The relationship between obtaining fecal occult blood test and beliefs regarding testing among Japanese
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**Purpose:** We examined the relationship between fecal occult blood test (FOBT) screening behavior and beliefs regarding FOBT screening in order to formulate effective measures to improve FOBT screening rates.

**Method:** In June 2010, we conducted a cross-sectional questionnaire survey of 600 randomly selected individuals aged 40–60 years who were registered participants of Refine, which was an internet research company to cooperate with this study. We assessed CRC knowledge, perceived risk of CRC, perceived severity of CRC, concern for CRC, beliefs of FOBT screening, FOBT screening behavior, and demographic variables.

**Result:** There were 592 valid responses (from 294 males and 298 females; mean age 53.96 ± 8.39) in the final analysis. A total of 266 (44.9%) underwent FOBT in the year preceding the survey. Factor analysis relating to the beliefs of obtaining FOBT demonstrated five factors (α = 0.829) including: (1) perceived barrier, (2) subjective norms, (3) low importance, (4) descriptive norms, and (5) non-necessity. Descriptive norms were found to be a promoting factor (OR = 1.18, CI = 1.09–1.28), and perceived barrier (OR = 0.88, CI = 0.84–0.94) and low importance (OR = 0.91, CI = 0.82–0.99) were inhibiting factors of FOBT screening behavior.

**Conclusion:** This study suggests the following three actions can effectively improve the cancer screening rate: (1) promotion of public awareness that everyone should be regularly screened for cancer, (2) informing the public about the ease of obtaining FOBT, and (3) promotion of the importance of FOBT.

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1. Introduction

While the global colorectal cancer (CRC) incidence is increasing, the incidence in Japan has had a particularly large recent increase (Center, Jemal, & Ward, 2009). It is widely accepted that early detection and treatment of CRC can improve prognosis, and that fecal occult blood testing (FOBT) and colonoscopy significantly decrease CRC mortality rates (Lee et al., 2007; Levin et al., n.d.; Nancy et al., 2009; Rex, Johnson, Lieberman, Burt, & Sonnenberg, 2000; Saito et al., 1995; Zauber et al., 2012). CRC screening guidelines in Japan recommend a yearly FOBT (a 2-day immunochemical FOBT) as the first stage of CRC screening in people over 40 years of age. The government notifies the eligible individuals with a recommendation to undergo FOBT for CRC screening, which includes the description of how and where to receive the FOBT kit and the price of the kit. Then the eligible individuals are expected to contact the predetermined hospital to receive the FOBT kit, collect the samples, and submit it to the clinic for testing (Tomotaka et al., 2005). The cost of FOBT varies depending on the municipality of residence, but the municipality partially bears the cost, which in turn lowers the cost born by the eligible individual to less than 1000 JPY (about 8 USD).

However, a recent research shows that the CRC screening rate in Japan remains low at under 30% (Matsuda et al., 2012), which needs to be increased in order to raise awareness of CRC screening. It is clear that improving the CRC screening rate is essential to prevent CRC-related deaths strongly. It is also essential to clarify what psychological factor affects the screening behavior.

Several previous studies have described predictors associated with CRC screening behavior, including high income, education level, health insurance (Liang, Phillips, Nagamine, Ladabaum, & Haas, 2006; Rawl et al., 2005), physician and family recommendations, fear and knowledge of CRC, and health literacy (de Bosset, Atashili, Miller, & Pignone, 2008; Manne et al., 2002; Ng, Tan, Teo, Seah, & Phua, 2007; Peterson, Dwyer, Mulvaney, Dietrich, & Rothman, 2007). Then predictors of whether or not a person follows guidelines of FOBT screening include age, type of medical insurance, recommendation from a healthcare provider, knowledge of CRC and FOBT (procedure, importance of FOBT, and cancer curability), and perceived discomfort of collecting stool samples (de Bosset et al., 2008; Jones, Devers, Kuzel, & Woolf, 2010; Liang et al., 2006; Manne et al., 2002; Matsuda et al., 2012; Ng et al., 2007; Peterson et al., 2007; Rawl et al., 2005). In Japan, these predictors have been researched in gastric and breast cancer screening behavior. Research of cancer screening predictors regardless of the cancer type revealed an association between targets’ behavior and demographic factors such as age, income, medical insurance, regularity of hospital visits, and education background (Watanabe, 2003). Gastric cancer screening research based on the Health Belief Model (Janz & Becker, 1984) described a negative correlation between ‘seriousness’ and ‘barriers’ (Tsibono, Fukao, Hisamichi, Sugawara, & Hosokawa, 1993). Additionally, a similar survey targeting breast cancer patients indicated that ‘barrier of screening’, ‘low importance’, and ‘subjective norms’ influence screening behavior (Nagatsuka, Arai, & Hirai, 2009; Seki et al., 2011).

