

# Clinical Knowledge, Perceptions, and Communication Confidence Regarding the Development of Thyroid Cancer —A Cross-Sectional Study of Clinical Medical Students in Chongqing, Southwest China

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**Purpose:** Medical students play an essential role in providing disease consultation for patients. Despite the rapid increase in thyroid disease, there are few data on how well Chinese medical students master the knowledge of thyroid diseases. This study aims to evaluate the clinical knowledge, perception, and clinical communication confidence of medical students on thyroid cancer (TC).

**Patients and Methods:** This cross-sectional study was carried out among medical students of Chongqing Medical University. An anonymous, self-administered questionnaire distributed from December 2022 to February 2023 included items on demographics and other information, the warning signs of cancer, perception regarding a person's chance of developing cancer, and clinical communication confidence. Descriptive analysis, difference analysis, and correlation analysis were carried out.

**Results:** A total of 226 medical students participated in the survey. Most students (n=191, 84.5%) had heard of TC, while only a few (n=10, 4.4%) regularly performed thyroid self-examination. One hundred and eighty-four students (81.4%) agreed that an unexplained lump or swelling could be a sign of cancer. There were significant differences in thyroid clinical knowledge in relation to gender (P<0.001), major (P=0.026), and thyroid disease (P=0.030). Clinical communication confidence showed significant differences in year of study (P=0.002), major (P=0.048), and graduate major (P<0.001). There was a correlation between clinical confidence and year of study (r=0.261, P<0.001).

**Conclusion:** Most medical students have sufficient clinical knowledge on TC prevention, but there are still misconceptions related to TC screening. In addition, medical students lack confidence in communicating with patients. Comprehensive communication training should be integrated into the medical curriculum and clinical activities should be initiated earlier.

**Keywords:** thyroid cancer, cancer warning signs, clinical communication confidence, communication skills training, medical students

## Introduction

The thyroid is the body's largest endocrine gland, and secretes hormones involved in metabolism. Thyroid disease is a common clinical disease, with thyroid cancer (TC) being the most severe. TC is the most common malignant tumor in the endocrine system.<sup>1</sup> The International Agency for Research on Cancer estimated 567,000 new cases and 41,000 deaths worldwide in 2020.<sup>1</sup> Although TC has a relatively good prognosis compared to other malignancies, its incidence has been steadily increasing in many parts of the world, particularly in high-income countries.<sup>2</sup> In America, it is estimated that it will be the second leading cancer diagnosis in women in 2030.<sup>3</sup> Previous data have shown that the prevalence of TC is

generally high in Asian countries, especially in South Korea, China, and other regions.<sup>4</sup> From 2000 to 2016, the prevalence of TC among Chinese women increased year by year.<sup>5</sup> The increasing incidence of TC has been attributed to the widespread use of imaging techniques such as ultrasound, which has led to the detection of small, indolent thyroid nodules that may not have been diagnosed in the past.<sup>6</sup>

There are multiple risk factors for TC. Exposure to ionizing radiation is a well-established risk factor for TC.<sup>7</sup> As future doctors, clinical medical students may be exposed to radiation from medical instruments in the medical environment. Therefore, evaluating their knowledge of the risk factors, symptoms, and signs of thyroid disease can help to inform regarding the progress of the disease.

As the leading role in the medical diagnosis and treatment process, doctors play an important role in providing assistance and treatment plans for patients. Previous studies have shown that more engagement in emotional exchanges can lead to better patient prognosis and satisfaction.<sup>8</sup> At present, communication skills training (CST) has been internationally recognized as an important component of medical education, which is reflected in the clinical process. A 2021 report among doctors in China showed that they are pessimistic about the doctor-patient relationship and there are obstacles in doctor-patient communication.<sup>9</sup> Compared with other developed countries, China's medical higher education is relatively backward. In addition, in the field of medical education, the curriculum system and curriculum development of communication skills in Chinese medical schools are not ideal, which can be attributed to the neglect of training in doctor-patient communication skills.<sup>10</sup> Thus, it is necessary to improve the communication ability of medical students.

