Knowledge and awareness of colorectal cancer risk factors, screening, and associated factors in advanced colorectal cancer patients: a multicenter cross-sectional study in China

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Background: Colorectal cancer (CRC) is the 3rd most common malignancy globally, and its disease burden is increasing rapidly in China. But CRC patients' knowledge and awareness of CRC have not yet been examined, which could facilitate the identification of targeted population from public for intervention.

Methods: A nationwide multicenter cross-sectional survey was conducted in 19 tertiary hospitals (10 cancer hospitals and 9 general hospitals) from March 2020 to March 2021 in China. During study period, all Stage

III and IV CRC patients were invited to complete a semi-structured survey that had been designed to collect information about their socio-demographic characteristics, and knowledge and awareness of CRC risk factors and screening. A multivariate logistic regression model was used to identify factors associated with their knowledge and awareness.

Results: In total, 4,589 advanced CRC patients were enrolled in this study, of whom, 46.2% were from tertiary cancer hospitals, and 59.5% were male. Patients had a mean age of 60.1±11.6 years. Before diagnosis, 65.1% of the patients had no related knowledge of the CRC risk factors, and 84.9% were unaware of the CRC screening-related information. Only 30.4% of patients had actively sought to acquire CRC-related knowledge before diagnosis. The 3 most common knowledge sources were relatives or friends who had been diagnosed with CRC (13.2%), popular science television/broadcast shows (12.9%), and community publicity and education (9.6%). Generally, knowledge and awareness were positively associated with better education level [odds ratios (ORs) ranged from 1.49 to 2.54, P<0.001], annual household income ranged from 50,000 Chinese Yuan (CNY) to 100,000 CNY (OR =1.32, P<0.001), being manual laborer (OR =1.25, P<0.001) and being white-collar worker (OR =1.47, P<0.001).

Conclusions: Advanced CRC patients' knowledge and awareness of CRC were severely limited before diagnosis. Thus, those who had limited knowledge and awareness should has a priority for intervention.

Keywords: Colorectal cancer; knowledge; awareness; patients

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Introduction

Colorectal cancer (CRC) ranks 3rd in cancer incidence and 2nd in cancer mortality (1), and is becoming increasingly prevalent in middle and high Human Development Index countries and young adults (2,3). In China, CRC was the 4th most common cancer, and the 5th major cause of cancer-related death in 2015 (4). In clinical practice, the majority of patients have been advanced CRC at the time of diagnosis (5), and have a poor prognosis. The 5-year survival rate is about 14% for metastatic CRC patients, a rate substantially lower than that of patients diagnosed at an earlier stage (6). Thus, it is necessary to reduce the proportion of advanced CRC patients.

Health beliefs and awareness could encourage people to develop healthy behavior habits and seek medical help in a timely manner (7). For CRC, it has been proven that health beliefs are negatively correlated with prehospital delay indicating the time interval from when the first symptom was noticed until hospital arrival, which was found to occur in 47.4% of CRC patients in clinical practice (8). At the same time, those individuals with limited knowledge and awareness about CRC screening always reported more barriers to screening (9,10), which could hinder the detection of CRC at early stage. Therefore, public's knowledge and awareness related to CRC play an important role in early CRC detection, diagnosis and treatment which could improve the prognosis of CRC.

Previous studies have evaluated public's knowledge and awareness on CRC and concluded that majority of the public had inadequate knowledge and awareness related to CRC (11-14). Considering resources was limited, it is necessary to identify the population with highest priority for education intervention. To address this issue, it is helpful to illuminate the knowledge and awareness on CRC among CRC patients before they were diagnosed with CRC. Therefore, the current study was designed to evaluate the knowledge and awareness of advanced CRC patients before diagnosis. We present the following article in accordance with the SURGE reporting checklist (available at https://atm.amegroups.com/article/view/10.21037/atm-22-1019/rc).

Methods

Study design

The current study was embedded in a nationwide, multicenter cross-sectional survey conducted in 7 geographical regions (i.e., northeastern, northern,

northwestern, eastern, central, southern, and southwestern) across China from March 2020 to March 2021, which was designed to provide a blueprint of advanced CRC patients on the knowledge and awareness, diagnosis and treatment, life-quality, medical expenditure and follow-up. Both tertiary cancer hospitals and tertiary general hospitals were selected as study centers based on multi-stage stratified sampling in each region. Ultimately, 19 hospitals were included in the current study (10 tertiary cancer hospitals and 9 tertiary general hospitals). The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the Review Board of the Henan Cancer Hospital (No. 2019273), and the study was approved by all institutional review boards of the participating hospitals. Informed consent was taken from all the patients before enrolled.

