

Factors associated with delayed presentation among patients with liver cancer in China: a cross-sectional study

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Abstract

Approximately 70% to 80% of liver cancer patients are already at intermediate to advanced stages when they seek medical attention for the first time. This study aimed to investigate the current status of delayed presentation among liver cancer patients in China and identify factors associated with such delays. Liver cancer patients who visited a specialized oncology hospital in Guangzhou from January to December 2021 and were admitted for examination and treatment were recruited. Independent-samples t-test, one-way analysis of variance, and multiple linear regression were used to explore factors associated with consultation delay. A total of 330 questionnaires were distributed, of which 318 were validly completed, yielding a valid response rate of 96.4%. Among the 318 liver cancer patients, the median duration of delayed presentation was 1.30 months (IQR, 0.39–4.00); 93.4% of patients experienced delays exceeding 1 month, and 33.3% experienced delays exceeding three months. The main reported reasons for delayed presentation were poor economic status (34.0%), underestimation of disease severity (21.0%), and fear of diagnostic results (18.0%). Multivariable linear regression analysis showed that educational attainment was independently associated with delayed presentation. Delayed presentation remains common among patients with liver cancer, and lower educational attainment was independently associated with longer delays, highlighting the need for targeted interventions to improve health literacy and promote timely healthcare-seeking behaviors.

Keywords: Liver cancer, Delayed presentation, Educational attainment

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Introduction

Cancer remains a major public health challenge. According to the GLOBOCAN 2022 report, an estimated 20 million new cancer cases and 9.7 million cancer-related deaths occurred worldwide in 2022^[1]. Liver cancer is one of the most prevalent malignant tumors in China and globally. In China, it ranks as the second leading cause of cancer-related deaths and the second leading cause of cancer mortality among men. The 5-year survival rate of liver cancer is only 22%, second only to pancreatic cancer, which has the lowest survival rate (13%) among major cancers^[2]. In 2024, China reported 241,501 new liver cancer cases and 207,474 liver cancer-related deaths^[3]. To alleviate the increasing cancer burden in China, the National Medium- and Long-Term Plan for the Prevention and Control of Chronic Diseases (2017–2025) and the Healthy China 2030 Plan Outline have established systematic strategies for cancer prevention and control, with positive progress achieved in recent years^[4,5]. In particular, advances in cancer screening, early diagnosis, early treatment programs, and vaccination have contributed to reductions in age-standardized mortality rates for liver cancer, gastric cancer, and other gastrointestinal cancers^[6,7]. A population-based study conducted in Guangzhou also demonstrated a declining trend in the burden of liver cancer^[8].

Despite these advances in cancer prevention and control in China, the insidious onset of liver cancer results in approximately 70%–80% of patients presenting at intermediate or advanced stages when they first seek medical care^[9]. The World Health Organization (WHO) actively advocates for cancer early diagnosis initiatives and explicitly

emphasizes that at any stage of the cancer disease cycle, from patients seeking medical care, undergoing disease assessment, to finally receiving subsequent standardized treatment, different degrees of diagnosis and treatment delay may occur^[10]. Previous studies have reported that the proportion of delayed presentation among Chinese cancer patients ranges from 25.93% to 62.50%, while among liver cancer patients, it ranges from 25% to 40%^[11]. However, relatively few studies have specifically investigated the current status of delayed presentation and its associated factors among patients with liver cancer. Therefore, this study aimed to investigate the current status of delayed presentation among liver cancer patients and identify factors associated with prolonged delay duration. The findings may provide evidence for developing targeted interventions to promote earlier diagnosis and treatment.

Implications for practice

Targeted health education: Deliver tailored health education to high-risk groups to improve awareness of early liver cancer symptoms and timely screening, reducing knowledge and financial barriers.

Enhanced healthcare access: Expand low-cost rural screening clinics and streamline referral pathways, with nurses supporting patients in navigating logistical and financial obstacles.

Proactive socioeconomic-demographic assessment: Incorporate routine socioeconomic-demographic assessments (education level, residential address) into patient admission procedures to identify individuals vulnerable to care delay and facilitate targeted interventions.

Methods

Study participants

A cross-sectional study was conducted using a convenience sampling method. The participants were liver cancer patients who visited a specialized oncology hospital in Guangzhou from January to December 2021 and were admitted for examination and treatment.