At present, the investigation of thyroid diseases in China is mainly aimed at the public, while research on the cognition and communication confidence of medical students on thyroid diseases is lacking. Also, the quality of self-made questionnaires in existing studies has not been assessed.<sup>11</sup> In this study, a professional scale was used to measure clinical medical students' knowledge of TC and to assess their current or future confidence in doctor-patient communication.

## Research Questions

How well do medical students master the knowledge of TC?

Do medical students feel confident enough to communicate with patients?

Are there differences among different medical students in TC knowledge and clinical communication confidence?

## Methods

### Setting and Participants

This cross-sectional study involved an anonymous questionnaire survey that lasted for three months from December 2022 to February 2023. The subjects included undergraduate and graduate students in clinical medicine and non-clinical medical students (including nursing, laboratory medicine, imaging medicine, and other medical majors) from Chongqing Medical University. Undergraduate clinical medicine students in mainland China need to study for five years to obtain a bachelor's degree. They spend the first four years of academic study in school and the fifth year in hospital clinical practice. Clinical graduate students need three years of standardized residency training to obtain a master's degree, and they must choose an interested department as their research direction during the master's degree period.<sup>12,13</sup> All undergraduate and graduate students have their communication group, where online questionnaires are distributed and students are asked to complete them voluntarily. Participants need to complete all the questions before submitting the questionnaire to ensure a 100% completion rate, and the questionnaire cannot be added to after submission. Participants provided informed consent before completing the questionnaire.

The required sample size for this study was calculated by the Rao soft sample size calculator (<http://www.raosoft.com/samplesize.html>) with a 95% confidence level, a pre-determined margin of error of 5%, and a 50% response distribution. We calculated a sample size of 306 students, and as the questionnaire was completed voluntarily, a total of only 226 students finally participated.

### Survey Questionnaire

Parts of the questionnaire are shown in [Figure 1](#). This questionnaire was based on early similar research,<sup>8,14,15</sup> and adjusted according to our research purposes. Cancer Awareness Measure Scale (CAM) was cited in the questionnaire to evaluate the

Part II The following may or may not be warning signs for cancer. Do you think these are warning sign for cancer?					
	Yes	No	Don't know		
an unexplained lump or swelling could be a sign of cancer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
persistent unexplained pain could be a sign of cancer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
unexplained bleeding could be a sign of cancer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
a persistent cough or hoarseness could be a sign of cancer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
a persistent change in bowel or bladder habits could be a sign of cancer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
persistent difficulty swallowing could be a sign of cancer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
a change in the appearance of a mole could be a sign of cancer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
a sore that does not heal could be a sign of cancer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
unexplained weight loss could be a sign of cancer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Part III These are some of the things that can increase a person's chance of developing cancer. How much do you agree that each of these can increase a person's chance of developing cancer?					
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Smoking any cigarettes at all	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Exposure to another person's cigarette smoke	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drinking more than 1 unit of alcohol a day	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Eating less than 5 portions of fruit and vegetables a day	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Eating red or processed meat once a day or more	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Being overweight (BMI over 25)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Getting sunburnt more than once as a child	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Being over 70 years old	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Having a close relative with cancer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Infection with HPV (Human Papillomavirus)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Doing less than 30 mins of moderate physical activity 5 times a week	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Part IV The following questions relate to clinical communication. How much do you agree with these opinion?					
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I know how to perform thyroid cancer screening for patients	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I can skillfully consult or palpate to understand the patient's condition	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
My current knowledge is sufficient to provide consultation for patients	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I can visually introduce patients to thyroid disease related knowledge	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I can provide treatment plans for patients based on their condition	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 1 Medical students' clinical knowledge, perceptions, and communication confidence questionnaire on thyroid cancer.

degree of medical students' knowledge on cancer. We used Physician Confidence in the Medical Interview Scale (PCMI) to measure medical students' confidence in communicating with patients. The first draft of the questionnaire was reviewed by experts; then, 37 medical students were randomly selected to conduct semi-structured interviews and complete a pre-survey questionnaire. Based on the pre-survey data, reliability analysis was conducted on the questions included in the questionnaire to evaluate the reliability of the scale items. We prepared a formal questionnaire according to the preliminary survey and interview results. The formal questionnaire consisted of four parts, I: Demographic and other information; II: The warning signs of cancer; III: Perception regarding a person's chance of developing cancer; IV: Clinical communication confidence. We stipulated that pre-survey data were not included in the formal survey.