Study population

During study period, all CRC patients diagnosed with stage III and IV disease at the enrolled hospitals were invited if they were aged 18 or above.

Sample size

Due to current study was a part of a national-wide survey conducted to draw a blueprint of advanced CRC patients in China, the sample size was determined according to the number of advanced CRC patients in China.

It was estimated that there are about 400,000 advanced CRC patients in China. We sought to recruit 1% of the advanced CRC patients for the current study to ensure the sample was representative. The non-response rate was set as 10% based on previous experience; thus, it was calculated that the sample size needed to be more than 4,445. For each region, the sample size was allocated based on population density.

Survey

The survey was designed to collect the patients' socio-demographic information, and information about their knowledge and awareness of CRC risk factors, CRC screening, and their knowledge sources. In relation to the risk factors, 1 multiple-choice question asked, "Before your diagnosis, what were the risk factors for CRC in your opinion?". In relation to the CRC screening, 1 question asked, "Before your diagnosis, what were the appropriate CRC screening modalities in your opinion?". In relation to the knowledge source, 1 question asked, "From the following list, which sources did you use to acquire CRC-related knowledge?". There were 10, 6, and 10 options listed for each of the above-mentioned questions, respectively. Any chosen option was assigned a score of 1, while a score of 0 was assigned if the patients selected, "I didn't know" or "I never paid attention". Thus, the total possible scores were 9, 5, and 9 for each question, respectively.

The development of the questionnaire included design, draft, pilot testing, and optimization. Therefore, the feasibility and representation of the questionnaire could be ensured.

All qualified advanced CRC patients were invited verbally up to 3 times to take part in current research by the interviewer, and a relative was invited to participate in the interview if the patient was unable to answer the questions. The survey was filled out by an interviewer during the face-to-face interview. All the interviewers had been systematically trained before the study launched. After interview, each subject would receive a brochure related CRC prevention and control.

Statistical analysis

In the current study, the categorical variables are presented as the frequency and percentage. Group comparisons were conducted using the Chi-square test. The continuous variables are described as the mean and standard deviation (SD). Comparisons of the continuous variables between the groups were conducted using the *t*-test, or the non-parametric test.

Multivariate logistic regression was used to identify the associated factors for the knowledge and awareness on specific aspect (e.g., CRC risk factors, screening) and overall knowledge and awareness. All socio-demographic variables (e.g., age, gender, marital status, education level, occupation, permanent residence, annual household income, and relatives or friends engaged in medically related jobs) were evaluated. In the model, forward regression was used, and those variables with a P value <0.05 would enter the multivariate model. In the current study, the questionnaire was regarded as complete if more than 95% of the items had been answered, otherwise the questionnaire was regarded as partially complete. For the analyses, all the unqualified variables whose response rates were less than 95% and missing data were excluded from analyses.

All the statistical analyses were performed using SAS

Software Version 9.4 (The SAS Institute, Cary, NC, USA). All the tests were 2-tailed, and the significance level was set at $P<0.05$.

Results

Socio-demographics

In total, 4,589 advanced CRC patients were enrolled in the study. The patients had a mean age of 60.1±11.6 years. Of the advanced CRC patients, 46.2% were from tertiary cancer hospitals, and 53.8% were from tertiary general hospitals. The proportion of males was 59.5% (male-to-female-ratio: 1.5). Of the advanced CRC patients, 29.0% were either illiterate or had a primary school level of education, 32.2% had a middle school level of education, and 22.8% had a high school level of education. Of the advanced CRC patients, 39.6% were white-collar workers, and 46.3% were manual laborers. The annual household income of 85.7% of the advanced CRC patients was <100,000 Chinese Yuan (CNY), and only 14.3% earned ≥100,000 CNY.

