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Comparison of Cancer Worries for Gastric Cancer by *Helicobacter Pylori* Infection Status at Health Check-Up Setting in Japan

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Helicobacter pylori (HP) infection is the major cause of gastric cancer (GC). No reports have been published on the effects of *HP* infection on anxiety for GC, although the majority of *HP*-positive subjects received eradication therapy intending to reduce their risk of GC in Japan. This study aimed to investigate the relationship between cancer worry (CW) for GC and participants' *HP* infection status. The original study was a quantitative, self-administered questionnaire survey to investigate CW for esophageal cancer in Barrett's esophagus. The present study used the same dataset on CW against GC. Participants were recruited between May 2021 and March 2022 from three health screening facilities in Akita Prefecture, Japan. The Cancer Worry Scale was used to quantitatively assess the fear of developing cancer. Logistic regression analyses were used to investigate factors associated with excessive CW (defined as ≥ 13). A total of 303 respondents were included. Excessive CW accounted for 63.0% (92/146) in *HP*-negative, 55.0% (11/20) in *HP*-positive, and 71.5% (98/137) in *HP*-eradicated patients. While the presence of upper gastrointestinal symptoms and subnormal mental health quality were significantly associated with excessive CW, the status of *HP* infection did not affect it. There is a significant discrepancy between CW for GC and actual GC risk, defined as their *HP* infection status, among those undergoing GC screening. It may be necessary to provide appropriate patient education when introducing risk-based (mainly *HP*-based) stratified screening for GC shortly in Japan.

Keywords: cancer worry; gastric cancer; *helicobacter pylori*; psychological effect; risk-based screening
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Introduction

In Japan, gastric cancer (GC) is a prevalent disease, and as a result, it is currently recommended that all adults aged 50 years and older undergo periodic endoscopic GC screening every two years (Hamashima and Fukao 2016). However, the risk of GC varies depending on whether or not a person has a *Helicobacter pylori (HP)* infection and has received treatment for it. In individuals who are *HP*-negative, the risk of GC is extremely low, and the likelihood of developing it is negligible (Uemura et al. 2001; Kaji et al. 2019). Conversely, the majority of GCs in Japan occur in individuals infected with *HP*, with an incidence rate of 0.3-0.5% per year (Uemura et al. 2001; Kaji et al. 2019). Eradicating *HP* reduces the risk of GC by approximately 40-50% (Ford et al. 2020). As the prevalence of GC in Japan has declined in parallel with the decline in *HP* infection rates (Iijima et al. 2024), there is a growing consideration for implementing risk-stratified screening for GC based on the infection status (Hamashima and Fukao 2016; Hamashima et al. 2020), as opposed to the current age-based screening approach.

Some studies have investigated the potential relationship between *HP* infection and mental health problems,

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including quality of life and depressed mood (Verma and Giaffer 2002; Taguchi et al. 2017; Shah et al. 2022). Nevertheless, no reports have yet been published on the effects of *HP* infection on anxiety for GC. This consideration is of particular importance, given that the majority of *HP*-positive subjects received eradication therapy intending to reduce their risk of GC in Japan, where eradication treatment is covered by national health insurance for all *HP*-positive subjects (Asaka 2013). Furthermore, anxiety for GC may influence health screening behavior (Diefenbach et al. 1999; Jensen et al. 2010; Hawranek et al. 2022). It is important to understand the impact of *HP* infection status on the fear and anxiety about GC when implementing risk-based stratified screening for GC in Japan.

Cancer worry (CW) is defined as the emotional response to the perceived threat of cancer (Douma et al. 2010). It is important to understand the appropriate level of CW to encourage participation in cancer screening (Diefenbach et al. 1999; Jensen et al. 2010; Hawranek et al. 2022). Conversely, excessive CW may impose an unwarranted psychological burden on individuals. We recently reported the level of CW against esophageal cancer in subjects with Barrett's esophagus (BE), a precursor of esophageal adenocarcinoma, in a health screening setting (Fukuda et al. 2024). Using the same dataset, the aim of this study was to identify the factors influencing CW among participants in health checkups in Japan, with special attention to the relationship between CW and the participants' *HP* infection status.

