

## ORIGINAL

# Interventional study for improvement of lung cancer screening rate

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**Abstract :** The aim of this study is to evaluate whether leaflet distribution affects lung screening rate, and what factor affects the motivation of consultation. Men and women aged 40 to 59 were targeted to improve screening rate of ages for cancer screening, especially in their prime. Each 1,000 subject, a total of 2,000 were selected and divided into 8 groups in consideration of age group by random sampling method. This group was further divided into two groups, an intervention group including subjects distributed a leaflet and a non-intervention (control) group. A survey was conducted by postal self-administered survey forms. Collection rate was 21.6% for the intervention and 17.6% for the control group. The numbers of respondents who answered that this leaflet was effective for motivation of consulting lung cancer screening and the leaflet was ineffective, were 120 (60.0%) and 80 (40.0%), respectively. This indicated that the leaflet was clearly effective ( $p < 0.01$ ). Actual cancer screening rate was 38.8% for the intervention group and 37.7% for the control group. It was shown that distribution by mail of even a single leaflet made by National Cancer Center was effective for motivation of consultation of lung cancer screening. *J. Med. Invest.* 59 : 127-135, February, 2012

**Keywords :** lung cancer, cancer screening rate, leaflet, questionnaire, intervention

## INTRODUCTION

In Japan, five kinds of cancers (stomach, lung, colorectal, uterus and breast cancers) are targeted as a national policy. However, in Western countries, the United States and Canada target uterus

and breast cancers, United Kingdom, Germany, and Finland target colorectal, uterus and breast cancers, and France targets only breast cancer. Between Japan and Western countries, there is a big difference of screening rates for uterus and breast cancers, which are targeted in many countries. It is obvious that the screening rate in Japan is much lower than that in Western countries (1, 2). There are two types of cancer screenings in Japan, opportunistic and population-based screenings. The latter screening is conducted under the stewardship of a regional municipality and it is not so difficult

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to grasp the accurate number of people who has undergone cancer screening because of public announcement. Thus, it is very important to improve population-based screening rate toward the achievement of 50% cancer screening rate, which is aimed in Basic Plan to Promote Cancer Control Programs.

Tokushima Prefecture has conducted many projects for the achievement of the aim based on Basic Plan to Promote Cancer Control Programs in 2007 as a national policy. The goal was the decrease of cancer death of aged-adjusted mortality rate under aged 75 by 20% (3). In such a situation, Cancer Control Promotion code was approved on March 30, 2010 in Tokushima Prefecture. The code stated that cancer screening should be actively undergone by Tokushima Prefecture in coordination with municipalities and consultation should be responsible to improve cancer screening rate for the residents (4). However, the data published in 2009 by Tokushima Prefecture showed that screening rates for stomach, lung, colorectal, breast and uterus cancers were 7.5%, 9.4%, 10.3%, 17.2% and 19.8%, respectively (3). It may be considerably difficult to achieve the goal of 50% even if the number of people who has undergone opportunistic screening is added.

We thought a new measure was necessary for the achievement of the goal and focused on a promotion. We worked out how to improve screening rate. According to the previous studies in other fields, leaflet distribution was effective to motivate people to take some actions (5-8), so a significant improvement of cancer screening rate was expected by leaflet distribution. However, interventional studies by those reports were mainly for specific groups and it was uncertain whether a similar result would be derived from the general population. In addition, the studies didn't examine the effectiveness of the leaflet distribution itself but the educational effects by using leaflet or promotion. Thus, a study on effectiveness of leaflet alone has not been published.

Therefore, we thought that in the future it was necessary to improve screening rate by a simple and low cost method, so we examined whether there was a difference of consultation behavior between a group distributed a leaflet (intervention group) and a group not distributed (control group). Lung cancer was targeted because it is the leading cause of current cancer death (9).

The purpose of this study is to evaluate whether leaflet distribution affects screening rate, and what factor effects the motivation of consultation.