Part I: Demographic information included the age, gender, major, year of study, and thyroid status of the respondents. Other information also included the awareness and clinical information of TC.

Part II: This part asked participants: "The following may or may not be warning signs for cancer. Do you think X is a warning sign for cancer?" It lists nine possible signs of cancer. These questions were designed to measure how many warning signs a respondent could recognize when prompted. The options were yes, no, or do not know. The correct answer to this question was that all of the warning signs and symptoms listed could be warning signs of cancer.

Part III: Similar to Part II, the students were asked "These are some of things that can increase a person's chance of developing cancer. How much do you agree that each of these can increase a person's chance of developing cancer?" Eleven questions related to cancer risk were then listed. These closed questions were designed to measure a respondent's level of agreement with the 11 risk factors. The correct answer to this question was that all of the risk factors listed could increase the chance of developing cancer.

Part IV: The last part of the questionnaire was related to medical students' current confidence in clinical communication, which is subjective and has no correct answer.

The options for the second part of the questionnaire were as follows: Yes, No, and Do not Know. The knowledge score for warning signs of cancer was calculated for each item by allocating "one" to the correct answer and "zero" to the wrong answer. A five-point Likert scale was used for the third and fourth parts of the questionnaire, which ranged from 1 = strongly disagree to 5 = strongly agree. Then, Part II and Part III scores were added together as an evaluation of the knowledge of TC, which ranged from 11 to 64. Similarly, the clinical communication confidence score in Part IV ranged from 5 to 25.

## Data Analysis

An online questionnaire platform was used to distribute questionnaires and collect information. The online questionnaire was imported into Excel, and the data were imported into SPSS for statistical analysis. Cronbach's alpha coefficients were calculated to examine the internal consistency of the scale. Descriptive statistical analysis was carried out using frequencies and percentages (Including demographic information and TC knowledge). To verify the hypothesis, the Mann-Whitney test, Kruskal-Wallis test and bivariate linear correlation analysis were used with the correlation coefficient and P value. The test level was  $\alpha = 0.05$  in all statistical tests.

## Ethical Consideration

This study was conducted according to the ethical guidelines of the Helsinki Declaration. The First Affiliated Hospital of Chongqing Medical University ethics committee ethically approved the study protocol (Approval No: K2023-165). As the survey was conducted anonymously, written informed consent was not necessary.

## Results

### Reliability Analysis

The Cronbach alpha of the total scale was 0.749, and the Cronbach alpha of each dimension was between 0.784 and 0.955, indicating that the scale had good reliability and high internal consistency among items.

#### Demographic and other information

The mean age of the 226 participants was 21.5, ranging from 17 to 28 years, with 150 (66.4%) females, and 76 (33.6%) males. One hundred and seventy (75.2%) were undergraduate (Year 1 to Year 5), and 56 (24.8%) were master

(Year 6 to Year 8). One hundred and seventy (75.2%) were clinical medicine students, and 56 (24.8%) were non-clinical medicine students. Of the 56 graduate students, 16 (7.1%) majored in thyroid disease research. Forty-four (19.5%) indicated that they or their relatives had thyroid disease.

Most (n=191, 84.5%) had heard of TC, while only a few (n=10, 4.4%) regularly performed thyroid self-examination. When asked where they obtained their knowledge of the thyroid (Figure 2), most of them (n=153, 67.7%) thought it was from medical college courses, nearly half of them (n=109, 48.2%) chose the media, followed by consult books and articles (n=65, 28.8%), and others had suffered from thyroid disease (n=53, 23.5%). Eighty-one (35.8%) thought biopsy was the most common diagnostic method for screening TC when examining a thyroid nodule, while others did not know (n=71, 31.4%), followed by thyroid ultrasonography (n=59, 26.1%), computed tomography (n=9, 4.0%), and magnetic resonance imaging (n=6, 2.7%), (Table 1).