Materials and Methods

In a recent report entitled "Disproportionate cancer worries in ultra-short-segment Barrett's esophagus in Japan", we examined the level of CW for esophageal cancer in subjects with BE in a health screening setting (Fukuda et al. 2024). In that study, we collected information on CW for GC as a reference for esophageal cancer. The current questionnaire survey used the same data set as the previous study.

The original study used a quantitative, multicenter, self-administered questionnaire survey. Participants were recruited between May 2021 and March 2022 from three health check-up facilities (Honjo-Daiichi Hospital, Yokote Municipal Hospital, and JCHO Akita Hospital) that provide screening esophagogastroduodenoscopy (EGD) in Akita Prefecture, Japan (Fukuda et al. 2024). Consecutive subjects diagnosed with BE by endoscopy at the three institutes were potential candidates for this study. About one month after the health screening, an invitation letter to participate in this study was sent to individuals with a diagnosis of BE based on EGD. The invitation letter included a summary of the study, the informed consent form and questionnaire, and the report of the overall health examination results. The information provided outlined the potential risk of esophageal cancer in BE but did not include a description of *HP* and its risk of GC. The subjects were instructed to complete the survey at home and return it to the research office at Akita University in Japan. The clinical data of each subject were obtained from medical records. The study protocol was approved by the ethics committee of Akita University and each participating institute (2620).

Cancer Worry Scale (CWS)

The CWS was employed in this study to quantitatively assess the fear of developing cancer. The scale consisted of the following six items, each rated on a four-point Likert scale, ranging from 1 (never) to 4 (almost always) (Custers et al. 2018; Otsuka and Fukumori 2020; Fukuda et al. 2024). The possible scores ranged from 6 to 24, with higher scores indicating greater worry. In this study, a cut-off of CWS $\geq$ 13 was adopted as positive, excessive cancer worry because it represents patients' responses to at least one item as having substantial anxiety and is considered clinically relevant. The CWS was scored individually on the separate questionnaire sheet for GC and esophageal cancer.

Items of cancer worry scale

- How often have you thought about your chances of getting cancer?
- Have these thoughts affected your mood?
- Have these thoughts interfered with your ability to do daily activities?
- How concerned are you about the possibility of getting cancer one day?
- How often do you worry about developing cancer?
- How much of a problem is this worry?

SF-8

Health-related quality of life was assessed using the SF-8 (Tokuda et al. 2009). The SF-8 consists of eight items, and physical health component summary (PCS) and mental health component summary (MCS) scores were calculated based on the questionnaire results. The PCS and MCS use a scoring system based on a mean of 50 points and a standard deviation of 10 points from the national norm. A higher score indicates a higher health-related quality of life, while a score below 50 indicates a lower health-related quality of life than the average Japanese.

The frequency scale for the symptoms of gastroesophageal reflux disease (FSSG)

The FSSG was used to evaluate gastroesophageal reflux disease (GERD)-related and other upper gastrointestinal symptoms (Kusano et al. 2012). The questionnaire consisted of 12 items, each of which was rated on a five-point scale (0 = never, 1 = occasionally, 2 = sometimes, 3 = often, and 4 = always). A score of $\geq$ 8 indicates the presence of abnormal GERD-related and other upper gastrointestinal symptoms.

Evaluation of HP infection status

The medical records of each patient were reviewed to determine their status of *HP* infection at the index health check-up. The evaluation was based primarily on antibody testing, which was performed as a voluntary procedure during a health check-up. In cases where endoscopic signs suggestive of *HP* infection were observed, the infection status was determined by a ^{13}C-urea breath test. Furthermore, each patient's medical record was reviewed to confirm a history of successful eradication of the infection prior to the index visit. In contrast, tests for *HP* infection have not been commonly recommended for individuals with no evidence of endoscopic atrophy and a regular arrangement of collecting venules (RAC) in the gastric antrum, findings consistent with a negative status for *HP* (Yagi et al. 2005; Yoshii et al. 2020). In the previous studies, the sensitivity, specificity, and accuracy of RAC for *HP*-negative normal stomach were 89.1-93.8%, 79.8-96.2%, and 85.5-95.5%, respectively (Yagi et al. 2005; Yoshii et al. 2020). Therefore, in this study, an individual was classified as *HP*-negative if they had a negative result for *HP* (serum antibody or ^{13}C-urea breath test) and/or no endoscopic atrophy and the presence of RAC, in addition to no documented history of eradication therapy.