It has been believed that extremely low awareness toward CRC and its screening programs results in the present status of screening participation. However, factors influencing CRC screening behavior have never been investigated in Japan. Knowledge of the current CRC screening situation and identification of modifiable cognitive factors including individual attitudinal factors are essential to formulate effective measures to improve screening rates. The purpose of this study is to examine the relationship between FOBT screening behavior and beliefs relating to FOBT.
2. Method

2.1. Participants and survey design
A population-based cross-sectional survey targeting regional residents was conducted through the internet in late June 2010. We requested registered participants of Refine, which was an internet research company to cooperate with this study. As numerical standards of participation of CRC screening (FOBT) are set for the population aged 40–69, the age eligibility for this study was 40–69 years of age. In addition, we excluded from the study people with histories of CRC or ulcerative colitis, or who are involved in the healthcare industry, the pharmaceutical industry, or medical equipment manufacturing and distribution. We then extracted 600 participants as eligible candidates after equalizing the number of candidates in each age and gender group.

2.2. Ethical considerations
We commissioned an internet research company to perform the survey, and our researchers did not meet the participants in person. We converted the collected private information and response data into ID numbers to make each candidate anonymous. The first page of the questionnaires clearly described that the personal identifiable information would not be disclosed, and the collected data would only be used for this study and would be disposed of after a certain period. This study was approved by the Ethics Committee of Osaka University, Graduate School of Human Science.

2.3. Measures
We created a questionnaire with reference to the established theoretical models of health behavior including the Health Belief Model (Janz & Becker, 1984), the Theory of Planned Behavior (Ajzen, 1991), Trans-theoretical Model (Prochaska & Velicer, 1997), and social cognitive theory (Bandura, 1998) in previous studies (Subramanian, Klosterman, Amonkar, & Hunt, 2004), all of which can be used to assess CRC screening behavior. We created the questionnaire for this study after discussions involving graduate students majoring in psychology, researchers of medical psychology, medical social workers, and clinical psychologists. We modified the questionnaire items used by previous studies in Western populations as some items were considered unsuitable for Japanese culture.

2.3.1. Background variables
Demographics and health: The variables recorded for demographics and health were (1) age and gender, (2) smoking habits, (3) drinking habits, (4) exercising habits, (5) cancer insurance, (6) familial history of CRC, and (7) regularity of hospital visits.

CRC knowledge: Thirteen items testing CRC knowledge were asked including the nature of CRC morbidity and mortality, risk of CRC morbidity, and CRC screening tests. We developed these items with reference to our previous studies (Nagatsuka et al., 2009; Seki et al., 2011). Subjects were asked whether they already had knowledge of each item (I already know/I did not know), and the answers were subjected to a CRC knowledge assessment.

Exposure to CRC screening information: The information source for CRC knowledge screening consisted of 10 variables including TV commercials, magazines, and direct mails from public administrations. We asked participants how often they have been exposed to these information sources, and the result was measured using a 6-point Likert scale (1 = never seen, 6 = frequently seen).
2.3.2. Psychological variables

Perceived risk of CRC: Perceived risk has been assessed in many studies (Janz & Becker, 1984). In this study, 3 items were used with reference to previous studies (Liang et al., 2006; Seki et al., 2011): (1) personal risk for CRC in males in the same age group measured with a 3-point Likert scale (1 = lower, 3 = higher); (2) personal risk for CRC in females in the same age group measured with a 3-point Likert scale (1 = lower, 3 = higher); and (3) a 0–100 scale rating of lifetime risk of CRC morbidity.