Inclusion criteria: (1) liver cancer confirmed by pathological examination; (2) aged ≥ 18 years; (3) voluntary consent to participate in the study.

Exclusion criteria: (1) patients with recurrent or metastatic liver cancer; (2) patients with other concurrent cancers.

This study was conducted in accordance with the ethical principles set forth in the Declaration of Helsinki. This study was approved by the Ethics Committee of Sun Yat-sen University Cancer Center, identification number: SL-B-390-05, approval date: 26 February 2024. All participants provided written informed consent before enrollment.

Sample size calculation

The sample size was determined based on the requirements of multiple linear regression analysis. According to previous recommendations that at least 10–20 observations per predictor variable are required to obtain stable estimates and reduce the risk of overfitting, approximately 8–10 clinically relevant candidate predictors were considered for inclusion in the regression model. Assuming 15 observations per predictor variable, the minimum required sample size was estimated to be 120–150 participants. Considering a 10% rate of incomplete data, the target sample size was increased to approximately 134–167 participants.

Data collection process

Investigators who received standardized training explained the study procedures to participants using standardized language. Questionnaires were completed on-site and collected immediately after completion. The quality of responses was checked, and incomplete information was supplemented promptly when necessary. Questionnaires were completed in a quiet ward office environment to minimize external interference and ensure reliable data collection.

The survey questionnaires consisted of two components: a general information questionnaire and a medical presentation status questionnaire.

The general information questionnaire collected demographic data (gender, education level, occupation, medical insurance, place of residence), disease-related information (pathological stage, family history, awareness of own hepatitis B history, etc.), and health-related behaviors (smoking status, drinking status, physical examination history).

The medical presentation status questionnaire was developed by the research team with reference to questionnaires previously used by Wu et al.^[12,13]. This questionnaire covered information such as delay duration, status of delayed presentation, and reasons for the delay. For the question regarding the time of first symptom onset, our specific inquiry in the questionnaire was as follows: 'When did you first notice this symptom? (year/month/day, or relative time, e.g., 'about three months ago')'. In addition, to minimize recall bias, we took the following measures: First, we prioritized recording specific dates or clear time anchors that patients could recall (e.g., 'around the Spring Festival', 'after a physical examination'). Second, for uncertain time points, we performed cross-verification by cross-referencing with the first outpatient or inpatient medical records. Third, for cases where the

recalled time differed from the medical records by more than 2 weeks, we used the medical records as the reference.

The study strictly adhered to the principles of informed consent, confidentiality, and voluntariness.

Definition of delayed presentation duration

Delayed presentation duration was defined as the interval from the onset of tumor-related symptoms in patients to their first medical presentation.

Statistical analysis

Data analysis was performed using SPSS 22.0 statistical software. Continuous variables with a normal distribution were presented as mean $\pm$ standard deviation (SD). Comparisons between two groups were conducted using the independent samples t-test, while comparisons among multiple groups employed one-way analysis of variance (ANOVA). Quantitative data that did not conform to a normal distribution were expressed as median and interquartile range (M [Q1, Q3]). The Kruskal–Wallis H test was used for comparisons between groups. Categorical variables were presented as relative proportions (%). Multiple linear regression analysis was employed to explore factors associated with delayed presentation duration. $p < 0.05$ was considered statistically significant.

Results

Basic characteristics of survey participants

A total of 330 questionnaires were distributed, of which 318 valid responses were obtained, yielding a valid response rate of 96.4%. The mean age of patients was 52.79 ± 10.7 years, including 149 males (46.9%) and 169 females (53.1%). Most participants had a junior high school education (51.89%), and the predominant occupational groups were service personnel and workers (40.57%). Medical insurance coverage was mainly provided through urban employee medical insurance and the New Rural Cooperative Medical Scheme (50.00%). Among the patients, 60 had never undergone physical examinations, and only 81 had liver cancer screening included in their check-ups, as detailed in Table 1. The median delay in presentation was 1.30 months (IQR, 0.39–4.00); 93.40% experienced delays exceeding 1 month; 33.33% had delays exceeding 3 months. Delays were < 1 month in 21 cases (6.6%), $1 \text{ month} \leq \text{delay} \leq 3 \text{ months}$ in 191 cases (60.1%), $3 \text{ months} < \text{delay} \leq 6 \text{ months}$ in 75 cases (23.6%), 17 cases (5.3%) had delays of 6 to 12 months, 11 cases (3.5%) had delays of 12 to 24 months, and three cases (0.9%) had delays exceeding 24 months.