Table 2 describes participants' attitudes toward cancer symptoms and signs. Most students agreed that these signs were related to cancer. One hundred and eighty-four (81.4%) agreed that an unexplained lump or swelling could be a sign of cancer.

The participants' attitudes regarding cancer risk are shown in Table 3. The results indicated that they were more inclined towards a supportive attitude. The majority of students agreed that smoking (85.9%) and exposure to smoke (83.2%) can cause cancer. More than two-thirds (76.6%) believed that drinking more than 1 unit of alcohol a day can increase a person's chance of developing cancer. Approximately 65.9% agreed that being overweight (BMI over 25) can increase the risk of cancer and 56.6% agreed that sunburn more than once as a child can cause cancer. Furthermore, more than half of the students agreed being over 70 years old (73.9%), having a close relative with cancer (75.2%), and infection with HPV (Human Papillomavirus) (62.8%) may also increase the likelihood of developing cancer.

However, less than half of the students agreed that other behaviors increase cancer risk. 38.9% believed eating less than 5 portions of fruit and vegetables a day can cause cancer while eating red or processed meat once a day or more will increase the risk of cancer. Similarly, 36.5% of the students thought that doing less than 30 mins of moderate physical activity 5 times a week was a risk factor.

The scores based on demographic information are summarized in Table 4. The average score for participants' knowledge was 47.07. There were significant differences in TC knowledge scores in terms of gender ( $P<0.001$ ), major ( $P=0.026$ ), and thyroid disease ( $P=0.030$ ), while there were no significant differences in years of study ( $P=0.223$ ), and graduate major ( $P=0.159$ ). The mean clinical communication confidence score was 12.85. Clinical communication

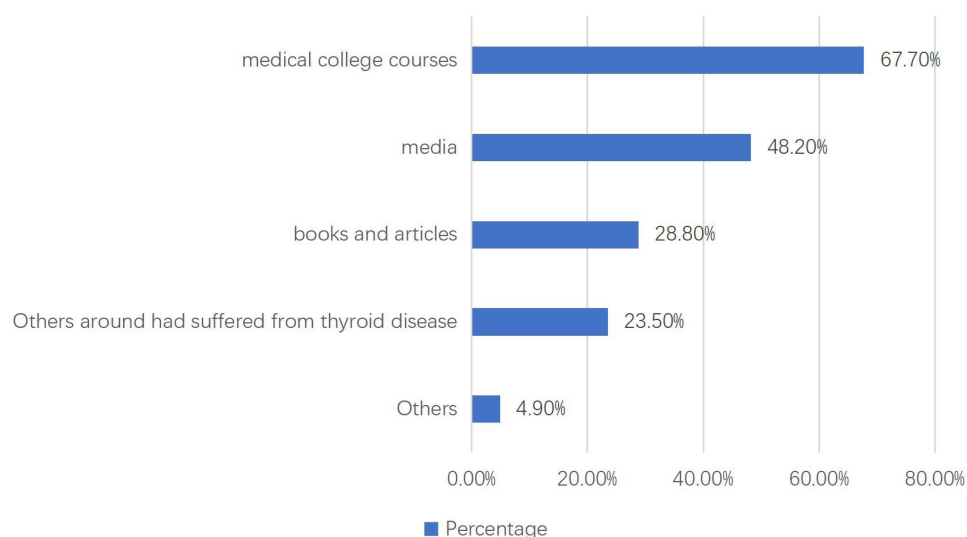


Figure 2 Sources of thyroid knowledge for medical students.