Perceived severity: In this assessment, we used two items with reference to the gastric cancer severity assessment by Tubono (Tsubono et al., 1993): (1) If you are diagnosed with CRC, how curable do you think it is? (1 = almost incurable, 5 = absolutely curable) and (2) How much easier is it to cure CRC than to cure other illnesses? (1 = much more difficult, 5 = much easier).

CRC worry: Four items with referenced to Lerman et al. (1991) were used to assess the degree of CRC worry. These items include an assessment of degree of worry about undergoing CRC screening and its impact on mood and daily life. The items were measured by a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree).

Beliefs of FOBT: Twenty-two items about beliefs regarding undergoing FOBT were developed with reference to three previous studies (Liang et al., 2006; Matsuda et al., 2012; Vernon, Myers, & Tilley, 1997). These items were constructed on the assumption of four psychological factors including perceived barrier, low importance, subjective norm, and descriptive norm. We modified perceived barrier and low importance, which were confirmed to be valid in previous studies about breast cancer screening in Japan (Seki et al., 2011), to make them suitable for CRC screening. We also adopted subjective norm and descriptive norm as questionnaire items because they are reportedly associated with CRC screening behavior (Sieverding, Matterne, & Ciccarello, 2010). Participants were presented with an item: ‘Read each question about thoughts and environment that may exist assuming that you are undergoing an FOBT, and choose a number that corresponds to your response’, which measured the level of agreement using a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree).

Self-efficacy: Self-efficacy is one of the main predictors of health behaviors (Bandura, 2004), and previous studies that investigated the predictors of screening behavior have adopted self-efficacy (Galvin, Fu, Nguyen, Glasheen, & Scharff, 2008; Salz et al., 2009). In this study, we adopted eight items that were used by Togari, Yamazaki, Koide, and Miyata (2006) in an assessment of self-efficacy for health management, for example, ‘I think I can manage my health well’ and ‘I usually manage my health well’. The level of agreement on the items was measured by a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree).

2.3.3. Outcome variable

Current FOBT-screening behavior: FOBT was used for CRC screening in this study because FOBT is generally considered as the standard for CRC screening in Japan. We explained the details of the FOBT procedure in the space above the question to provide an understanding of the correct way to take the test. Furthermore, since yearly FOBT screening is recommended, we provided a simple question: ‘Have you done FOBT in the past year?’ to assess current FOBT screening behavior.

2.4. Statistical analyses

Initially, we checked ceiling effect and floor effect of 22 items regarding beliefs of FOBT. Secondly, we employed the maximum likelihood method and the promax rotation method to analyze an exploratory factor. After extracting the factor structure, we performed the confirmatory
factor analysis using the maximum likelihood method to test whether the extracted factor structure fitted the data. Then, we calculated the total score of each subscale and performed univariate logistic regression analyses to assess the association between the FOBT screening state and each independent variable. Finally, we performed multiple logistic regression analyses to assess the association between beliefs of FOBT screening and FOBT screening behavior. The choice of moderator variables was made with reference to a $p$ value of less than 0.25 in bivariate analysis results. For all analyses, we analyzed dates using the two-tailed test, with $p$ value of less than .05 considered statistically significant. A likelihood ratio test determined statistical significance of predictors for multiple logistic regression analyses. SPSS for Windows 17.0J was used for all statistical analyses except for the confirmatory factor analysis, for which AMOS 14.0J was used.

3. Result

3.1. Background of participants

Of 600 participants, 592 (294 males and 298 females) responded to the questionnaire completely (98.7% response rate). The mean age of participants was 53.96 ± 8.39 years (range 40–69). A summary of other variables is presented in Table 1. Table 2 shows the results of CRC knowledge. The most unacknowledged item was ‘CRC is the second most common cancer among Japanese’ (16.6%). On the other hand, ‘Most people are cured if the CRC is detected early’ (77.0%) was the most acknowledged item. Finally, 266 participants (44.9%) underwent FOBT in the past year. We found a significant difference only in those subjects in their 60s, and also noticed that more males tended to get the FOBT than females ($\chi^2 = 4.50, p = .047$).