At the time of diagnosis, 79.9% of the patients had stage III and IV CRC. Among the advanced CRC patients, the highest proportion of patients came from a 3rd-tier city or below (58.5%), followed by a 2nd-tier city (36.7%), and only 4.8% came from a 1st-tier city. The proportion of advanced colon cancer patients was 45.0%, which is lower than that for rectal cancer (53.8%). Before diagnosis, only 2.6% of the patients had undergone coloscopy (see *Table 1*). The 3 most common reasons as to why the patients had not had a coloscopy were a lack of knowledge (86.9%), fear of an uncomfortable experience (16.1%), and a lack of time (8.3%).

Knowledge and awareness

Advanced CRC patients' knowledge and awareness of the risk factors and screening options before diagnosis are summarized in *Tables 2,3*. In relation to the CRC risk factors, 65.1% of the advanced CRC patients did not have any related knowledge before diagnosis, and only 8.3% knew 4 or more of the risk factors. Patients had an average score of 0.9±1.5 in relation to their knowledge and awareness of the risk factors. Before diagnosis, the common risk factors of CRC were better known than the specific risk factors, of which, an unhealthy lifestyle was the most known risk factor (19.0%), followed by an age above 50 (17.4%), a history of bloody stool (14.6%), a personal or family history of CRC (13.4%), an unhealthy diet (12.5%), and physical inactivity (9.6%).

In relation to CRC screening, up to 84.9% of patients were unaware of the related information, and only 2.4% had a good level of knowledge of CRC screening. Similarly, the average knowledge and awareness score for screening was 0.3±0.7. In general, advanced CRC patients had a similar level of awareness of different screening strategies, which ranged from 5.5% to 8.1%.

In relation to the knowledge source, 69.6% of the patients never sought to acquire knowledge actively, and 9.5% acquired CRC-related information by the above-mentioned 3 ways. The 3 most common knowledge sources were relatives or friends diagnosed with CRC (13.2%), followed by popular science television/radio shows (12.9%), and community publicity and education (9.6%).

Knowledge and awareness associated factors

The associated factors were summarized in *Table 4*. Overall knowledge and awareness were positively associated with education [middle school: odds ratio (OR) =1.49, 95% confidence interval (CI): 1.25–1.76, high school: OR =2.05, 95% CI: 1.70–2.47, college and above: OR =2.54, 95% CI: 2.04–3.16], annual household income (50,000–100,000 CNY: OR =1.32, 95% CI: 1.14–1.54), and occupation (white-collar worker: OR =1.47, 95% CI: 1.19–1.82; manual laborer: OR =1.25, 95% CI: 1.02–1.53). Similarly, patients' knowledge and awareness of the risk factors before diagnosis were also positively associated with their education level, annual household income, and occupation, of which education level had the most significant positive effect (OR =1.43 for middle school, 1.92 for high school, and 2.42 for college and above). Patients with the following characteristics had better knowledge and awareness of CRC screening: a better education level, a higher annual household income, white-collar worker, inhabitants of cities with a better economic status, and medical professionals or relatives engaged in medically related jobs. Among these factors, education level had a larger effect (ORs ranged from 1.85 to 3.27) than the other factors (ORs ranged from 1.30 to 1.64).

Discussion

This was the first nationwide multicenter hospital-based survey conducted with advanced CRC patients to determine

Table 1 Socio-demographic and clinical characteristics of advanced CRC patients

Variables	All, n (%)	Hospital type, n (%)		P
		Cancer hospital	General hospital	
No. of patients		2,122 (46.2)	2,467 (53.8)	
Age (years, $\bar{x} \pm s$)	60.1±11.6	57.5±11.3	62.3±11.4	<0.001
<40	270 (5.9)	176 (8.3)	94 (3.8)	
40–60	1,979 (43.1)	1,069 (50.4)	910 (36.9)	
≥60	2,340 (51.0)	877 (41.3)	1,463 (59.3)	
Gender				0.316
Male	2,730 (59.5)	1,279 (60.3)	1,451 (58.8)	
Female	1,859 (40.5)	843 (39.7)	1,016 (41.2)	
Marital status				0.061
Married	4,318 (94.1)	2,012 (94.8)	2,306 (93.5)	
Other	270 (5.9)	110 (5.2)	160 (6.5)	
Education				<0.001
Primary school or below	1,330 (29.0)	530 (25.0)	800 (32.5)	
Middle school	1,478 (32.2)	685 (32.3)	793 (32.2)	
High school	1,044 (22.8)	465 (21.9)	579 (23.5)	
College and above	734 (16.0)	441 (20.8)	293 (11.9)	
Occupation				<0.001
White-collar worker[1]	1,816 (39.6)	810 (38.2)	1,006 (40.8)	
Manual laborer[2]	2,126 (46.3)	1,057 (49.8)	1,069 (43.3)	
Unemployed	646 (14.1)	254 (12.0)	392 (15.9)	
Family income (10,000 CNY)				0.053
<5	2,624 (57.4)	1,224 (58.0)	1,400 (56.8)	
5–10	1,293 (28.3)	564 (26.7)	729 (29.6)	
≥10	656 (14.3)	322 (15.3)	334 (13.6)	
Permanent residence				<0.001
1st-tier city	222 (4.8)	173 (8.2)	49 (2.0)	
2nd-tier city	1,682 (36.7)	812 (38.3)	870 (35.3)	
3rd-tier city and below	2,685 (58.5)	1,137 (53.6)	1,548 (62.8)	
Stage when diagnosed				<0.001
Stage I/II	887 (20.1)	205 (10.0)	682 (29.0)	
Stage III	1,970 (44.7)	1,015 (49.5)	955 (40.5)	
Stage IV	1,550 (35.2)	832 (40.5)	718 (30.5)	

