

BMJ Open Awareness of risk factors and warning symptoms and attitude towards gastric cancer screening among the general public in China: a cross-sectional study

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ABSTRACT

Objectives This study aimed to assess the knowledge of risk factors and warning symptoms and attitude towards gastric cancer screening among the general population in China.

Setting Hunan province, China

Participants Individuals aged older than 18 years were recruited using a cluster sampling method.

Design A cross-sectional study, and a pretested structured questionnaire was used to assess participants' awareness of gastric cancer.

Primary and secondary outcome measures Knowledge level of risk factors and warning symptoms of gastric cancer, gastric cancer screening attitude, sociodemographic factors associated with gastric cancer knowledge and screening behaviour.

Results This study comprised 1200 participants with a mean age of 40.31 (SD 16.73) years, of whom 622 (51.8%) were women. The mean score for gastric cancer knowledge was 8.85/22 (SD 6.48). There were 47.0% of the participants who had a low knowledge level about the risk factors and warning symptoms of gastric cancer. In total, 83.8% believed screening is helpful for early detection of gastric cancer, and 15.2% had undergone gastric cancer screening. The most common reason for not undergoing screening was having 'no symptoms' (63.0%), followed by 'fear of undergoing gastroscopy' (38.1%). Independent factors related to lower knowledge levels included male sex, living in rural areas, lower educational level, working as a farmer and without a family history of gastric cancer ($p < 0.05$). Factors independently associated with screening behaviour included white-collar employment, higher income and having upper gastrointestinal tract diseases ($p < 0.05$).

Conclusions In China, people have poor knowledge about risk factors and warning symptoms of gastric cancer, but a majority have a positive attitude towards the benefits of gastric cancer screening. Being asymptomatic and having a fear of gastroscopy were the main self-reported reasons for not undergoing screening. These results highlight the urgent need for educational campaigns to improve gastric cancer awareness.

INTRODUCTION

Although the incidence of gastric cancer has been declining, it remains the fifth most

Strengths and limitations of this study

- ▶ We used quantitative methods to assess the level of gastric cancer knowledge among the general population.
- ▶ Our findings may be used as a reference for other countries with high incidence rates of gastric cancer and no screening programmes.
- ▶ The participants' screening history was self-reported, and thus, there may be biases in the accuracy of recalling information.
- ▶ Other factors possibly related to knowledge and screening, such as cancer risk awareness, belief or culture, were not explored in this study.

common cancer and the third leading cause of cancer-related deaths worldwide.¹ Particularly, the incidence and mortality rates of gastric cancer in China account for a staggering 42.6% and 45.0%, respectively, of the global rates, and the number of new cases continues to increase due to population growth and ageing.^{2,3}

Early gastric cancer has significantly better prognosis than advanced gastric cancer.^{4,5} However, the 5-year survival rate of gastric cancer is significantly lower in China than in Japan and Korea,⁶ suggesting delays in diagnosis.⁷ Factors contributing to this delay could be poor awareness of risk factors or symptoms, and a negative attitude towards gastric cancer screening. *Helicobacter pylori* (*H. pylori*) infection has been identified as a primary causative factor of gastric cancer, with almost 90% of non-cardia gastric cancer cases attributable to *H. pylori* infection.⁸ A previous study found that awareness of the association between *H. pylori* infection and gastric cancer is more likely to make a person undergo screening and receive treatment for *H. pylori* infection.⁹ This may primarily be because knowledge of the risk factors is a vital

aspect in developing cancer risk perceptions and further influencing the participation in cancer screening.^{10 11} Moreover, knowledge about risk factors is an important prerequisite to healthy behaviours.¹²

In addition, knowledge about warning symptoms is critical for early diagnosis of cancer. The presence of an abdominal lump, abdominal fullness and pain are warning symptoms of gastric cancer.¹³ A recent study showed that knowledge about warning symptoms can lead to earlier presentation to medical care, which could result in earlier diagnosis and better outcomes.¹⁴ Studies investigating public knowledge of risk factors or warning symptoms of gastric cancer in Korea and Iran reported a general lack of knowledge.^{15 16}