3.2. Beliefs of FOBT

Initially, we specified skewed items in the 22 items used to assess the beliefs regarding FOBT. Although a slight occurrence of floor effects was observed during the assessment of four items

Table 1. Demographics and health states ($n = 592$).

| Demographics                          | % or mean(SD) |
|---------------------------------------|---------------|
| Age                                   | 54.0(8.39)    |
| Gender                                |               |
| Male                                  | 49.7          |
| Female                                | 50.3          |
| Region of residence                   |               |
| Hokkaido/Tohoku                       | 7.1           |
| Kanto                                 | 42.7          |
| Hokuriku/Chubu                        | 14.4          |
| Kinki                                 | 21.8          |
| Chugoku/Shikoku                       | 6.9           |
| Kyushu/Okinawa                        | 7.1           |
| Health states                         |               |
| Cancer insurance                      | 51.2          |
| Familial history of CRC               | 13.0          |
| Smoking habits                        | 46.5          |
| Drinking habits                       | 62.8          |
| Exercising habits                     | 32.6          |
| Regular hospital visit                | 40.4          |
| Exposed information                   | 21.8(8.8)     |
categorized in *Subjective norms*, we considered these items important in this study and decided to use them in the subsequent analysis. We then yielded a 5-factor structure to analyze the exploratory factor of the 22 items by using the maximum likelihood method and the promax rotation method. We deleted items with a factor loading of less than 0.4, then reanalyzed 20 items and determined a 5-factor structure. We interpreted these subscales as: (1) *Perceived barrier*, (2) *Subjective norms*, (3) *Low importance*, (4) *Descriptive norms*, and (5) *Non-necessity*. Calculating internal consistency (Cronbach’s alpha coefficients) of this scale indicated that the coefficient alpha was .829 for the total score. Alpha ranged from .61 for *Non-necessity* to .92 for *Subjective norms* for this subscale (Table 3). Additionally, we determined the validity of this scale by adopting the confirmatory factor analysis using the maximum-likelihood method. We obtained adequate fit index as the result of a confirmatory factor analysis regarding the models of these five factors: chi-square (df = 163) = 665.78, *p* < .001; GFI = 0.89; AGFI = 0.86; RMSEA = 0.072.

3.3. **Relationship between beliefs of FOBT and FOBT-screening behavior.**

Results of univariate logistic analysis indicated that *Perceived barrier* (OR = 0.83, 95% CI = 0.80–0.86), *Subjective norm* (OR = 1.07, 95% CI = 1.03–1.11), *Low importance* (OR = 0.75, 95% CI = 0.70–0.80), and *Descriptive norm* (OR = 1.31, 95% CI = 1.22–1.41) were associated with Beliefs of FOBT (OR = 1.02, 95% CI = 0.96–1.10). Then we conducted a multiple logistic regression analysis, which indicated that predictors of FOBT screening were *Perceived barrier* (OR = 0.87, 95% CI = 0.84–0.92), *Low importance* (OR = 0.91, 95% CI = 0.84–0.99), and *Descriptive norm* (OR = 1.18, 95% CI = 1.09–1.28) (Table 4).

4. **Discussion**

Despite the fact that FOBT is part of the recommended CRC screening in Japan, the screening rate remains low. An effective measure is needed to raise the CRC screening rate in Japan. In this study we intended to elucidate the relationship between FOBT screening behavior and beliefs of FOBT, both of which are manipulative variables.