## MATERIALS AND METHODS

### *Subjects*

Men and women aged 40 to 59 were selected from the ages of targets for lung cancer screening, because the aim was to improve cancer screening rate for the generation in their prime of life. Each 1,000 people, a total of 2,000 were extracted from about 36,000 men and about 40,000 women for lung cancer screening in Anan City by the following criteria. The extraction was conducted in consideration of age-group. The group was divided into 4 age-groups by 5 years ; age-group 40-44 years, 45-49 years, 50-54 years and 55-59 years. Two-hundred and fifty subjects for each group were extracted by random sampling method. As a result, 4 groups of men and 4 groups of women, a total of 8 groups of 2,000 subjects were obtained. In addition, each group was further divided into 2 groups, an intervention and a control groups. In this way, 16 ( $4 \times 2 \times 2$ ) groups of 125 people each by age-group (4 groups), gender (2 groups) and intervention and control (2 groups) were arranged. The number of samples was determined by the following reason. Given the effective rate is 60% for the test of leaflet effectiveness, the minimum sample number of 150 cases will be needed at a significant level of 0.01. Therefore, the goal was more than 200 collections out of 1,000 interventional subjects in the study.

A targeted region was selected from the municipalities where the screening rate for lung cancer was low and the population was relatively large in Tokushima Prefecture. The cancer screening rate of Anan City in 2008 was 6.5% (7.0% for men, 6.2% for women) and it was lower than the average rate of 10.7% (11.0% for men, 10.5% for women) in Tokushima Prefecture (9).

### *Interventional method and survey method*

A leaflet with the title of "Do you know lung cancer screening (in Japanese ; Gozonji desuka? Haigan Kennshin)" made by National Cancer Center for lung cancer screening was used for the interventional method by permission (10). The leaflet was one sheet of A4 spread size and made in October, 2010 after longstanding consideration for improvement of lung cancer screening rate. The leaflet consisted of 5 parts, Q & A (questions and answers) for lung cancer screening, a flowchart of lung cancer screening, tobacco and lung cancer, a site of occurrence of lung cancer and lung cancer screening. The leaflet was printed in color with illustrations, figures

and graphs for eye appeal. The leaflet pointed out the necessity of lung cancer screening, importance of early detection and early treatment, and high mortality rate of lung cancer with data. The leaflet was sent to the intervention group.

A questionnaire was featured by 10 multiple-choice questions so that anybody could answer easily in a short time. The questions were about their cancer screening record, knowledge and interest in cancer, occupation, and smoking and alcohol drinking habit (appendix).

#### Appendix Questionnaire

1. Please tell me your age and sex.  
( ) years old, (1.Man, 2.Woman)
2. What is your occupation?  
(1. Self-employment, 2. Public, 3. Company, 4. Others)
3. Are you covered with health insurance?  
1. Yes (1. Public, 2. Employee's, 3. Unknown), 2. No
4. Have you undergone cancer screening this year?  
1. Yes (1. Stomach, 2. Lung, 3. Colorectal, 4. Breast, 5. Uterus), 2. No
5. How many times do you undergo cancer screening?  
(Person only who has experienced lung cancer screening)  
1. Every year, 2. Every two year, 3. Others
6. Do you have a cancer patient around you such as your family, relative and friend?  
1. Yes, 2. No
7. Have you participated in any seminar on cancer?  
1. Yes, 2. No
8. Have you read any leaflet (newsletter or brochures without magazine and book) on cancer?  
1. Yes, 2. No
9. Do you smoke?  
1. Yes, 2. No
10. Do you drink alcohol?  
1. Yes, 2. No
11. What method prompts you to undergo cancer screening?  
(1. Newsletter, 2. Poster, 3. TV, 4. Newspaper, 5. Others)
12. Do you undergo cancer screening due to the leaflet?  
(only intervention group)  
1. Yes, 2. No
13. What is the most impressive thing in the leaflet?  
(only intervention group)
14. Please comment on the questionnaire.