Gastric cancer screening via gastroscopy has been shown to reduce disease-related mortality as it detects precancerous polyps, and thus enables early diagnosis.^{17 18} An individual's attitude towards screening has been shown to be significantly related to screening behaviour.¹⁹ Despite the serious burden of gastric cancer in China, there are no nationwide screening guidelines or programmes.⁷ Due to its large population and the relative lack of medical and health resources, opportunistic screening with gastroscopy in asymptomatic people is the primary practice in China.^{20 21} However, opportunistic screening operates on a voluntary basis and depends only on requests from the individual or their physician.²² In clinical practice, at-risk individuals (eg, those with *H. pylori* infection and first-degree relatives with gastric cancer) are recommended for gastric cancer screening, for which they shoulder the entire cost.^{23–25} Compared with organised screening, opportunistic screening involves fewer formal decisions about whether to screen, whom to screen and at what intervals screening should be done.²²

In China, there is little information about public awareness of risk factors or warning symptoms and screening for gastric cancer. Therefore, it is important to assess gastric cancer awareness in the Chinese population as a basis for future practice. The primary aim of this study was to evaluate the knowledge about risk factors and warning symptoms, and the attitude towards gastric cancer screening among the general population in China. The secondary aim was to investigate sociodemographic factors associated with gastric cancer knowledge and screening behaviour.

METHODS

Setting and sample

This cross-sectional, descriptive study was conducted between March and July 2018. The minimum calculated sample size was 896, which was determined using the formula $N = [\mu\alpha^2 \times \varpi \times (1 - \varpi)] / \delta^2$,²⁶ in which the prevalence rate was 30% (ϖ) based on the knowledge level of the pilot group, the significance level was 0.05 (α) and the allowable error was 0.03 (δ). Considering a non-response rate of 40%, a target sample of 1250 was finally determined.

Of the 32 medical centres in Hunan province, 11 were included in this study using a cluster random sampling method. People who visited the medical centres were invited to this study. With the support of medical centres, each trained interviewer was accompanied by a medical staff (physician or nurse) to introduce the study purpose. The inclusion criteria were (a) age ≥ 18 years, (b) ability to communicate verbally and (c) no history of cancer. The exclusion criteria were (a) age < 18 years, (b) language barrier and (c) history of cancer. Individuals who agreed to participate in this study completed a standardised face-to-face questionnaire about gastric cancer knowledge and screening attitude. Administering the questionnaire took approximately 10–20 min. To maximise the response rate, each participant received a gift worth ¥25 (about US\$3.5).

Study instrument

The questionnaire consisted of items about risk factors, warning symptoms and screening for gastric cancer. The risk factors and warning symptoms listed were those identified by the American Cancer Society and China Anti-Cancer Association. The questionnaire comprised four sections: (1) Sociodemographic characteristics, including gender, age, residence, marital status, educational level, occupation, monthly income, family history of gastric cancer, family history of cancer, personal health status and history of gastrointestinal disease. (2) Identification of risk factors of gastric cancer: participants were asked to judge whether the following 16 items were risk factors of gastric cancer: male sex, older age, *H. pylori* infection, stomach ulcer, previous stomach surgery, atrophic gastritis, family history of gastric cancer, salty diet, consumption of pickled foods, consumption of smoked foods, irregular diet, frequently eating of leftovers, frequent midnight snacking, smoking, drinking and stress. Responses included 'Yes', 'No' or 'Not sure/Do not know', with 'Yes' indicating that they identified the items to be risk factors. (3) Identification of warning symptoms of gastric cancer: participants were asked to judge whether the following six items were warning symptoms of gastric cancer: gastrointestinal bleeding, recurrent nausea and vomiting, weight loss, upper abdominal fullness, abdominal lump and abdominal pain. The response categories were similar to those in section (2). (4) Perceptions on the screening for gastric cancer: (i) 'Do you think gastric cancer can be prevented?' Options included 'Yes' and 'No'; (ii) 'Do you think early gastric cancer can be cured?' (Yes or No); (iii) 'Do you think screening can help to detect early gastric cancer?' (Yes or No); (iv) 'Have you ever undergone gastric cancer screening?' (Yes or No); (v) 'Why do you not undergo a screening for gastric cancer?' Options included 'Do not know the benefits of screening', 'Fear of undergoing gastroscopy', 'Worried about screening results', 'No symptoms', 'No time' and 'Financial limitations' (multiple answers were allowed) and (vi) 'Which screening method for gastric cancer would you prefer?' Options included 'Gastroscopy', 'Blood test' and 'None of them'.