Firstly, we extracted *Perceived barrier* and *Low importance* as inhibiting factors of FOBT screening behavior. *Perceived barrier* consisted of inconvenient operating hours of medical institutions performing FOBT, waiting time, and cost. *Perceived barrier* shows an association with structural barriers such as cost and unsuitable screening hours that are revealed in this study,
Table 3. Factor loadings and Cronbach alpha coefficients.

|   | Average | SD  | Factor1 | Factor2 | Factor3 | Factor4 | Factor5 | Cronbach alpha coefficients |
|---|---------|-----|---------|---------|---------|---------|---------|-----------------------------|
| 1 | Perceived barrier $\alpha = .916$ | 2.36 | 1.07    | 0.98    |         |         |         | 0.829                      |
|   | It is difficult to undergo an FOBT because the time that the medical institution is available is inconvenient |       |         |         |         |         |         |                            |
|   | Having to wait for a long time makes it difficult to undergo an FOBT | 2.42  | 1.06    | 0.93    |         |         |         |                            |
|   | Time and effort required for an appointment making makes it difficult to undergo an FOBT | 2.37  | 1.01    | 0.89    |         |         |         |                            |
|   | Inconvenient transportation to medical institutions makes it difficult to undergo an FOBT | 2.20  | 0.97    | 0.80    |         |         |         |                            |
|   | Not knowing when and where to do an FOBT | 2.55  | 1.27    | 0.59    |         |         |         |                            |
|   | It costs money to do an FOBT | 2.92  | 1.18    | 0.51    |         |         |         |                            |
| 2 | Subjective norms $\alpha = .929$ |       |         |         |         |         |         |                            |
|   | I have been recommended to do an FOBT by family members (brother, sister, son, and daughter) | 1.96  | 1.03    | 0.96    |         |         |         |                            |
|   | I have been recommended to do an FOBT by friends and acquaintances | 1.91  | 0.99    | 0.90    |         |         |         |                            |
|   | I have been recommended to do an FOBT by my superior at work | 1.90  | 1.01    | 0.89    |         |         |         |                            |
|   | I have been recommended to do an FOBT by a partner | 2.10  | 1.11    | 0.79    |         |         |         |                            |
|   | I have been recommended to do an FOBT by my primary care doctor | 2.07  | 1.07    | 0.74    |         |         |         |                            |
| 3 | Low importance $\alpha = .826$ |       |         |         |         |         |         |                            |
|   | Undergoing a FOBT is not as important as dealing with other health issues | 2.23  | 0.92    |         | 0.78    |         |         |                            |
|   | There is no need to do an FOBT for a few years after undergoing FOBT once | 2.20  | 0.95    |         | 0.77    |         |         |                            |
|   | There is no need to do an FOBT because I have been consulting my primary care doctor | 1.99  | 0.86    |         | 0.64    |         |         |                            |
|   | I can self-check my health status without doing an FOBT | 2.23  | 0.89    |         | 0.61    |         |         |                            |
| 4 | Descriptive norms $\alpha = .858$ |       |         |         |         |         |         |                            |
|   | I think women of my age have done FOBT | 2.85  | 0.98    |         | 0.95    |         |         |                            |
|   | I think men of my age have done FOBT | 2.95  | 1.01    |         | 0.93    |         |         |                            |
|   | I think the acquaintances in the workplace or close friends have done FOBT | 2.64  | 1.13    |         | 0.52    |         |         |                            |
| 5 | Uncertainty $\alpha = .611$ |       |         |         |         |         |         |                            |
|   | A positive result of the FOBT does not always indicate that there is a cancer | 2.86  | 0.86    |         |         | 0.70    |         |                            |
|   | I think there is still a possibility that the colon cancer is overlooked even if I undergo an FOBT | 3.17  | 0.98    |         |         | 0.63    |         |                            |
which many previous studies indicated as obstructive factors for intention for or compliance with CRC screening (James, Campbell, & Hudson, 2002; Jones, Woolf, et al., 2010; Kiviniemi, Bennett, Zaiter, & Marshall, 2011; Power, Miles, von Wagner, Robb, & Wardle, 2009). Moreover, we consider this indicative of an association between perceived barrier and FOBT screening that is reasonable given that prior Japanese cancer screening studies for gastric and breast cancer have also shown this to be a factor with a negative correlation (Seki et al., 2011; Tsubono et al., 1993). The questions included in Low importance related to ideas that FOBT is less important than the screening of other illnesses, and that regular visits to the primary care doctor and self-examination are sufficient for prevention of CRC. For these items related to the importance of FOBT, attitudinal barriers such as ‘I am in good health’ and ‘I do not undergo FOBT because there is no health problem (especially in the stomach)’ were considered as a part of Perceived barrier or Cons (Beeker, Kraft, Southwell, & Jorgensen, 2000; Jones, Devers, et al., 2010; Klabunde et al., 2005; Liang et al., 2006; Matsuda et al., 2012). Kandula, Wen, Jacobs, and Lauderdale (2006) investigated cultural influences on cancer screening behavior based on the fact that Asian Americans have lower rates of CRC screening compared to non-Hispanic whites. He observed a trend of thinking in cancer screening that affects the low FOBT screening rate among Asian Americans, which considers cancer screening as a reaction to certain perceivable symptoms and not as a proactive measure to prevent cancer when the subjects are asymptomatic. Moreover, recent research in Japan revealed that ‘not having time to get screened’ (Cabinet Office, Government of Japan, 2013) is the most common reason for not receiving cancer screening.