Table 1 (*continued*)

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Variables	All, n (%)	Hospital type, n (%)		P
		Cancer hospital	General hospital	
Cancer type				<0.001
Colon cancer	2,063 (45.0)	920 (43.4)	1,143 (46.4)	
Rectal cancer	2,470 (53.8)	1,163 (54.8)	1,307 (53.0)	
Other	55 (1.2)	39 (1.8)	16 (0.6)	
Colonoscopy				0.455
Yes	121 (2.6)	60 (2.8)	61 (2.5)	
No	4,465 (97.4)	2,061 (97.2)	2,404 (97.5)	

[1], included employees of enterprises, and government institutions; [2], included service staff, blue-collar workers, and farmers. CRC, colorectal cancer; CNY, Chinese Yuan.

Table 2 Scores of knowledge and awareness toward risk factors and screening

Variables	All, n (%)	Hospital type, n (%)		P
		Cancer hospital	General hospital	
Risk factors				<0.001
0	2,985 (65.1)	1,438 (67.9)	1,547 (62.7)	
1	401 (8.8)	194 (9.2)	207 (8.4)	
2	484 (10.6)	193 (9.1)	291 (11.8)	
3	336 (7.3)	152 (7.2)	184 (7.5)	
≥4	379 (8.3)	142 (6.7)	237 (9.6)	
Average score	0.9±1.5	0.8±1.4	1.0±1.6	
Screening				0.002
0	3,876 (84.9)	1,832 (87.0)	2,044 (83.1)	
1	358 (7.9)	146 (6.9)	212 (8.6)	
2	221 (4.8)	82 (3.9)	139 (5.7)	
≥3	110 (2.4)	45 (2.1)	65 (2.6)	
Average score	0.3±0.7	0.2±0.7	0.3±0.7	
Knowledge source				<0.001
0	3,183 (69.6)	1,573 (74.5)	1,610 (65.5)	
1	539 (11.8)	264 (12.5)	275 (11.2)	
2	416 (9.1)	159 (7.5)	257 (10.5)	
3	248 (5.4)	69 (3.3)	179 (7.3)	
≥4	185 (4.1)	47 (2.2)	138 (5.6)	
Average score	0.7±1.2	0.5±1.0	0.8±1.4	