For the second and third sections, each correct answer was scored one point, with the total scores ranging from 0 to 22 points. The respondents' knowledge was then categorised according to the total scores: high knowledge, 15–22 points; moderate knowledge, 8–14 points; and low knowledge, 0–7 points.²⁷

The reliability of the questionnaire was evaluated by pretesting it in 100 adults. The retest coefficients of the second, third and fourth sections were 0.852, 0.874 and 0.791, respectively, while the Cronbach's α coefficient were 0.879, 0.890 and 0.783, respectively.

Data analysis

All data were analysed using SPSS V.23.0. Sociodemographic characteristics and responses to each question were described using frequencies and percentages. Univariate logistic regression was used to determine the relationship between sociodemographic characteristics and knowledge and participation in gastric cancer screening. Variables with a p value ≤ 0.15 in the univariate analysis were entered into the multivariate logistic regression analysis to investigate the independent factors influencing knowledge and screening behaviour. For each gastric cancer knowledge model, response options for the dependent variable were categorised as 'low/moderate knowledge' and 'high knowledge'. Only the results of the multivariate analysis were presented using OR and 95% CI. A two-tailed p value of <0.05 was considered statistically significant.

Patient and public involvement

None of the patients was involved in the design or development of the research question and outcome measures. They were also not involved in the recruitment and conduct of the study. The participants were informed of the study results via text message after completion of the study.

RESULTS

Sociodemographic characteristics of the participants

Of the 1250 individuals given the questionnaire, 1230 responded, of whom 30 completed less than 50% of the questionnaire. Thus, the final response rate was 96% ($n=1200$). The mean age of the participants was 40.31 (SD 16.73) years. Of the 1200 participants, 622 (51.8%) were women, 766 (63.8%) lived in rural areas, 408 (34.0%) had high educational level (college or above) and 169 (14.1%) had high income (\geq ¥5000). In total, 198 (16.5%) participants had a family history of cancer, 58 (4.8%) had a family history of gastric cancer and 248 (20.7%) had diseases of the upper gastrointestinal tract (table 1).

Knowledge about risk factors and warning symptoms of gastric cancer

Table 2 presents the participants' knowledge about gastric cancer. The mean knowledge score was 8.85 (SD 6.48). Of the 1200 participants, 564 (47.0%), 347

Table 1 Sociodemographic characteristics of participants ($n=1200$)