Primary reasons for delayed presentation

Table 2 presented the primary reasons for delayed presentation among liver cancer patients. Poor economic status was the most significant factor contributing to delayed presentation (34%, $n = 107$), followed by the perception that the condition was not serious (21%, $n = 66$). Fear of diagnostic results ranked as the third most common reason for delayed presentation (18%, $n = 59$), while being too busy accounted for the lowest proportion of delayed presentation among liver cancer patients (12%, $n = 37$).

Factors associated with delayed presentation

Univariate analysis revealed statistically significant differences in delayed presentation duration across educational level ($H = 11.711$,

Table 1. Baseline data of liver cancer patients.

Variables	N (%) / $\bar{x} \pm s$ / M (Q ₁ , Q ₃)
Age (years)	52.79 ± 10.7
Gender	
Male	149 (46.86%)
Female	169 (53.14%)
Educational level	
Primary school and below	36 (11.32%)
Junior high school	165 (51.89%)
Senior high school and above	117 (36.79%)
Occupations	
Government staff/technical personnel/military personnel	79 (24.84%)
Service staff and workers	129 (40.57%)
Agriculture, forestry, animal husbandry and others	110 (34.59%)
Medical insurance	
Full self-payment and others	32 (10.06%)
Employee medical insurance and commercial insurance	116 (36.48%)
Urban resident medical insurance and new rural cooperative medical insurance	159 (50.00%)
Public-funded medical insurance	11 (3.46%)
Place of residence	
City	92 (28.93%)
County town	69 (21.7%)
Township and rural area	157 (49.37%)
Pathological stage	
Stage II	38 (11.95%)
Stage III	76 (23.9%)
Stage IV	109 (34.28%)
Stage V	95 (29.87%)
Smoking status	
Non smoker	118 (37.11%)
Occasional smoker	69 (21.7%)
Regular smoker	46 (14.47%)
Former smoker	85 (26.73%)
Drinking status	
Non drinker	124 (38.99%)
Occasional drinker	90 (28.3%)
Regular drinker	25 (7.86%)
Former drinker	79 (24.84%)
Family history	
Yes	31 (9.75%)
No	287 (90.25%)
Awareness of own hepatitis B status	
Yes (aware of having hepatitis B)	210 (66.04%)
No (unaware of having hepatitis B)	108 (33.96%)
Physical examination type	
Unit-organized physical examination	61 (22.1%)
Self-initiated physical examination	215 (77.9%)
Physical examination frequency	
None	60 (18.87%)
Occasional	129 (40.57%)
Once a year	119 (37.42%)
Multiple times a year	10 (3.14%)
Inclusion of liver cancer-related items (in physical examination)	
Not included	237 (74.53%)
Included	81 (25.47%)
Presentation delay duration	1.30 (0.39, 4.00)
Presentation delay duration (months)	
< 1	21 (6.6%)
1 ≤ delay duration ≤ 3	191 (60.06%)
3 < delay duration ≤ 6	75 (23.58%)
6 < delay duration ≤ 12	17 (5.35%)
12 < delay duration ≤ 24	11 (3.46%)
> 24	3 (0.94%)

Table 2. Causes of presentation delay.

Causes of presentation delay	Number of cases	Percentage
Poor economic status	107	34%
Insidious symptoms (e.g., abdominal distension, abdominal pain) with insufficient attention	49	15%
Perception that the condition was not serious	66	21%
Being too busy	37	12%
Fear of diagnostic results	59	18%

$p = 0.003$) and place of residence ($H = 11.005$, $p = 0.004$) (Table 3). As a socioeconomic indicator, occupation may influence patients' health awareness, access to healthcare, working arrangements, and health-seeking behaviors, making it a potential confounder related to delayed presentation. Furthermore, the omnibus test demonstrated that occupation was statistically associated with the outcome ($F = 5.819$, $p = 0.050$). Accordingly, occupation was additionally incorporated into the multivariable regression model as a categorical independent variable. Multivariable linear regression analysis (Table 4) showed that educational level was significantly associated with delayed presentation. Compared with patients with primary school education or below, patients with junior high school education ($\beta = -3.067$, standardized $\beta = -0.381$, $p < 0.001$) and those with senior high school education and above ($\beta = -3.822$, standardized $\beta = -0.459$, $p < 0.001$) had shorter delayed presentation time.