#### Examination of screening rate

An actual lung cancer screening rate was examined by return postcard from subjects out of all the 2,000 subjects in intervention and control groups. Subjects chose one answer out of 3 : 1. screened, 2. plan to screen, 3. unscreened.

#### Ethical consideration

The following ethical considerations were taken in this study.

The approval by the relevant administrative

agency was obtained to conduct the intervention study for the regional residents. Enclosed were a request letter approved by the ethical committee of Tokushima University Hospital (No. 1156), a questionnaire and a return envelope and it was mailed to each subject in intervention and control groups. To be given consent was judged by return mail.

#### Methods of analysis

1) Analysis was conducted on the subjects who answered that the distribution of the leaflet was effective for cancer screening. The subjects were analyzed by gender and age-group. The effectiveness of the leaflet was examined based on the influence of their occupation, experience of participation to a seminar on cancer, cancer screening record, presence of cancer patient around them, smoking and alcohol drinking habits.

2) The differences in answers of the questionnaires between the intervention and the control group were compared. The items concerning whether they have read a leaflet in the past or not and appropriate medium recommending cancer screening were also evaluated for both groups.

3) True effectiveness of leaflet distribution was evaluated by comparing actual lung cancer screening rates between both groups.

Comparison of two proportions or multi proportions by chi-square independence test was used for analysis.

## RESULTS

### 1) Collection of questionnaire from the intervention and the control groups.

Each 1,000 questionnaire, a total of 2,000 were mailed to the intervention and the control groups. Five letters from the intervention group and 4 letters from the control group were sent back as address unknown. Eight subjects were reported that they were not in the condition to respond over the telephone. As a result, the effective responses were 214 from the intervention group (collection rate 21.6%) and 175 from the control group (collection rate 17.6%). The collection rate of the intervention group was higher than that of the control group ( $p < 0.05$ ). The number of the respondents in the

intervention group was 93 of men (43%) and 121 of women (57%), and the number of women was higher ( $p < 0.05$ ). By age-group, 33 responses from age-group 40 to 44 years (15%), 49 from age-group 45 to 49 years (23%), 67 from age-group 50 to 54 years (31%) and 60 from age-group 55 to 59 years (28%), and the average age ( $\pm$  standard deviation) was 50.6 ( $\pm$  5.4) for men and 51.2 ( $\pm$  5.3) for women. The response rate of age-group 40 to 44 years was significantly lower than any other age-group ( $p < 0.01$ ) (Table 1, 2). The answers to other items were not significant.

Table 1 Profile of subjects

	The number of subjects (%)	
	Intervention group	Control group
Total	214	174
Gender		
Man	93 (43.5)	66 (37.9)
Woman	121 (56.5)	108 (62.0)
Age group		
40~44	33 (15.4)	32 (18.3)
45~49	49 (22.9)	50 (28.7)
50~54	67 (31.3)	46 (26.4)
55~59	60 (28.0)	42 (24.1)
Unknown	5 (2.3)	4 (2.3)
Occupation		
Self-employed worker	34 (15.9)	26 (14.9)
Public worker	24 (11.2)	23 (13.2)
Company worker	72 (33.6)	52 (29.9)
Inoccupation	44 (20.6)	38 (21.8)
Others	40 (18.7)	35 (20.1)
Health insurance		
National	64 (29.9)	53 (30.4)
Employee's	141 (65.9)	120 (69.0)

Table 2 Comparison of each item concerning lifestyle between intervention and control groups

	The number of respondents (%)	
	Intervention group	Control group
Total	214	174
Undergone lung cancer screening this year	63 (29)	31(18)
The number of lung cancer screening status		
Every year	60 (28)	33(19)
Every two year	6 (3)	9(5)
Others	29 (14)	19(11)
Presence of cancer patient around one	117 (55)	98(56)
Participation in a lecture on cancer	25 (12)	13(7)
Experience of seeing a leaflet	116 (54)	83(48)
Smoking	36 (17)	27(16)
Alcohol drinking	95 (44)	73(42)