| Characteristic | Number (%) |
|---|-------------------|
| Gender | |
| Male | 578 (48.2) |
| Female | 622 (51.8) |
| Age (years) | |
| 18–29 | 425 (35.4) |
| 30–39 | 208 (17.3) |
| 40–49 | 192 (16.0) |
| 50–59 | 209 (17.4) |
| >60 | 166 (13.8) |
| Mean \pm SD | 40.31 \pm 16.73 |
| Marital status | |
| Single | 467 (38.9) |
| Married | 733 (61.1) |
| Residence | |
| City | 434 (36.2) |
| Rural | 766 (63.8) |
| Educational Level | |
| Uneducated or elementary school | 294 (24.5) |
| High school | 498 (41.5) |
| College or above | 408 (34.0) |
| Occupation | |
| Farmer | 399 (33.3) |
| Worker | 283 (23.6) |
| White collar | 243 (20.3) |
| Student | 275 (22.9) |
| Income | |
| <¥2000 (<US\$300) | 575 (47.9) |
| ¥2000–5000 (US\$300–755) | 456 (38.0) |
| >¥5000 (>US\$755) | 169 (14.1) |
| Family history of gastric cancer | |
| Yes | 58 (4.8) |
| No | 1142 (95.2) |
| Family history of cancer | |
| Yes | 198 (16.5) |
| No | 1002 (83.5) |
| Health status | |
| Unhealthy | 130 (10.8) |
| Suboptimal | 672 (56.0) |
| Healthy | 398 (33.2) |
| Diseases of the upper gastrointestinal tract | |
| Yes | 248 (20.7) |
| No | 952 (79.3) |

(28.9%) and 289 (24.1%) had low, moderate and high knowledge of gastric cancer, respectively. The most highly recognised risk factor was irregular diet (59.8%),

Table 2 Participants' knowledge about risk factors and warning symptoms of gastric cancer (n=1200)

| Category | Number | % |
|--|----------------|------|
| Risk factors of gastric cancer | | |
| Irregular diet | 717 | 59.8 |
| Consumption of pickled foods | 690 | 57.5 |
| Drinking | 681 | 56.8 |
| Consumption of smoked foods | 671 | 55.8 |
| Salty diet | 611 | 50.9 |
| Stomach ulcer | 587 | 48.9 |
| Stress | 538 | 44.8 |
| Smoking | 534 | 44.5 |
| Frequent eating of leftovers | 534 | 44.5 |
| Atrophic gastritis | 431 | 35.9 |
| Older age | 419 | 34.9 |
| <i>H. pylori</i> infection | 418 | 34.8 |
| Family history of gastric cancer | 415 | 34.6 |
| Male sex | 304 | 25.3 |
| Previous stomach surgery | 285 | 23.8 |
| Frequent midnight snacking | 225 | 18.8 |
| Warning symptoms of gastric cancer | | |
| Gastrointestinal bleeding | 598 | 49.8 |
| Abdominal lump | 541 | 45.1 |
| Abdominal pain | 524 | 43.7 |
| Upper abdominal fullness | 501 | 41.8 |
| Weight loss | 452 | 37.7 |
| Recurrent nausea and vomiting | 413 | 34.4 |
| Total knowledge level (22 points) | | |
| Low (0–7) | 564 | 47.0 |
| Moderate (8–14) | 347 | 28.9 |
| High (15–22) | 289 | 24.1 |
| Mean score of gastric cancer risk factors and warning symptoms (22 points) | 8.85 (SD 6.48) | |

H. pylori, *Helicobacter pylori*.

followed by consumption of pickled foods (57.5%), drinking (56.8%), consumption of smoked foods (55.8%) and salty diet (50.9%). Less well-recognised risk factors included male sex (25.3%), previous stomach surgery (23.8%) and frequent midnight snacking (18.8%). The most highly recognised warning symptom was gastrointestinal bleeding (49.8%), followed by abdominal lump (45.1%) and abdominal pain (43.7%), while less well-recognised warning symptoms included weight loss (37.7%) and recurrent nausea and vomiting (34.4%).

Table 3 presents the outcomes of the multivariate analysis for factors associated with gastric cancer knowledge. In the univariate analysis, gender, age, residence, marital

status, educational level, occupation and family history of gastric cancer were significantly associated with gastric cancer knowledge ($p < 0.05$). These factors plus variables with p value < 0.15 in the univariate analysis were entered into the multivariate logistic regression model. The independent variables associated with knowledge included gender, age, residence, educational level, occupation and family history of gastric cancer ($p < 0.05$; table 3).