Discussion

Delayed presentation remains a major challenge in the management of liver cancer, potentially limiting opportunities for early diagnosis and curative treatment. In this study, we found that delayed presentation was common among liver cancer patients, with more than 90% of patients experiencing delays exceeding one month and approximately one-third experiencing delays longer than three months. Financial constraints, underestimation of disease severity, and fear of diagnostic results were the leading reasons for delayed presentation. Furthermore, educational level was independently associated with delayed presentation, with higher educational attainment associated with shorter delay duration. These findings highlight the important role of educational attainment in delayed presentation, while the reported financial barriers further indicate the need for interventions aimed at improving health literacy and reducing barriers to timely diagnosis.

The proportion of delayed presentation observed in our cohort appeared relatively high compared with previous reports from other countries. A study conducted in northern Tanzania reported that 78% of patients experienced delays exceeding 1 month, whereas studies from Malaysia and Indonesia reported proportions of 54.2% and 42.9%, respectively^[14–16]. These differences may reflect variations in healthcare systems, socioeconomic conditions, cancer awareness, and study populations. Although China has achieved broad coverage of basic medical insurance, financial barriers, concerns regarding treatment affordability, and insufficient awareness of early liver cancer detection may continue to influence healthcare-seeking behaviors. In comparison, some countries have implemented targeted strategies to reduce diagnostic barriers. For example, Malaysia provides free abdominal ultrasound and alpha-fetoprotein testing for hepatitis B virus carriers within its public healthcare system, while Indonesia's national health insurance program covers liver cancer diagnostic examinations for eligible individuals^[17,18]. Overall, delayed

Table 3. Presentation delay duration in liver cancer patients with different baseline characteristics.

Characteristic	Number of cases	Duration of delay in presentation (months, median [IQR])	H value	p
Gender			0.005	0.946
Male	149	1.10 (0.43, 3.40)		
Female	169	1.57 (0.32, 4.10)		
Educational level			11.711	0.003
Primary school and below	36	3.12 (0.93, 8.89)		
Junior high school	165	1.77 (0.43, 3.88)		
Senior high school and above	117	1.03 (0.30, 3.13)		
Occupations			5.819	0.050
Government staff/technical personnel/military personnel	79	1.03 (0.17, 3.97)		
Service staff and workers	129	1.27 (0.37, 3.05)		
Agriculture, forestry, animal husbandry and others	110	1.82 (0.59, 4.11)		
Medical insurance			2.772	0.428
Full self-payment and others	32	1.03 (0.38, 4.89)		
Employee medical insurance and commercial insurance	116	1.53 (0.43, 4.19)		
Urban resident medical insurance and new rural cooperative medical insurance	159	1.13 (0.33, 3.20)		
Publicly funded medical insurance	11	4.00 (1.03, 4.13)		
Place of residence			11.005	0.004
City	92	1.00 (0.18, 3.00)		
County town	69	1.03 (0.40, 3.33)		
Township and rural area	157	1.93 (0.67, 4.17)		
Pathological stage			4.016	0.119
Stage II	38	0.73 (0.19, 3.58)		
Stage III	76	1.92 (0.43, 3.73)		
Stage IV	109	1.60 (0.42, 4.10)		
Stage V	95	1.50 (0.50, 4.30)		
Smoking status			4.940	0.176
Non smoker	118	1.18 (0.43, 4.08)		
Occasional smoker	69	1.60 (0.43, 3.83)		
Regular smoker	46	2.13 (0.43, 4.42)		
Former smoker	85	1.03 (0.32, 3.00)		
Drinking status			4.063	0.255
Non drinker	124	1.03 (0.41, 3.12)		
Occasional drinker	90	1.73 (0.33, 4.31)		
Regular drinker	25	2.50 (1.02, 4.32)		
Former drinker	79	1.33 (0.33, 3.73)		
Family history			1.722	0.189
Yes	31	1.03 (0.17, 2.77)		
No	287	1.37 (0.43, 4.00)		
Awareness of own hepatitis B status			0.017	0.897
Yes (aware of having hepatitis B)	210	1.63 (0.39, 3.87)		
No (unaware of having hepatitis B)	108	1.03 (0.38, 4.10)		

presentation is a common challenge in cancer diagnosis and treatment globally: targeted intervention strategies to reduce delayed presentation need to be developed based on factors such as health awareness, medical resources, and socioeconomic conditions in different regions.