Statistical analysis

Continuous variables were expressed as median and interquartile range (IQR: first and third quartiles) and compared using the Mann-Whitney U test or the Kruskal-Wallis test, as appropriate. Categorical variables were expressed as numbers (proportions) and compared using Fisher's exact test or chi-square test, as appropriate. Logistic regression analyses were used to investigate the association between a positive CWS (defined as $\geq$ 13) and associated factors. Results were expressed as odds ratios (OR) and 95% confidence intervals (CI). Because there was considerable overlap between *HP* status (e.g., -negative vs. -positive or eradicated) and a history of successful *HP* eradication (e.g., -negative plus -positive vs. eradicated), each factor was included in the different multiple regression models to avoid a covariate effect. The correlation between the number of years since *HP* eradication and the CWS was determined by linear regression analysis. All statistical analyses were performed using the EZR software program (Saitama Medical Center, Jichi Medical University, Saitama, Japan) (Kanda 2013), and P values of < 0.05 were considered statistically significant.

Results

A total of 1,045 individuals (23.2% of the entire examinee population) were diagnosed with BE at three health checkup institutes during the study period. They were then invited to participate in this study. Of these, 334 returned the questionnaire with informed consent (Fukuda et al. 2024). A total of 31 individuals were excluded from the study due to incomplete questionnaire responses (n = 9), a history of gastric cancer (n = 5), and an unknown *HP* status (n = 17). This resulted in a final sample size of 303 subjects (29.0%, 186 males, median age 58 years) for the current study. A flow chart of this study enrollment is shown in