In our study, only Descriptive norms was identified as a promoting factor of CRC screening. Honda and Kagawa-Singer (2006) conducted research on the associated factors of CRC screening adherence, targeting Japanese people living in the USA. The result of this research discussed that

| Variables                      | Range or category | % or mean (SD) | Bivariate analyses | Multivariate analyses |
|--------------------------------|-------------------|----------------|-------------------|----------------------|
|                                |                   |                | Crude             | Adjusteda            |
|                                |                   |                | OR (95% CL)       | p value              |
|                                |                   |                |                   | OR (95% CL)          | p value              |
| FOBT screening rateb           | Yes               | 44.9           |                   |                      |
| Perceived risk                 | 2–106             | 30.2(19.5)     | 1.01(1.00–1.015)  | 0.115                |
| Perceived severity             | 2–10              | 5.4(1.8)       | 0.92(0.84–1.01)   | 0.07                 |
| Belief of FOBT Belief of FOBT  |                   |                |                   |                      |
| Barrier                        | 5–30              | 14.8(5.5)      | 0.83(0.80–0.86)   | <0.001               |
| Subjective norms               | 5–25              | 8.7(2.9)       | 1.07(1.03–1.11)   | <0.001               |
| Low importance                 | 5–20              | 6.0(1.6)       | 0.75(0.70–0.80)   | <0.001               |
| Objective                      | 5–15              | 9.9(4.6)       | 1.31(1.22–1.41)   | <0.001               |
| Norms                          |                   |                |                   |                      |
| Uncertainty                    | 5–10              | 8.4(2.8)       | 0.9(0.82–1.00)    | 0.058                |
| CRC worry                      | 4–20              | 20.1(3.4)      | 1.00(0.95–1.05)   | 0.936                |
| Self-efficacy of health        | 8–40              | 21.8(8.8)      | 0.98(0.95–1.01)   | 0.189                |
| Knowledge of CRC               | 0–13              | 5.9(3.4)       | 1.06(1.01–1.11)   | 0.015                |