Participants who were found to be less knowledgeable about risk factors and warning symptoms of gastric cancer included male sex (OR 0.59; 95% CI 0.46 to 0.75), living in rural areas (OR 0.76; 95% CI 0.59 to 0.99), with lower educational level (uneducated and elementary school: OR 0.25; 95% CI 0.16 to 0.41), working as a farmer (OR 0.38; 95% CI 0.22 to 0.66) and those with a family history of gastric cancer (OR 0.20; 95% CI 0.12 to 0.34). Participants aged 18–29 years had better knowledge about gastric cancer than the other age groups (OR 3.50; 95% CI 2.10 to 5.81).

Attitudes towards gastric cancer screening

Table 4 presents the participants' attitudes towards gastric cancer screening. In total, 84.7% of participants thought gastric cancer could be prevented, 83.8% thought gastric cancer could be detected early and only 15.2% thought early gastric cancer could not be cured. Among the 1200 participants, 182 (15.2%) had undergone gastric cancer screening, including 97 participants aged older than 40 years, which is the recommended age range for gastric cancer screening. For the 1018 participants who did not undergo gastric cancer screening, the most common reason was 'no symptoms', followed by 'fear of undergoing gastroscopy' and being 'worried about screening results'. The participants were asked about the most acceptable screening method for gastric cancer and 60.2% preferred blood testing as their first choice, while only 29.8% chose endoscopy as their first option.

Table 5 presents a multivariate analysis of the factors associated with gastric cancer screening behaviour. In the univariate analysis, factors significantly associated with gastric cancer screening behaviour were age, marital status, occupation, income and diseases of the upper gastrointestinal tract ($p < 0.05$). These factors plus variables with p value < 0.15 in the univariate analysis were entered into the multivariate logistic regression model. Only three of these factors were independently associated with gastric cancer screening behaviour: occupation, income and diseases of the upper gastrointestinal tract ($p < 0.05$). White collar employees were more likely to have undergone gastric cancer screening compared with those in other occupations (OR 4.88; 95% CI 2.04 to 11.72). Participants with the lowest income were less likely to have undergone gastric cancer screening than those with higher incomes (OR 0.22; 95% CI 0.12 to 0.38). Further, participants without upper gastrointestinal diseases were less likely to have undergone gastric cancer screening than those with upper gastrointestinal diseases (OR 0.23; 95% CI 0.16 to 0.34).

Table 3 Multivariate analysis of factors associated with gastric cancer knowledge (n=1200)

| Variable | Low/moderate, n (%) | High, n (%) | OR | 95% CI |
|---|---------------------|-------------|-------------|---------------------|
| Gender | | | | |
| Male | 492 (85.1) | 86 (14.9) | 0.59 | 0.46 to 0.75 |
| Female | 419 (67.3) | 203 (32.6) | 1 (ref) | |
| Age (years) | | | | |
| 18–29 | 252 (59.3) | 173 (40.7) | 3.50 | 2.10 to 5.81 |
| 30–39 | 144 (69.2) | 64 (30.8) | 3.34 | 2.06 to 5.40 |
| 40–49 | 163 (84.9) | 29 (15.1) | 2.26 | 1.40 to 3.63 |
| 50–59 | 198 (94.8) | 11 (5.2) | 1.18 | 0.73 to 1.93 |
| ≥60 | 154 (92.8) | 12 (7.2) | 1 (ref) | |
| Residence | | | | |
| Rural | 611 (79.8) | 155 (20.2) | 0.76 | 0.59 to 0.99 |
| City | 300 (69.1) | 134 (30.9) | 1 (ref) | |
| Educational level | | | | |
| Uneducated or elementary school | 270 (91.8) | 24 (8.2) | 0.25 | 0.16 to 0.41 |
| High school | 426 (85.5) | 72 (14.5) | 0.43 | 0.30 to 0.61 |
| College or above | 215 (52.7) | 193 (47.3) | 1 (ref) | |
| Occupation | | | | |
| Farmer | 367 (92.0) | 32 (8.0) | 0.38 | 0.22 to 0.66 |
| Worker | 241 (85.2) | 42 (14.8) | 0.49 | 0.30 to 0.82 |
| White collar | 166 (68.4) | 77 (31.6) | 0.61 | 0.40 to 0.94 |
| Student | 137 (49.8) | 138 (50.2) | 1 (ref) | |
| Family history of gastric cancer | | | | |
| No | 885 (77.5) | 257 (22.5) | 0.20 | 0.12 to 0.34 |
| Yes | 26 (44.8) | 32 (55.2) | 1 (ref) | |