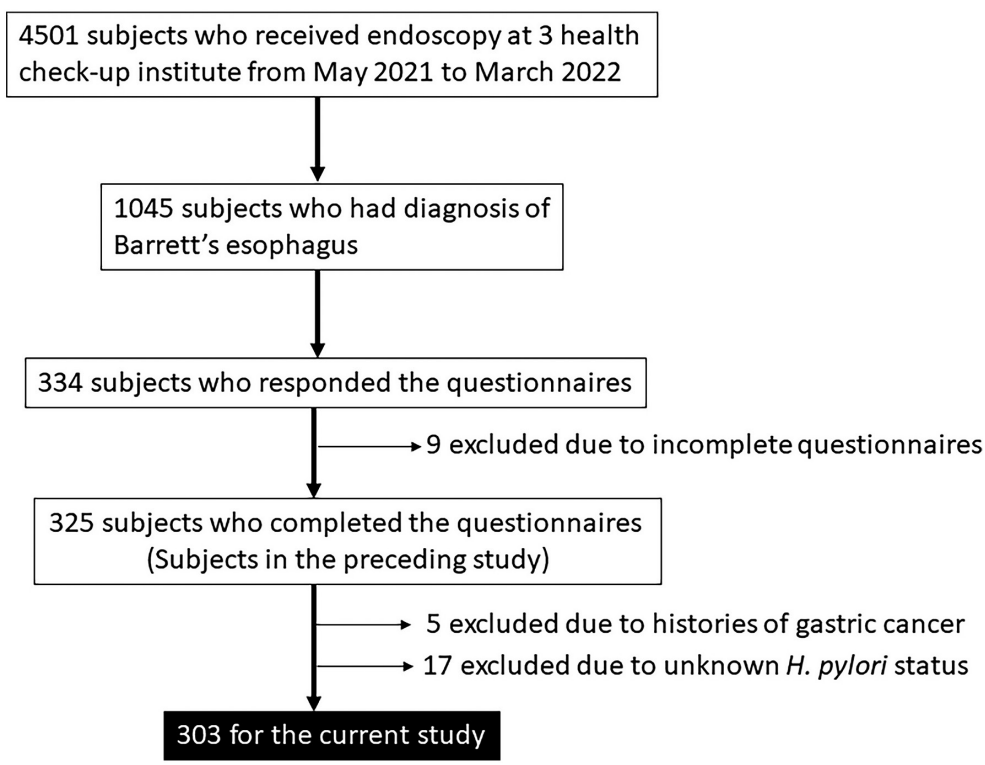

Fig. 1. A flow chat of the study enrollment.

Fig. 1. The median CWS for the entire cohort was 14 (12-17), and positive CWS, defined as ≥ 13, accounted for 66.3% (201/303). Concerning the status of *HP* infection, 146 (48.2%) and 137 (45.2%) were classified as *HP*-negative and *HP*-eradicated, respectively, while only 20 (6.6%) were identified as *HP*-positive. *HP*-negativity was determined by *HP* test plus endoscopic findings in 38 subjects, and by endoscopic findings alone in 108 patients. Among subjects who had diagnostic tests for *HP* infection and did not have a history of eradication in the current study, the sensitivity, specificity, and accuracy of endoscopic evaluation (RAC plus gastric atrophy) for *HP* infection status were 83.3%, 84.0%, and 83.9%, respectively.

Table 1 shows comparisons of the factors examined according to *HP* status. As expected, there is a statistically significant difference in age (i.e., *HP*-negative subjects are younger than others), but there is no significant difference in other factors. It is noteworthy that the medians of CWS by *HP* status were 14 (12-16) in *HP*-negative, 14 (10.8-16) in *HP*-positive, and 15 (12-17) in *HP*-eradicated, and there was no statistical difference in the CWS among the three groups (P = 0.11).

Table 2 shows the comparisons of the studied factors according to the positivity of the CWS. The analysis showed that age, sex, and the institutes where the check-up was conducted did not significantly affect the CWS. The prevalence of positive upper GI symptoms, as defined by an FSSG score of ≥ 8, was significantly higher in CWS-positive subjects than in CWS-negative subjects (43.8% vs. 28.6%, p = 0.012). Poor mental health quality, as defined by MCS scores below 50, was also significantly more common in CWS-positive subjects than in CWS-negative subjects (44.3% vs. 27.5%, p = 0.006). Meanwhile, positive CWS accounted for 63.0% (92/146) in *HP*-negative, 55.0% (11/20) in *HP*-positive, and 71.5% (98/137) in *HP*-eradicated. There was no statistical difference in the proportion of CWS-positive subjects among the three groups by *HP* status (p = 0.169). In addition, the proportion of CWS-positive subjects was found to be higher in those who had successful eradication in comparison with others (*HP*-negative plus -positive), although this did not reach a statistical significance (p = 0.08). For reference, the CWS for esophageal cancer in the same cohort is also shown in Table 2. Factors affecting the positive CWS are largely similar between GC and esophageal cancer, except for a significant association between CWS for esophageal cancer and proton pump inhibitor use. The histogram of CWS scores in those who had successful eradication and those who did not are shown in Fig. 2.

Table 3 shows the results of logistic regression analyses examining the factors associated with positive CWS. The results of the univariate analysis showed a significant association between positive FSSGs and positive CWS with an OR (95% CI): 1.96 (1.17-3.27), p = 0.010. The significance of the associations remained in multivariate analysis with an adjusted OR (95% CI): 1.93 (1.09-3.42), p = 0.024 or 1.94 (1.09-3.42), p = 0.023. Furthermore, subnormal MCS is also significantly associated with positive CWS in both univariate analysis with an OR (95% CI): 2.10 (1.25-3.52, p = 0.005) and multivariate analysis with an OR (95% CI): 2.07 (1.19-3.59), p = 0.010 and 2.08 (1.20-3.61), p = 0.0009, respectively. Meanwhile, there was no significant association between *HP* status and positive CWS in both univariate and multivariate regression analyses. Using *HP*-negative as the reference, the adjusted OR (95% CI) for *HP*-positive was 0.81 (0.30-2.18), while the adjusted OR (95% CI) for *HP*-eradicated was 1.54 (0.87-2.72). In addition, those who had undergone successful eradication ther-

Table 1. Comparisons of study factors by the status of *Helicobacter pylori* infection.