aRate of participants undergoing FOBT in the past year.
bAdjusted for age, gender, cancer insurance, drinking habits, exercising habits, exposed CRC information.
Subjective norms (family or friends) are the strongest predictive factors because sharing of value and attitude is enhanced by the influence of Japanese culture. However, this research measured only the Subjective norms and not the Objective norms. The three previously conducted meta-analyses on Social norms (Armitage & Conner, 2001; Manning, 2009; Rivis & Sheeran, 2003) indicated that the Descriptive norms are strongly associated with behavior and intention, and it revealed that Subjective norms and Injunctive norms (the perception that others will approve or disapprove of what one does) are less influential than Descriptive norms. Therefore, it is reasonable for Descriptive norms to remain in the present study, which employed both Subjective and Descriptive variables. Our study indicates that Descriptive norms influence health risk behaviors more strongly than health-promoting behaviors. Since cancer screening is considered to be secondary prevention (risk behavior), the result of Descriptive norms being significant is reasonable. However, among the studies on Normative factors in cancer screening, some studies have not shown an association between Descriptive norms and intention in CRC screening (Smith-McLallen & Fishbein, 2008). In addition, studies acknowledging the significant association between Subjective norms and intention report a possibility that Subjective norms become a predictable factor in certain subgroups (Sieverding et al., 2010). For example, subjective norms may function as a trigger of a behavior in a culture that strongly recognizes the value of cancer screening, such as that in the USA (Schwartz, Woloshin, Fowler, & Welch, 2004) where Honda conducted research. On the other hand, the Descriptive norms represent a behavior in line with others rather than the value of cancer screening, which could be caused by the influences of collectivism in Japanese culture. Caution is necessary before interpreting cultural differences because there have been researchers that deny the influence of cultural differences such as collectivism and individualism on human behavior (Takano & Sogon, 2009). However, we consider that future studies are necessary, which bear in mind these cultural differences and Social norms.

Based on these results, we believe that providing the public with messages and information about cancer screening, particularly stressing the following concepts, will be effective in order to improve the CRC screening rate: (1) everyone should be regularly screened for cancer, (2) ease of obtaining FOBT, and (3) the importance of FOBT. Furthermore, knowledge of CRC screening is perceived to be a precognition in an effort to effectively intervene in behavioral change (Kiviniemi et al., 2011). The knowledge of CRC and CRC screening has been identified as a predictor of CRC screening (Ng et al., 2007; Sieverding et al., 2010; Takano & Sogon, 2009). However, an association between knowledge and behavior has yet to be identified (Liang et al., 2006; Ng et al., 2007; Subramanian et al., 2004; Weinberg et al., 2009). This study revealed an unawareness of both the CRC incidence rate increase in Japan and the link between CRC and lifestyle. We would also like to make reference to the necessity for dissemination of appropriate knowledge regarding the results of this study.

In conclusion, we would like to discuss the limitations of this study and the challenges for the future. First, we determined whether a patient completed FOBT test or not while depending on the self-report submitted by a patient. Therefore, a research in cooperation with an institution which conducts the screening will be required in the future studies as we have not confirmed who actually underwent FOBT this time. Second, we should consider the possibility of sample bias. The FOBT screening rate in the year preceding the survey was 44.9%, which was significantly higher than the FOBT screening rate previously reported in Japan (Tomotaka et al., 2005). Behind these differences lies the fact that the FOBT is performed not only in medical checkups by municipalities targeting their citizens, but also in the complete medical checkups conducted by companies for their employees. However, because this study was conducted through the internet, there is inherent sampling bias, which indicates the interests of participants in cancer screening. We believe that the study participants readily undergo FOBT screening. As for our metrics, we modified the items used in a separate study of the beliefs of breast cancer
screening in Japan. For this reason, the items cited as perceived barriers such as a feeling of discomfort towards collecting stool samples and embarrassment (Cabinet Office, Government of Japan, 2013; Jones, Devers, et al., 2010; Kandula et al., 2006) were not included in the items relating to a specific belief regarding FOBT. We consider that we can extract barriers that are more influential to CRC screening in the future by adding the items specific to CRC screening.

Despite these limitations, this study is important in terms of revealing the psychological factors influencing CRC screening behavior, particularly in a Japanese population. Based on the results of this study, cancer screening rates of people between the ages of 40 and 60 can be increased by eliminating the barriers to CRC screening, acknowledging the importance of CRC screening, and becoming aware that CRC screening is very common among healthy people. Development of specific messages reflecting the factors outlined in this study and an intervention study testing whether the actual interventions changes screening behavior are conceivable for the future.

5. Informed consent

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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Disclosure statement

Author T Taniguchi, Author K Hirai, Author K Harada, Author Y Ishikawa, Author M Nagatsuka, Author J Fukuyoshi, Author H Arai, Author H Saito, Author Y Mizota, Author S Yamamoto, and Author D Shibuya declare that they have no conflict of interest.

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