Bold figures indicate the statistically significant findings ($p < 0.05$). CI, confidence interval; OR, odds ratio; ref, reference.

DISCUSSION

Measuring and understanding public awareness about risk factors, warning symptoms and screening attitude could help in developing appropriate policies for gastric cancer prevention. In general, this study found that a large number of the population had poor knowledge about risk factors and warning symptoms of gastric cancer. However, the majority of participants had a positive attitude towards screening and its benefits. The most common reasons for not seeking screening included no symptoms and fear of undergoing gastroscopy.

Gastric cancer knowledge

In this study, the knowledge level was relatively lower than those reported in the Korean and Iranian populations,^{15 16} signifying poor awareness among the Chinese population regarding gastric cancer. Moreover, while participants had relatively good knowledge of lifestyle risk factors, they had a poorer knowledge of disease risk factors. For instance, more than 50% of participants identified irregular diet, drinking and consumption of pickled foods as

risk factors of gastric cancer, while less than 36% of participants identified atrophic gastritis, *H. pylori* infection and previous stomach surgery as risk factors. This result indicates that people are unfamiliar with these medical terms, which may imply a gap in educational interventions.

More than 50% of Chinese experience *H. pylori* infection.²⁸ In general, 24.2% of China's cancer burden is attributed to infection, of which 42% is attributed to *H. pylori* infection.²⁹ However, only 34.8% of participants in this study identified *H. pylori* infection as a risk factor of gastric cancer, and this was significantly lower compared with the rate among Koreans (58.3%).¹⁶ One of the reasons for this difference could be that Korea has national guidelines for gastric cancer screening. Further, healthcare professionals in Korea are more aware of the significance of gastric cancer knowledge, and thus provide better educational intervention.^{30 31} Another reason could be the high media exposure of *H. pylori* infection: due to the high prevalence of *H. pylori* infection, several advertisements about *H. pylori* infection are broadcast

Table 4 Gastric cancer screening perceptions among participants (n=1200)

| Question | Number | % |
|---|--------|------|
| Gastric cancer can be prevented | | |
| Yes | 1016 | 84.7 |
| No | 184 | 15.3 |
| Early gastric cancer can be cured | | |
| Yes | 1018 | 84.8 |
| No | 182 | 15.2 |
| Gastric cancer can be detected early by screening | | |
| Yes | 1006 | 83.8 |
| No | 194 | 16.2 |
| Have you ever participated in gastric cancer screening? | | |
| Yes | 182 | 15.2 |
| No | 1018 | 84.8 |
| Why do you not undergo gastric cancer screening? (multiple selections possible) (n=1018)* | | |
| No symptoms | 641 | 63.0 |
| Fear of undergoing gastroscopy | 388 | 38.1 |
| Worried about screening results | 196 | 19.3 |
| Do not know the benefits of screening | 143 | 14.0 |
| No time | 109 | 10.7 |
| Financial limitations | 92 | 9.0 |
| Which screening test for GC would you prefer? (n=1200) | | |
| Blood test | 722 | 60.2 |
| Gastroscopy | 358 | 29.8 |
| None of them | 120 | 10.0 |

*Participants who did not undergo gastric cancer screening. GC, gastric cancer.

in Korea.³¹ In our study, more than 50% of participants did not identify any warning symptoms of gastric cancer, and this rate was higher than that among Iranians.¹⁵ This result shows that poor awareness of warning symptoms is a factor contributing to the high rate of advanced-stage diagnosis of gastric cancer in Chinese patients, and indicates that these warning symptoms could be a good target for awareness-raising initiatives.⁷