**Table 1** Demographic and Other Information (N=226)

Characteristic	Description	N (%)
Gender	Female	150 (66.4%)
	Male	76 (33.6%)
Years of study	Year 1	38 (16.8%)
	Year 2	31 (13.7%)
	Year 3	37 (16.4%)
	Year 4	41 (18.1%)
	Year 5	23 (10.2%)
	Year 6	24 (10.6%)
	Year 7	15 (6.6%)
	Year 8	17 (7.5%)
Major	Clinical medicine	170 (75.2%)
	Non-clinical medicine	56 (24.8%)
Department of graduate students	Thyroid surgery	16 (7.1%)
	Non-thyroid surgery	40 (17.7%)
Others around had suffered from thyroid disease	Yes	44 (19.5%)
	No	182 (80.5%)
Have you ever heard of TC	Yes	191 (84.5%)
	No	35 (15.5%)
Whether to perform thyroid self-examination regularly	Yes	10 (4.4%)
	Used to check, but not often	49 (21.7%)
	No	167 (73.9%)
Sources of thyroid knowledge	Medical college courses	153 (67.7%)
	Media	109 (48.2%)
	Books and articles	65 (28.8%)
	Others around had suffered from thyroid disease	53 (23.5%)
	Others	11 (4.9%)
The most common diagnostic methods for screening TC when touching thyroid nodules	Biopsy	81 (35.8%)
	Computed Tomography	9 (4.0%)
	Ultrasonography	59 (26.1%)
	Magnetic Resonance Imaging	6 (2.7%)
	Do not know	71 (31.4%)

**Table 2** Clinical Medical Students' Knowledge Regarding Warning Signs of Cancer (N=226)

Knowledge Regarding Warning Signs for Cancer	Yes	No	Do not Know
An unexplained lump or swelling could be a sign of cancer	184 (81.4%)	27 (11.9%)	15 (6.6%)
Persistent unexplained pain could be a sign of cancer	172 (76.1%)	32 (14.2%)	22 (9.7%)
Unexplained bleeding could be a sign of cancer	176 (77.9%)	25 (11.1%)	25 (11.1%)
A persistent cough or hoarseness could be a sign of cancer	152 (67.3%)	39 (17.3%)	35 (15.5%)
A persistent change in bowel or bladder habits could be a sign of cancer	139 (61.5%)	44 (19.5%)	43 (19.0%)
Persistent difficulty swallowing could be a sign of cancer	173 (76.5%)	29 (12.8%)	24 (10.6%)
A change in the appearance of a mole could be a sign of cancer	165 (73.0%)	30 (13.3%)	31 (13.7%)
A sore that does not heal could be a sign of cancer	148 (65.5%)	36 (15.9%)	42 (18.6%)
Unexplained weight loss could be a sign of cancer	180 (79.6%)	24 (10.6%)	22 (9.7%)

confidence showed significant differences in years of study (P=0.002), major (P=0.048), and graduate major (P<0.001), and clinical confidence was correlated with years of study (r=0.261, P<0.001). There was no significant difference in gender (P=0.118) and thyroid disease (P=0.694).