Table 3 Knowledge and awareness of CRC risk factors and screening

Variables	All, n (%)	Hospital type, n (%)		P
		Cancer hospital	General hospital	
Risk factors				
Aged 50 or above	800 (17.4)	340 (16.0)	460 (18.7)	0.02
Family history, history of polyps	615 (13.4)	191 (9.0)	424 (17.2)	<0.001
History of bloody stool	669 (14.6)	316 (14.9)	353 (14.3)	0.577
History of chronic appendicitis	116 (2.5)	36 (1.7)	80 (3.2)	0.001
History of chronic cholecystitis	74 (1.6)	26 (1.2)	48 (2.0)	0.053
Physical inactivity	439 (9.6)	203 (9.6)	236 (9.6)	1
Unhealthy lifestyle	872 (19.0)	343 (16.2)	529 (21.4)	<0.001
Unhealthy diet	575 (12.5)	261 (12.3)	314 (12.7)	0.662
Didn't know	2,985 (65.1)	1,438 (67.9)	1,547 (62.7)	<0.001
Screening strategies				
Risk assessment is necessary before colonoscopy for general population	253 (5.5)	102 (4.8)	151 (6.1)	0.052
Take fecal occult blood test every year for general population	280 (6.1)	113 (5.3)	167 (6.8)	0.042
Take colonoscopy every 5 years for general population	264 (5.8)	105 (5.0)	159 (6.5)	0.03
Take colonoscopy every year for high-risk population	373 (8.1)	145 (6.8)	228 (9.2)	0.03
Didn't know	3,876 (84.9)	1,832 (87.0)	2,044 (83.1)	<0.001
Knowledge source				
Publicity and education	439 (9.6)	83 (3.9)	356 (14.4)	<0.001
Portal website (e.g., Sina)	310 (6.8)	141 (6.6)	169 (6.9)	0.782
Medical academic website (e.g., DXY)	197 (4.3)	65 (3.1)	132 (5.4)	<0.001
Popular science television/radio show	594 (12.9)	166 (7.8)	428 (17.4)	<0.001
Social media platform (e.g., WeChat)	334 (7.3)	117 (5.5)	217 (8.8)	<0.001
Relatives or friends with CRC	605 (13.2)	260 (12.3)	345 (14.0)	0.084
Online medical service platform (e.g., good doctor)	174 (3.8)	66 (3.1)	108 (4.4)	0.025
Other patients	305 (6.7)	98 (4.6)	207 (8.4)	<0.001
Other	25 (0.5)	16 (0.8)	9 (0.4)	0.074
Never pay attention to above ways	3,183 (69.6)	1,573 (74.5)	1,610 (65.5)	<0.001

CRC, colorectal cancer; DXY, Dingxiangyuan.

their knowledge and awareness of the CRC risk factors and CRC screening before diagnosis, and the associated factors. The findings demonstrated that the majority of patients had limited knowledge and awareness of the CRC risk factors and CRC screening, of which, the majority had not acquired CRC-related knowledge actively. Generally, the advanced CRC patients had better knowledge and awareness if they had a better education, a higher annual household income,

Table 4 Associated factors of knowledge and awareness for CRC risk factors and screening

Variables	Overall		Risk factors		Screening	
	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Education						
Primary school or below	1		1		1	
Middle school	1.49 (1.25, 1.76)	<0.001	1.43 (1.21, 1.70)	<0.001	1.85 (1.44, 2.38)	<0.001
High school	2.05 (1.70, 2.47)	<0.001	1.92 (1.59, 2.32)	<0.001	2.47 (1. 90, 3.21)	<0.001
College and above	2.54 (2.04, 3.16)	<0.001	2.42 (1.94, 3.01)	<0.001	3.27 (2.47, 4.32)	<0.001
Annual household income (10,000 CNY)						
<5	1		1			
5–10	1.32 (1.14, 1.54)	<0.001	1.32 (1.14, 1.54)	<0.001		
≥10	1.13 (0.93, 1.38)	0.22	1.16 (0.95, 1.41)	0.154		
Occupation						
White-collar worker[1]	1.47 (1.19, 1.82)	<0.001	1.52 (1.23, 1.89)	<0.001	1.64 (1.20, 2.23)	0.002
Manual laborer[2]	1.25 (1.02, 1.53)	0.031	1.26 (1.03, 1.55)	0.027	1.43 (1.06, 1.94)	0.021
Unemployed	1		1		1	
Permanent residence						
1st-tier city					1.44 (1.02, 2.02)	0.038
2nd-tier city					1.30 (1.09, 1.54)	0.003
3rd-tier city or below					1	1
Engaged in medical related job (patients or relatives)						
Yes					1.34 (1.07, 1.69)	0.011
No					1	

[1], included employees of enterprises, and government institutions; [2], included service staff, blue-collar workers, and farmers. CRC, colorectal cancer; OR, odds ratio; CI, confidence interval; CNY, Chinese Yuan.

and were white-collar worker. Further, the patients had better knowledge and awareness of CRC screening if they lived in a city with a better economic status, they themselves or their relatives were engaged in medically related work, they had a higher level of education, and they were a white-collar worker.