	The entire cohort (*n* = 303)	*H. pylori* infection status			*p* value
		Negative (*n* = 146)	Positive (*n* = 20)	Eradicated (*n* = 137)	
Demographics					
Male sex, *n* (%)	186 (61.4)	85 (58.2)	12 (60.0)	89 (65.0)	0.503
Age, years, median (IQR)	58 (51-66)	54 (47.3-60)	57.5 (51.5-68)	63 (56-69)	< 0.001
Institute, *n* (%)					
H	131 (43.2)	56 (38.4)	6 (30.0)	69 (50.4)	0.099
N	33 (10.9)	21 (14.4)	2 (10.0)	10 (7.3)	
Y	139 (45.9)	69 (47.3)	12 (60.0)	58 (42.3)	
PPI use, *n* (%)	55 (18.2)	31 (21.2)	1 (5.0)	23 (16.8)	0.180
FSSG ≥ 8, *n* (%)	117 (38.6)	66 (45.2)	6 (30.0)	45 (32.8)	0.073
SF8					
PCS < 50, *n* (%)	104 (34.3)	51 (34.9)	8 (40.0)	45 (32.8)	0.802
MCS < 50, *n* (%)	117 (38.6)	65 (44.5)	6 (30.0)	46 (33.6)	0.120
CWS, median (IQR)	14 (12-17)	14 (12-16)	14 (10.8-16)	15 (12-17)	0.109

PPI, proton pomp inhibitor; FSSG, frequency scale for the symptoms of gastroesophageal reflux disease; CWS, cancer worry scale; PCS, physical health component summary; MCS, mental health component summary.

Table 2. Comparisons of study factors by presence or absence of excessive cancer worry for gastric cancer and esophageal cancer.

	For gastric cancer			For esophageal cancer		
	CWS ≥ 13 (*n* = 201)	CWS < 13 (*n* = 102)	*p* value	CWS ≥ 13 (*n* = 146)	CWS < 13 (*n* = 156)	*p* value
Demographics						
Male sex, *n* (%)	128 (63.7)	58 (56.9)	0.263	88 (60.3)	97 (62.2)	0.813
Age, years, median (IQR)	59 (52–66)	57.5 (48–66)	0.265	58 (50–64)	59 (52–67)	0.177
Institute, *n* (%)						
H	90 (44.8)	41 (40.2)	0.417	67 (45.9)	63 (40.4)	0.214
N	24 (11.9)	9 (8.8)		19 (13.0)	14 (9.0)	
Y	87 (43.3)	52 (51.0)		60 (41.1)	79 (50.6)	
PPI use, *n* (%)	39 (19.4)	16 (15.7)	0.528	35 (24.0)	19 (12.2)	0.010
FSSG ≥ 8, *n* (%)	88 (43.8)	29 (28.4)	0.012	74 (50.7)	43 (27.6)	< 0.001
SF8						
PCS < 50, *n* (%)	74 (36.8)	30 (29.4)	0.249	57 (39.0)	47 (30.1)	0.116
MCS < 50, *n* (%)	89 (44.3)	28 (27.5)	0.006	70 (47.9)	47 (30.1)	0.002
Hp infection status, *n* (%)						
Negative	92 (45.8)	54 (52.9)	0.169	80 (54.8)	66 (42.3)	0.052
Positive	11 (5.5)	9 (8.8)		6 (4.1)	14 (9.0)	
Eradicated	98 (48.8)	39 (38.2)		60 (41.1)	76 (48.7)	
Eradication therapy, *n* (%)	98 (48.8)	39 (38.2)	0.088	60 (41.1)	76 (48.7)	0.204

PPI, proton pump inhibitor; FSSG, frequency scale for the symptoms of gastroesophageal reflux disease; CWS, cancer worry scale; PCS, physical health component summary; MCS, mental health component summary.