Knowledge of gastric cancer differed according to sociodemographic characteristics. Similar to a previous study,³² we found that women had better gastric cancer knowledge than men. This finding may be because women tend to be family caregivers, and thus typically have more interactions with the healthcare system, and get more opportunities to learn about cancer.^{33,34} Further, we found that middle-aged and older participants were

less knowledgeable about gastric cancer than younger individuals, which can be worrying because gastric cancer often occurs in people aged older than 40 years.³⁵ This suggests that middle-aged and older adults should be the key population for gastric cancer education. Participants from rural areas, who were uneducated or had primary education only, and who worked as farmers, showed lower knowledge about gastric cancer. Studies regarding lung or colorectal cancer awareness have reported similar findings, in which the lower socioeconomic groups were less knowledgeable.^{36,37} Evidence also suggests that the lower socioeconomic groups were more likely to have later-stage cancer at diagnosis.^{38,39} McCutchan *et al* reported that fearful and fatalistic beliefs about cancer and emotional barriers were also the reasons for delay in seeking medical help in cancer patients with lower socioeconomic status.⁴⁰ Thus, when educating this group about gastric cancer, attention should also be paid on their negative beliefs about cancer.

Gastric cancer screening attitude

Participants held positive attitudes towards screening and early diagnosis of gastric cancer, implying that they were aware of the value of early diagnosis and that the screening helps gastric cancer prevention. As expected, a small percentage of participants (15.2%) had undergone gastric cancer screening at least once. In China, gastroscopy is conducted via opportunistic screening and therefore, it relies on individuals voluntarily requesting it and burdening the cost.^{20,23} The response 'No symptoms' was the most common self-reported reason for not undergoing gastric cancer screening, which is concordant with findings from a previous study,¹⁶ implying that participants mistakenly believed screening was only required when symptoms appeared. Therefore, it is necessary to educate the public regarding the indications of cancer screening.

Moreover, 'fearing of undergoing gastroscopy' was also a major barrier for participation in screening, and the expressed willingness to have a blood test was markedly higher than undergoing gastroscopy. This finding reveals that the availability of reliable blood tests for gastric cancer could be a key driver of increased screening rates. Although gastroscopy remains the gold standard for detecting gastric cancer, it has the disadvantages of being painful and costly.²¹ Serologic testing is a more convenient and cost-effective method; however, although it has been used to identify the high-risk gastric cancer population, its effectiveness needs to be further clarified.⁴¹ The development of precision medicine may lead to novel alternative methods for early detection of gastric cancer.⁴²

'Financial limitations' was not found to be a reason for not undergoing gastric cancer screening; however, multivariate analysis showed that the high-income group or those with white-collar jobs were more likely to undergo screening than the low-income group. This may be partly because gastroscopy for gastric cancer screening is not covered by Chinese health insurance. It is also possible

Table 5 Multivariate analysis of factors associated with gastric cancer screening behaviour (n=1200)

| Variable | Screened, n (%) | Not screened, n (%) | OR | 95% CI |
|---|-----------------|---------------------|-------------|----------------------|
| Occupation | | | | |
| Farmer | 59 (14.8) | 340 (85.2) | 3.66 | 1.63 to 8.19 |
| Worker | 53 (18.7) | 230 (81.3) | 3.35 | 1.42 to 7.91 |
| White collar | 62 (25.5) | 181 (74.5) | 4.88 | 2.04 to 11.72 |
| Student | 8 (2.9) | 267 (97.1) | 1 (ref) | |
| Income | | | | |
| <¥2000 (<US\$300) | 35 (6.1) | 540 (93.9) | 0.22 | 0.12 to 0.38 |
| ¥2000–5000 (US\$300–755) | 94 (20.6) | 363 (79.4) | 0.58 | 0.38 to 0.89 |
| >¥5000 (>US\$755) | 53 (31.4) | 116 (68.6) | 1 (ref) | |
| Diseases of the upper gastrointestinal tract | | | | |
| No | 104 (10.9) | 848 (89.1) | 0.23 | 0.16 to 0.34 |
| Yes | 78 (31.5) | 170 (68.5) | 1 (ref) | |