## 2) The effectiveness of the leaflet

The number of the answer "yes" to the question whether the leaflet was effective as a method to motivate subjects to undertake lung cancer screening was 120 (60.0%) and "No" was 80 (40.0%). This indicated a clear effectiveness of the leaflet ( $p < 0.01$ ). Though 63% of woman subjects responded that the leaflet was effective ( $p < 0.01$ ), the clear effectiveness was not observed in men. Significantly large number of women who responded that the leaflet was effective were seen in age-group 40 to 44, 50 to 54 and 55 to 59 ( $p < 0.05$ ). Examination by occupation, the effectiveness of the leaflet was highly evaluated in public worker ( $p < 0.05$ ), part-time worker ( $p < 0.01$ ) and inoccupation ( $p < 0.05$ ) groups. And 81 persons (61%) who were covered by employee's health insurance responded the leaflet was effective ( $p < 0.01$ ) (Table 3).

Table 3 Effectiveness of the leaflet for undergoing cancer screening

	The number of respondents (%)	
	Effective	Ineffective
Total	120 (60) **	80 (40)
Gender		
Man	49 (56)	39 (44)
Woman	71 (63) **	41 (37)
Age group		
40~44	21 (68) *	10 (32)
45~49	23 (51)	22 (49)
50~54	38 (61) *	24 (39)
55~59	35 (61) *	22 (39)
Unknown	3 (60)	2 (40)
Occupation		
Self-employed worker	16 (50)	16 (50)
Public worker	15 (68) *	7 (32)
Company worker	33 (49)	34 (51)
Inoccupation	28 (65) *	15 (35)
Others (part-time worker)	28 (78) **	8 (22)
Health insurance		
National	34 (57)	26 (43)
Employee's	81 (61) **	51 (39)

\* :  $p < 0.05$

\*\* :  $p < 0.01$

## 3) Factors leading to screening

Relations between the effectiveness of the leaflet for lung cancer screening and five items : presence

of the cancer patient around, smoking habit, alcohol drinking habit, experience of participation to a seminar on cancer and experience of seeing a leaflet, were evaluated. As a result, the percentage of the subjects who answered to under go cancer screening due to the leaflet distribution (Table 4) was

74% of 35 smokers (73% for men, 80% for women) ( $p < 0.01$ ), 63% of 108 subjects having cancer patient around (57% for men, 67% for women) ( $p < 0.01$ ), 80% of 20 subjects having an experience of seminar on cancer (80% for men, 80% for women) ( $p < 0.01$ ), 64% of 107 subjects who have seen a leaflet previously (70% for men, 61% for women) ( $p < 0.01$ ) and 60% of 86 alcohol consumers.

Table 4 The relations between the effectiveness of the leaflet and each item concerning lifestyle

	The number of respondents (%)	
	Effective	Ineffective
Presence of cancer patient around		
Total	68 (63) **	40 (37)
Men	24 (57)	18 (43)
Women	44 (67) **	22 (33)
Experience of participation in lecture on cancer		
Total	16 (80) **	4 (20)
Men	4 (80)	1 (20)
Women	12 (80) *	3 (20)
Awareness of a leaflet		
Total	69 (64) **	38 (36)
Men	28 (70) **	12 (30)
Women	41 (61) *	26 (39)
Smoking		
Total	26 (74) **	9 (26)
Men	22 (73) **	8 (27)
Women	4 (80)	1 (20)
Alcohol drinking		
Total	52 (60) *	34 (40)
Men	31 (57)	23 (43)
Women	21 (66)	11 (34)

\* :  $p < 0.05$

\*\* :  $p < 0.01$

4) Comments from the subjects in the questionnaire

The number of comments was 46 out of 214 subjects (21%) in the intervention group and 22 out of 175 subjects (13%) in the control group, and the response rate of the former group was significantly higher ( $p < 0.05$ ). Seventeen subjects (37%) commented on the impression of the leaflet, and this was the largest number of the comments. Secondary, 13 (28%) commented on cancer screening program, and 7 (15%) commented on the cost from the intervention group, but no comment on the cost was seen in the control group. The largest number of the comments in the control group was about a notice of cancer screening, 9 (41%), but it was lower number of the comments in the intervention group, 5 subjects (11%). And cancer screening program, problems of the cost, schedule and obligatory system were pointed out (Table 5).