In the current study, advanced CRC patients' knowledge and awareness of CRC risk factors before diagnosis were severely limited. Indeed, 65.1% of the patients were unaware of the CRC risk factors before diagnosis. Similar findings have also been reported in other countries and regions; for example, in Lebanon, 83% of participants were not aware of the CRC risk factors, but 56% were aware of the necessity of screenings (15). Similarly, in Pakistan, only 59.9% of college students knew the CRC risk factors (12). Awareness of the risk factors of CRC was also poor in the Caribbean territory (11), Hong Kong (16), and Jorden (17). In one study, 46% of patients attributed CRC to common risk factors, including smoking tobacco, drinking alcohol, being overweight or obese, physical inactivity, a low vegetable intake, a low fruit intake, and a high red and processed meat intake (18); however, the awareness of other risk factors, such as physical inactivity and age, were still low (19). In the present study, advanced CRC patients had relatively better awareness of the most common risk factors of CRC, such as age, an unhealthy lifestyle and diet, a family or personal history of cancer, than those diseases seemingly unrelated to CRC, such as inflammatory disease of appendix and gallbladder, which reflects the similar findings of other studies (12,13,20). The results indicate

that educators should pay more attention to less well-known risk factors than common risk factors.

Further, similar to previous studies (21,22), the majority of advanced CRC patients had severely limited knowledge and awareness of CRC screening before diagnosis. As expected, only 2.6% of the advanced CRC patients had ever undergone a colonoscopy before diagnosis in the current study, a figure substantially lower than those reported by other studies (23,24). Additionally, the effect of knowledge and awareness for CRC screening, and the lower participation rate of coloscopy were also associated with the enrolled population. Before diagnosis, advanced CRC patients were unwilling to participate in screenings because of a fear that the experience would be uncomfortable or because they had no time to do so. Thus, it is crucial to improve people's knowledge and awareness of CRC screening to promote the conversion of knowledge to practice (i.e., to the attendance of screenings). Education interventions provided by PowerPoint could be an effective way to facilitate the improve of knowledge and awareness (25,26).

In line with other studies (27-29), the associated factors of knowledge and awareness of CRC risk factors included a higher level of education, a higher annual household income, being white-collar worker, and the patient or relatives having a medically related job. However, unlike in other studies, in this study, the female patients did not have better CRC knowledge and awareness, which may be partly explained by the study population's composition. The male-to-female ratio was 1.5, which reflects the gender ratio of CRC patients in China. However, in other studies, females have comprised 50% of the participants (28,30). Nevertheless, it can be concluded that groups with a lower level of financial support and a lower level of education had deficient CRC knowledge and awareness. This may be due to limited access to knowledge or an absence of financial support. Thus, such individuals should be the primary target population for any intervention (28,30).

In relation to screening-related knowledge and awareness, the economic level of the city in which the patients lived and a patient's or a relative's engagement in a medically related job also had a positive effect. In China, the Cancer Screening Program in Urban China (CanSPUC) was launched in cities in 2012 and provide free coloscopy screenings to high-risk populations. However, CRC patients from the 1st- and 2nd-tier cities have a greater possibility of accessing these screenings than those from 3rd-tier cities or below, and this may also be affected by the factors of education and occupation. Additionally, patients with relatives engaged in medically related job have more opportunities of acquiring related knowledge, but only a positive association between relatives with medically related jobs and screenings was observed, which may need to be further validated.

The current study had some limitations. First, recall bias was inevitable, as the current study evaluated patients' knowledge and awareness of CRC risk factors and screening before diagnosis, and the data were collected by self-reporting. Second, only advanced CRC patients were included in the present study, which limits the generalizability of the findings. Third, no information on lifestyle or behavior risk factors were collected; thus, the effects of these factors on knowledge and awareness could not be evaluated.

Conclusions

Generally, knowledge and awareness of CRC risk factors and CRC screening among advanced CRC patients were poor before diagnosis and were positively affected by education, occupation, annual household income, and city tier. These findings highlight the necessity of promoting education related to CRC to the public, especially among vulnerable populations.

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Footnote

Reporting Checklist: The authors have completed the SURGE reporting checklist. Available at https://atm.amegroups.com/article/view/10.21037/atm-22-1019/rc

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Ethical Statement: The authors are accountable for all

aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the Review Board of the Henan Cancer Hospital (No. 2019273), and the study was approved by all institutional review boards of the participating hospitals. Informed consent was taken from all the patients before enrolled.

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