Bold figures indicate the statistically significant findings ($p < 0.05$).
CI, confidence interval; OR, odds ratio; ref, reference.

that high-income people have better health literacy, so they give more importance to cancer screening.⁴³

Taking one step forward

In Japan, a country with high gastric cancer incidence, cancer education and awareness is one of the specific initiatives of the Basic Plan to Promote Cancer Control Programs under the Cancer Control Act. This project was aimed to raise adolescent cancer awareness through cancer education courses among middle school students.⁴⁴ In China, the government has started to pay attention to public awareness about cancer. The Three Years Action Plan for Cancer Prevention and Control in China set a goal of attaining a 60% awareness rate of cancer prevention knowledge. In 2018, the China Digestive Union set 15–21 October as the gastric cancer prevention and awareness week, with the aim to popularise knowledge on gastric cancer prevention and improve awareness on screening and its benefits. However, data to evaluate the effectiveness of such interventions are lacking, and thus, this study could be used as a basis to measure the effectiveness of future public health campaigns.

Our study has shown that Chinese have low awareness regarding the risk factors and warning symptoms of gastric cancer. Further, they have some misconceptions about gastric cancer screening. There are several suggestions to improve public awareness of gastric cancer. First, the government could learn from initiatives in different countries, who used the media, such as TV, to broadcast knowledge on gastric cancer prevention.³¹ Moreover, the government should implement an organised gastric cancer screening programme and incorporate screening into insurance plans to improve people's screening behaviour.⁷ Second, health education platforms, such as through WeChat, should be set up at the hospital and community level, and this platform should be promoted

among the people. Third, health workers, especially community and oncology nurses, should be trained in raising public awareness about gastric cancer prevention. Less-known risk factors and warning symptoms found in this study need to be emphasised during education interventions. Further, more attention should be given to the lower-income population, who are at high risk for gastric cancer.⁴⁵ In this study, people with lower socioeconomic status not only had poorer knowledge, but also were less likely to be screened. Therefore, improving gastric cancer knowledge and financial subsidies for screening in this population is crucial to reduce the gastric cancer burden in China. In addition, men and the elderly should be targeted during education interventions.

Strengths and limitations

The main strength of this study is the high response rate, which could decrease the non-response bias.⁴⁶ This high response rate may be attributed to the medical centres' support, experienced interviewers, shorter survey length and a gift incentive. Further, face-to-face interview, which has the highest response rates compared with other survey methods,⁴⁶ was used in this study. However, this method inevitably cost a lot of manpower and material resources. Our study had several limitations. First, the participants' screening history was self-reported, and thus, the possibility of biases in the accuracy of recall information could not be eliminated. However, a previous study reported no significant difference in accuracy between self-reported and recorded screening history.⁴⁷ Second, sociocultural factors possibly related to knowledge and screening behaviour, such as beliefs and tradition, were not explored, because only a quantitative method was used. Moreover, the awareness of the gastric cancer risk, which is an important factor for cancer screening,⁴⁸ was not investigated. Qualitative or mixed-method studies

may be considered for a more comprehensive analysis of related factors. Third, the screening attitude was assessed under the Chinese gastric cancer screening system, which limits the generalisability of the results to other countries. However, the results of this study have valuable implications for improving gastric cancer screening systems in China and other developing countries.

CONCLUSIONS

This study indicates that people lack knowledge about the risk factors and warning symptoms of gastric cancer in China. However, the majority had a positive attitude towards the benefits of gastric cancer screening. Being asymptomatic and having fear of gastroscopy were the main self-reported reasons for not undergoing screening. Interventions should be developed to improve knowledge on gastric cancer and screening participation in China.

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