5) Actual screening rate for lung cancer

Return postcard was sent to 991 subjects in the intervention group and 992 subjects in the control group. The subjects who were excluded at the first stage were not among them as the second survey was impossible. The screening rate for lung cancer

Table 5 Comments in free space

	The number of responses § (%)	
	Intervention group	Control group
Total	46 (21)	22 (13)
Matters of cancer screening program	33 (72)	13 (19)
Cost	7 (15)	0 (0)
Schedule and place	6 (13)	4 (18)
Method of information	5 (11)	9 (41)
Reasons for consultation	13 (28)	0 (0)
Others	0 (0)	1 (5)
Matters of cancer	4 (9)	2 (9)
Content of the questionnaire	4 (9)	7 (32)
Others	1 (2)	0 (0)
Comments on the leaflet #	17 (37)	-

# : Intervention group only

§ : Multiple answers were allowed.

was 38.8% for the intervention group and 37.7% for the control group. The collection rate was 24.2% for the intervention group and 24.6% for the control group (Table 6).

Table 6 The number (percentage) of subjects undergone lung cancer screening in 2011

	Intervention group	Control group
Dispatch	991	992
Responses	240 (24.2)	244 (24.6)
Screened	93 (38.8)	92 (37.7)
Finished	66 (27.5)	64 (26.2)
Plan to be screened	27 (11.3)	28 (11.5)
Unscreened	147 (61.3)	152 (62.3)

## DISCUSSION

### *Characteristics of subjects*

The past research (11) reported that collection rates of the questionnaire about the effectiveness of the leaflet were 21% to 74%. They varied widely depending on how to choose the populations and the methods of survey. Collection rates were high when the subjects had detailed knowledge and were interested in the investigation objects. And collection rates also rise when there is a stake. When subjects get benefit by answering the questionnaire and when they are disadvantageous if they do not answer them, collection rates are high. On the other hand, the rates decrease when questionnaires need long time to answer, posting and registration. We singled out the postal self-administered survey forms as the best method. In which subjects were selected by random sampling and they answer anonymously and return by mail on their own. We simplified questionnaires with minimum multiple choice questions so that subjects can answer easily and we can expect high collection rate. As a result, the collection rate was 21.6% for the intervention group and 17.6% for the control group. These rates were below average of the same kinds in the past research (11). It was attributable to the random sampling and anonymous survey. We were not able to raise the collection rate, because we did not know their address and names to follow. According to the survey of collection rates, questionnaires returned by mail without pay showed 18.3%, and it rises to

31.7% if subjects were paid beforehand (12). Taking these into consideration, the collection rate of 22% for the intervention group in our research was appropriate. In our study in 2010, the collection rate of the questionnaires from local residents in other region was 17.5% (13).

This time, we chose the subjects randomly from all the local regional residents. So, they didn't belong to specific groups like that they had health problems or were interested in cancer or they were intellectuals. They didn't get benefits such as rewards or free cancer screenings by answering the questionnaires. Accordingly, we can expect unbiased answers from the subjects. In addition to that, we set the large number of 2,000 for the subjects, so we can expect high reliability statistically.

### *Meaning of leaflets*

The effectiveness of the leaflet which we used in this study is thought to have raised awareness of screening. Because the leaflet was compiled with concise information, it is easy to understand for general public. Other organizations also have issued the similar leaflets but they have large number of pages with detailed information (14). Collection rate from the intervention group was 21% to compare with 13% of the collection rate from the control group. A lot of comments were written in the questionnaires and 37% of their comments were about the leaflet. It showed their deep interest in that.