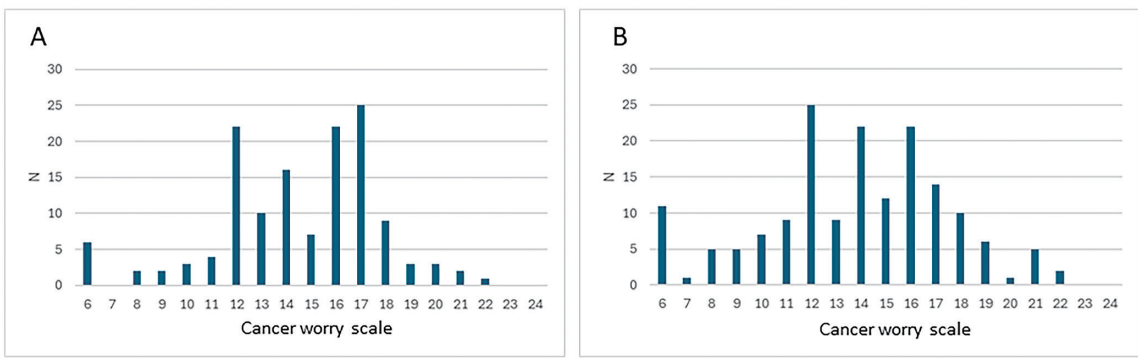

Fig. 2. Distribution of cancer worry scale for gastric cancer in those who had successful eradication (A) or those who did not (B).

apy showed a trend toward a higher prevalence of positive CWS than those who had not with an adjusted OR (95% CI): 1.59 (0.92-2.75), p = 0.096. The correlation between the number of years elapsed after *HP* eradication and the CWS in those who had successful eradication indicated that there was no downward trend in CWS over time after the eradication (Fig. 3).

Discussion

This study sought to identify the factors that influence anxiety about GC among individuals diagnosed with BE at health check-up EGD. The results showed that the presence of upper GI symptoms and subnormal mental health quality were significantly associated with anxiety. In contrast, the status of *HP* infection, which is the main determinant of GC development (Uemura et al. 2001; Kaji et al. 2019), did not affect the anxiety for GC. Furthermore, the high level of anxiety persisted for an extended period of time even after successful eradication.

In the preceding paper using the same patient cohort, we reported an overall median of CWS of 12 (10-15) for esophageal cancer (Fukuda et al. 2024). The score for GC in the current study, with a median of 14 (12-17), is considerably higher than that for esophageal cancer. Furthermore, 66.3% of all participants in this study had excessive CW (defined as ≥ 13) for GC. Potential selection bias may have affected the results because the study was conducted in patients with BE, a precursor to esophageal adenocarcinoma. However, considering that GC is three times more common than esophageal cancer in Japan and that esopha-

Table 3. Logistic regression analyses examining factors associated with positive worry about gastric cancer.

		Univariate analysis			Multivariate analysis 1			Multivariate analysis 2		
		Crude OR	95% CI	*p* value	Adjusted OR	95% CI	*p* value	Adjusted OR	95% CI	*p* value
Demographics										
Male sex		1.33	0.82-2.16	0.250	1.47	0.87-2.48	0.149	1.47	0.87-2.48	0.150
Age, years		1.01	0.99-1.04	0.289	1.01	0.99-1.04	0.285	1.01	0.99-1.04	0.303
Institute	H	1.31	0.79-2.17	0.291	1.28	0.75-2.18	0.372	1.28	0.75-2.19	0.359
	N	1.59	0.69-3.69	0.276	1.95	0.80-4.75	0.141	1.96	0.81-4.77	0.136
	Y	Ref.			Ref.			Ref.		
PPI use		1.29	0.68-2.45	0.428	0.96	0.48-1.92	0.906	0.98	0.49-1.95	0.944
FSSG ≥ 8		1.96	1.17-3.27	0.010	1.93	1.09-3.42	0.024	1.94	1.09-3.42	0.023
SF8	PCS < 50	1.40	0.84-2.34	0.200	1.29	0.74-2.24	0.371	1.28	0.74-2.22	0.380
	MCS < 50	2.10	1.25-3.52	0.005	2.07	1.19-3.59	0.010	2.08	1.20-3.61	0.009
H. pylori status	Negative	Ref.			Ref.					
	Positive	0.72	0.28-1.84	0.490	0.81	0.30-2.18	0.680			
	Eradicated	1.47	0.89-2.43	0.128	1.54	0.87-2.72	0.137			
Eradication therapy		1.54	0.95-2.50	0.083				1.59	0.92-2.75	0.096

