stomach cancer or gastric ulcer could be made by photofluorographic means alone or there were extensive abnormal changes all over the stomach.

There were 175 cases of stomach cancer or gastric ulcer included in this series. A correct diagnosis was made in 91 (91 percent) of 100 cases in which a lesion was located in the gastric angle, in 38 (79.2 percent) of 48 cases in which the gastric body was involved, and in 13 (59.1 percent) of 22 cases in which the vestibule was involved, with an overall rate of correct diagnosis of 82.3 percent or 144 in 175.

Table VI. Accuracy of diagnosis photofluorographic images

Location		Cases	No. of correct diagnosis (%)
Cancer & Ulcers	Gastric bubble	1	1
	Body	48	38 (79.2)
	Gastric angle	100	91 (91.0)
	Sinus	4	1
	Antrum	22	13 (59.1)
	Total	175	144 (82.3)
Polyp	Gastric bubble	2	2
	Body	4	2
	Sinus	9	6 (66.7)
	Antrum	14	13 (92.9)
	Total	29	23 (79.3)
Total		204	167 (81.9)

There were 29 cases of gastric polyp included. A correct diagnosis was made during mass screening examination in 13 (92.9 percent) of 14 cases in which the lesion was located in the vestibule and in 6 (66.7 percent) of 9 cases in which the antrum was involved, with an overall incidence of 79.3 percent or 23 in 29. In all, a correct diagnosis was made in 167 of 204 cases examined. In other words, a lesion was actually located in a site other than that pointed out during mass screening examination in 34 (18.1 percent) of 204 cases.

#### 7. Diagnostic value of photofluorographic images

Assessment was made of the diagnostic value of photofluorographic images taken during mass screening examination. A survey was made in 77 cases in which the condition appeared to be diagnosable on reading the photofluorographic images. Pertinent information was available in 65 of these cases. The results are summarized in Table VII.

Table VII. Diagnostic value of photofluorographic images (1974, 1975)

Diagnosis of pictures	No. of cases	No. of accuracy of diagnosis (%)
Stomach cancer	34	10 (29.4)
Gastric ulcer	21	14 (66.7)
Gastric polyp	10	7 (70.0)
Total	65	31 (47.7)

A correct diagnosis was made by photofluorography alone in 10 (29.4 percent) of 34 cases of stomach cancer, in 14 (66.7 percent) of 21 cases of gastric ulcer and in 7 (70 percent) of 10 cases of gastric polyp. The overall rate of correct diagnosis was 47.7 percent or 31 in 65, the rate being high in gastric polyp or ulcer and low in stomach cancer.

### IV. DISCUSSION

In the mass screening program for stomach cancer instituted by the Kumamoto Cancer Society, the examinee is not subjected to close examination if he falls under the category B. As stated earlier, data on the percentage of suspects requiring close examination are inadequate because the examination is left to registered general practitioners and hence the data are available only in the form of the close examination report.

Data collected from the report showed that stomach cancer was detected in 0.15 percent of cases examined, an incidence which is somewhat higher than the national mean value or 0.1 percent<sup>1)2)</sup>. According to our survey, in contrast, a definite diagnosis was made in only 0.7 percent of cases. Stomach cancer detected was early cancer in as few as 19 percent<sup>2)3)</sup> of cases. The detection rate of stomach cancer increased with age, and in the male in particular it doubled with an increment in age of 10 years. No such tendency was noted in the female. This suggests that efforts at mass screening should be directed towards old men, inasmuch as its efficiency is concerned, as mentioned by previous investigators<sup>4)5)</sup>.

Data from the close examination report pointed to a high morbidity rate. The actual figure, however, was about two-thirds as large for stomach cancer and approximately one-fifth for the diseases examined as a whole. The rate of examinee requiring close examination is generally believed



to be 15 percent, whereas in our series it was as low as 12 percent. It follows that mass screening account for 80 percent of the total. However, such service cannot be dispensed with for the early detection of stomach cancer.

Mention has frequently been made of the necessity of following up those persons who have failed to take close examination required. Our study showed, however, that almost all of such persons had really undergone the examination. Close examination revealed approximately three times as high a morbidity rate as that indicated by the close examination report. It appears that less reports are available for persons with than those without positive findings. Closer contact should be maintained with institutions participating in close examination programs.

The location of lesion was correctly diagnosed in a considerably high percentage of persons during mass screening examination but with false negative cases accounting for 20 percent of the total, an incidence which is roughly identical with previously reported incidence figures for stomach cancer going unnoticed<sup>6)7)8)</sup>.

As to the diagnostic value of photofluorographic image, it was found that a correct diagnosis was made by this means alone in 48 percent of cases. No claim can reasonably be made for so high a rate of correct diagnosis to be achieved in mass screening examination for stomach cancer. Consideration in this regard, however, will be of help in encouraging physicians to point out suspected cases of stomach cancer and hence to have more people subjected to close examination as well as in improving the proficiency of those who are engaged in interpreting the photofluorographic image.

## V. CONCLUSION

Some statistical analyses were made of data collected from the population covered by mass screening programs for stomach cancer instituted by the Dept. of Health of the Kumamoto Prefectural Office and the Kumamoto Cancer Society. The results obtained may be summarized as follows:

- 1) Stomach cancer was detected in 0.07 percent of cases examined. The estimated detection rate was 0.10 percent. In 19 percent of cases of stomach early cancer was found.
- 2) The incidence of individuals undergoing close examination among those covered by the program was 68.5 percent according to the close examination report. The incidence is estimated to exceed 90 percent in reality. Those who failed to take close examination were more frequently affected than those not.
- 3) The location of lesion as determined by photofluorography proved to be correct in 82 percent of cases.
- 4) A correct diagnosis was made by photofluorography alone in 48 percent of cases.

## ACKNOWLEDGEMENTS

The author was grateful to Prof. Kenshi Katayama MD. for reviewing this study. I wish to thank Kazuko Iwasaki for her secretarial assistance.

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