Consistent with previous studies, socioeconomic barriers and health literacy-related factors may contribute to delayed presentation^[19,20]. In

our study, poor economic status was the most frequently reported reason for delay, suggesting that financial concerns remain an important barrier to timely medical consultation. In addition, lower educational attainment was independently associated with longer delayed presentation duration. After adjustment for covariates, patients with junior high school education and those with senior high school education or above exhibited mean delays that were approximately 3.1 months and 3.8 months shorter, respectively, compared with patients with primary school education or below. A study among cancer patients in India also identified lower educational attainment as an important factor associated with delayed presentation^[21]. According to the Health Belief Model, patients with low educational levels may ignore early symptoms due to insufficient perception of disease severity or low self-efficacy^[22]. Furthermore, higher educational attainment is often associated with greater health literacy, better recognition of cancer-related symptoms, and improved ability to access and utilize healthcare resources^[23]. In contrast, individuals with lower education levels may underestimate symptom severity or experience difficulties navigating healthcare services, thereby contributing to prolonged diagnostic delays. These findings highlight the importance of targeted health education interventions for populations with lower educational attainment to promote earlier healthcare-seeking behaviors.

These findings highlight the importance of addressing socioeconomic and health literacy-related barriers to reduce delayed presentation among liver cancer patients. Targeted health education and improved access to healthcare services, particularly for individuals with lower educational attainment, may contribute to earlier medical consultation and diagnosis. Further studies are needed to evaluate effective interventions for reducing presentation delays.

This study has several limitations. First, the cross-sectional design prevents causal inference between socioeconomic factors and delayed presentation. Second, the reasons for delayed presentation were collected through patient self-report and may have been affected by recall bias. Third, this study was conducted at a single center, which may limit the generalizability of the findings to other regions. Future multicenter prospective studies are needed to further explore the mechanisms underlying delayed presentation and evaluate effective interventions to promote earlier diagnosis.

Conclusions

Delayed presentation remains prevalent among patients with liver cancer. Lower educational attainment was independently associated with longer diagnostic delays, highlighting the importance of targeted health education and strategies to promote timely healthcare-seeking behaviors, especially among populations with limited educational backgrounds.

Ethical statements

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. This study was approved by the Ethics Committee of Sun Yat-sen University Cancer Center (No. SL-B-390-05), and all participants provided written informed consent before enrollment.

Author contributions

All authors have made substantial contributions to this study and meet the authorship criteria defined by the International Committee of Medical Journal Editors (ICMJE). He Fengying took charge of

Table 4. Multiple linear regression analysis of the factors possibly associated with delayed presentation in liver cancer patients.

Independent variable	β	Standard error (SE)	Standardized regression coefficient	t-value	p
Constant	4.940	0.847	–	5.830	< 0.001
Educational level (with 'primary school or below' as the reference)	–	–	–	–	–
Junior high school	–3.067	0.710	–0.381	–4.321	< 0.001
Senior high school and above	–3.822	0.738	–0.459	–5.810	< 0.001
Occupations (with 'government staff/technical personnel/military personnel' as the reference)	–	–	–	–	–
Service staff and workers	–0.083	0.546	–0.010	–0.151	0.880
Agriculture, forestry, animal husbandry and others	0.930	0.579	0.110	1.604	0.110
Place of residence (with 'city' as the reference)	–	–	–	–	–
County town	–0.004	0.615	0.001	–0.006	0.995
Township and rural area	0.979	0.516	0.122	1.898	0.059

drafting the original manuscript, developing the study methodology, and conducting data analysis. Kang Yongjiao was responsible for reviewing and revising the manuscript, as well as overseeing data collection, data curation, and result visualization. Liu Na contributed to reviewing and revising the manuscript, led the study design, provided necessary resources, and supervised the overall implementation and management of the project. All authors have read and approved the final version of the manuscript.

Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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