"*H. pylori* status" and "Eradication therapy" are added separately to the multivariate model to avoid confounding effects.
PPI, proton pomp inhibitor; FSSG, frequency scale for the symptoms of gastroesophageal reflux disease; CWS, cancer worry scale; PCS, physical health component summary; MCS, mental health component summary; OR, odds ratio; CI, confidence interval.

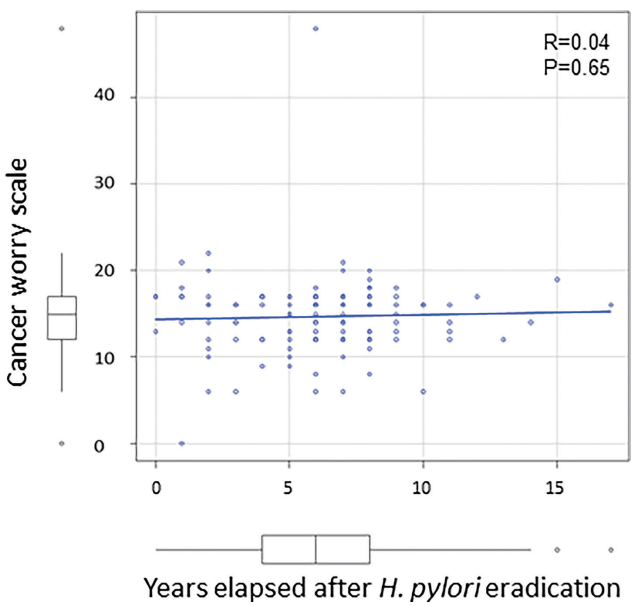

Fig. 3. Correlation between the number of years elapsed after eradication and the cancer worry scale for gastric cancer.

geal adenocarcinoma is still very rare (Okuyama et al. 2022), the results are reasonable. Moreover, this phenomenon is observed even in subjects with BE, for example, in our recent study, the annual incidence of gastric and esophageal (squamous cell carcinoma plus adenocarcinoma) cancer in patients with ultra-short-segment BE was 0.30% and 0.088%, respectively (Fukuda et al. 2022). Furthermore, Akita Prefecture, where this study was conducted, has the highest mortality rate for GC in Japan (Iijima et al. 2022, 2023). Consequently, the residents of this region are likely to be more aware of the risks associated with this disease in their daily lives.

This study found no significant difference in CWS for GC among the three groups based on *HP* infection status, even though the actual GC risks differed considerably among the groups (Uemura et al. 2001; Kaji et al. 2019). It is noteworthy that 63% of *HP*-negative subjects express concern about GC, even though this patient group has a negligible risk for GC (Uemura et al. 2001; Kaji et al. 2019). However, the findings would be unavoidable given the current GC screening guidelines in Japan, which recommend screening for everyone over the age of 50 (Hamashima and Fukao 2016). Furthermore, the CWS for GC tended to be higher in those who had undergone successful eradication, and the elevated score remained consistent over time. This appears to be inconsistent with the true risk of GC, as the risk of GC is halved after eradication in the general population (Ford et al. 2020). Nevertheless, such persistent and excessive anxiety about GC may be beneficial in motivating eradicated individuals to undergo the necessary GC screening even after eradication (Diefenbach et al. 1999; Jensen et al. 2010; Hawranek et al. 2022). In any case, there is a significant discrepancy between the anxiety about GC and the actual risk of GC among those who undergo GC screening. Therefore, it is necessary to provide appropriate patient education when introducing risk-based (mainly, *HP*-based) stratified screening for GC in Japan (Hamashima and Fukao 2016; Hamashima et al. 2020).