Leaflets are used widely as one of the methods for intervention study. There are several reports on the effectiveness of leaflet itself (5-8), but specific groups are targets in most studies. And in most studies, they take a method to distribute leaflets and add explanation on that (7). Intervention study for influence of alcohol to pregnant women was conducted to 81 students in the department of nutrition. In that study, it was reported that education with leaflet was effective, but it was unknown whether the leaflet itself was effective or education was effective or there was a synergetic effect (5). Intervention study with leaflet for working women who suffer from depression was reported. Questionnaires were delivered to 252 people and 174 responded. Consultation by paper was conducted to 129 people based on their answers. Eighty-four responded to that and effective improvement was shown in the group of depression (6). Those studies were targeted to specific groups, so applying the results to regional residents as an effective method prompts questions. Recent study said that the colorectal

cancer screening rate of unscreened people was increased by 7 to 10% as a result of suggestion by individual letters (15). This case was also targeted to a specific group. Further more, there is a report that the screening rate changed when the way of delivery of notice letter of screening toward people who didn't undergo stomach cancer screening was changed, and individual delivery of notice letter and medical consultation form was the best method (16). Consequently, there has been no study that investigated the effectiveness of the use of the leaflet alone to the random sampling from general group. The result of this study proved the real effectiveness of the leaflet.

In this study, a leaflet was distributed once but several times in other studies (8). They researched the number of mailing of leaflets and home guidance for dental health care, and found home guidance was the best way and mailing more than once was better than once. In this study, 64% of people who have seen leaflets in the past answered that leaflets used this time were effective for cancer screening, and that means delivery of leaflets more than once is very effective. Judging from this, delivery of leaflets more than once is effective to raise the screening rate.

In this study, we focused on cancer related questions. We examined what people thought of the leaflet who answered "Yes" to the questions about whether they have cancer patients around them, they have attended seminar, they have seen leaflets in the past, they smoke, and they drink or not. The result of that a leaflet was effective to prompt them to undergo cancer screening was shown in every question. Out of 35, 26 smokers (74%,  $p < 0.01$ ) approved the effectiveness of the leaflet. This is because they are aware of higher risk of lung cancer mortality of smokers (17). In terms of drinking, 60% (52 out of 86,  $p < 0.05$ ) of drinkers approved the effectiveness of the leaflet, and this fact was beyond our expectation as the risk of cancer by drinking has not been reported at this moment (18). This result was contributable to the wide known idea that drinking raises the risk of oral cancer, pharyngeal cancer (19), esophageal cancer, liver cancer, and breast cancer, so they judged to undergo cancer screening in some ways.

We have a lot of possible opinions in the questionnaires that lead to the improvement of screening rate. What's more, many comments in the questionnaires from the intervention group ( $p < 0.05$ ) was the evidence that they were interested in the leaflet.

#### *Toward the improvement of screening rate*

In this study, increased awareness about cancer screening by the leaflet was clearly approved. The object is not only improvement of cancer screening rate but also decrease of cancer mortality rate. There are evidences only in anti-tobacco program and some cancer screening as preventive measures to reduce cancer mortality rate. Cancer screening is regarded as a very effective measure to reduce cancer mortality rate by cancer detection at the early stage (20). In fact, decrease of cancer mortality rate can be expected by improvement of screening rate. The case-control study which was lead by Ministry of Health, Labour and Welfare was conducted in 4 Prefectures, Miyagi, Niigata, Okayama and Gunma. It is reported that lung cancer mortality rate of people who have undergone population-based screening for lung cancer was significantly decreased by 41% to 60% to compare with those who didn't undergo (21-25). Ways and means to promote people to undergo screening are required to think out from now on.

## CONCLUSIONS

Just one sheet of leaflet made by National Cancer Center which was sent by mail motivated people to undergo cancer screening. These results suggest that the distribution of the leaflet leads to the improvement of the screening rate.

Reasons to undergo lung cancer screening were thought that people had patients around them, had smoking history and they had seen leaflets before. But there was no gap of screening rate between intervention group and control group, so we need to think of measures that lead to consultation.

## CONFLICT OF INTEREST

None of the authors have any conflicts of interest to declare.

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