The presence of upper GI symptoms is an independent predictor of excessive CW for GC in this study. This finding is consistent with previous studies in a different context,

namely that such symptoms are associated with CW for esophageal cancer in patients with BE (Britton et al. 2019; Ratcliffe et al. 2022; Fukuda et al. 2024). Moreover, this study showed that suboptimal mental health is also associated with excessive CW for GC. This is also consistent with a recent nationwide sample study in the United States, which showed that self-reported depressive symptoms were significantly associated with excessive CW for cancers in general (Mamudu et al. 2024). Therefore, it is critical to provide these individuals with accurate information about the likelihood of GC and the benefits of preventive measures to reduce their level of anxiety.

A notable strength of this study is the use of a mail invitation with a self-administered questionnaire rather than on-site personal recruitment. This approach was used to investigate the natural emotional response to GC at home. Furthermore, the CW questionnaire for GC was collected as a reference in the original study, which investigated CW for esophageal cancer in patients with BE. Therefore, the invitation letter of the original study did not include any information about *HP* or GC. This omission may provide us with a unique opportunity to elicit the participants' neutral, usual feelings about GC, thus avoiding preconceptions (e.g., a preconception about the association between *HP* infection and GC).

In contrast, this study has several limitations. First, the low response rate to the invitation is a significant limitation of this study. Consequently, those who were more concerned about cancer were more likely to respond to the questionnaire and participate in this study. However, the CW of participants in this study is less likely to be biased by *HP* infection status, which is the main interest of this analysis, because there is no description of *HP* in the invitation letter as mentioned above. Second, all participants in this study were diagnosed with BE, and the characteristics of the study participants may differ from those of the entire examinee population. Nevertheless, the vast majority (99.7%) of the participants were diagnosed with short forms of BE, with 72.5% having subtle forms (ultrashort-segment BE) measuring 1 cm or less (Fukuda et al. 2022). BE, especially ultrashort-segment BE, is a very common and frequent diagnosis (15-80%) at health screening EGD in Japan, and this is true in our study setting (23.2%) (Fukuda et al. 2022). Consequently, the characteristics of the study participants are not markedly different from those of the entire examinee population. In fact, the participants expressed a greater concern about GC than about esophageal cancer, despite having been diagnosed with BE. Third, the participants in the study were all recruited through health screening. Therefore, it is reasonable to assume that they were more health-conscious than the general population. A similar study in the general population would be of interest, as it would allow the association between CW for GC and motivation to undergo regular EGD in eradicated patients to be investigated. For instance, although periodic EGD is recommended even after eradication (Asaka 2013), some individuals may erroneously believe that eradication eliminates the risk of GC and therefore stop worrying about GC. As a result, they may rarely undergo voluntary GC screening after eradication. Fourth, a small number of *HP*-positive subjects precluded meaningful analysis in this study, although this is common in the current field of health screening in Japan (Adachi et al. 2021; Kubota et al. 2022). Finally, because the study was conducted in Akita Prefecture, where GC mortality is the highest in Japan (Iijima et al. 2022, 2023), it is uncertain whether the present results can be generalized to all of Japan.

In conclusion, this is the first study to investigate the level of anxiety for GC according to *HP* infection status. A substantial proportion of individuals undergoing screening for GC exhibited excessive anxiety about GC, regardless of their actual GC risk, defined as their *HP* infection status. This is an inevitable consequence of the current age-based screening approach for GC. Therefore, patients need to be properly educated when undergoing risk-based (primarily *HP* status-based) stratified screening for GC in Japan.

Conflict of Interest

The authors declare no conflict of interest.

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