**Table 3** Clinical Medical Students' Perception Regarding a Person's Chance of Developing Cancer

Variables	Mean $\pm$ std	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Smoking any cigarettes at all	4.17 $\pm$ 0.87	5 (2.2%)	6 (2.7%)	21 (9.3%)	108 (47.8%)	86 (38.1%)
Exposure to another person's cigarette smoke	4.10 $\pm$ 0.92	4 (1.8%)	13 (5.8%)	21 (9.3%)	106 (46.9%)	82 (36.3%)
Drinking more than 1 unit of alcohol a day	3.98 $\pm$ 0.96	4 (1.8%)	6 (2.7%)	43 (19.0%)	110 (48.7%)	63 (27.9%)
Eating less than 5 portions of fruit and vegetables a day	3.19 $\pm$ 1.11	15 (6.6%)	45 (19.9%)	78 (34.5%)	57 (25.2%)	31 (13.7%)
Eating red or processed meat once a day or more	3.28 $\pm$ 1.01	12 (5.3%)	29 (12.8%)	95 (42.0%)	63 (27.9%)	27 (11.9%)
Being overweight (BMI over 25)	3.71 $\pm$ 0.89	5 (2.2%)	15 (6.6%)	57 (25.2%)	113 (50%)	36 (15.9%)
Getting sunburnt more than once as a child	3.57 $\pm$ 0.92	7 (3.1%)	16 (7.1%)	75 (33.2%)	97 (42.9%)	31 (13.7%)
Being over 70 years old	3.85 $\pm$ 0.89	4 (1.8%)	15 (6.6%)	40 (17.7%)	119 (52.7%)	48 (21.2%)
Having a close relative with cancer	3.88 $\pm$ 0.94	7 (3.1%)	12 (5.3%)	37 (16.4%)	115 (50.9%)	55 (24.3%)
Infection with HPV (Human Papillomavirus)	3.72 $\pm$ 0.97	6 (2.7%)	16 (7.1%)	62 (27.4%)	94 (41.6%)	48 (21.2%)
Doing less than 30 mins of moderate physical activity 5 times a week	3.02 $\pm$ 1.15	23 (10.2%)	54 (23.9%)	67 (29.6%)	59 (26.1%)	23 (10.2%)

**Table 4** Association Between the Students' Knowledge and Clinical Communication Confidence Score Levels and Demographics

		Score $\pm$ std <sup>a</sup>	P-value	Score $\pm$ std <sup>b</sup>	P-value
Characteristic	All People	47.07 $\pm$ 8.69		12.85 $\pm$ 5.27	
Gender	Female	48.73 $\pm$ 7.62	<0.001 <sup>c</sup>	12.56 $\pm$ 5.46	0.118 <sup>c</sup>
	Male	43.78 $\pm$ 9.73		13.42 $\pm$ 4.88	
Years of study	Year 1	47.45 $\pm$ 1.00	0.223 <sup>d</sup>	10.24 $\pm$ 5.47	0.002 <sup>d</sup>
	Year 2	44.10 $\pm$ 7.78		11.61 $\pm$ 4.72	
	Year 3	48.32 $\pm$ 9.80		12.41 $\pm$ 5.28	
	Year 4	46.78 $\pm$ 7.40		13.98 $\pm$ 4.67	
	Year 5	48.96 $\pm$ 6.51		13.91 $\pm$ 3.63	
	Year 6	46.13 $\pm$ 9.47		14.63 $\pm$ 6.41	
	Year 7	47.27 $\pm$ 9.94		12.60 $\pm$ 4.15	
	Year 8	48.18 $\pm$ 7.80		15.47 $\pm$ 5.84	
Major	Clinical medicine	47.76 $\pm$ 8.59	0.026 <sup>c</sup>	13.24 $\pm$ 5.25	0.048 <sup>c</sup>
	Non-clinical medicine	44.95 $\pm$ 8.72		11.64 $\pm$ 5.20	
Postgraduate major	Thyroid surgery	49.44 $\pm$ 9.37	0.159 <sup>c</sup>	20.50 $\pm$ 4.00	<0.001 <sup>c</sup>
	Non-thyroid surgery	46.1 $\pm$ 8.79		11.88 $\pm$ 4.27	
Whether they or their relatives have thyroid disease	Yes	49.32 $\pm$ 9.44	0.030 <sup>c</sup>	13.43 $\pm$ 6.14	0.694 <sup>c</sup>
	No	46.52 $\pm$ 8.43		12.71 $\pm$ 5.05	

Notes: <sup>a</sup>Means that cancer knowledge score of different groups. <sup>b</sup>Means the communication confidence score of different groups. <sup>c</sup>Analyze group differences and refer to the Mann-Whitney Test. <sup>d</sup>Analyze group differences on different grades and refer to the Kruskal-Wallis Test.

To verify our hypothesis, we calculated the correlation between TC knowledge, clinical communication confidence and years of study (Table 5).

## Discussion

TC, as an endocrine system tumor, has gradually received attention from the public due to a rise in incidence. We conducted our study at a Chinese Medical University. This appears to be the first time a professional scale has been used to evaluate the knowledge of TC among Chinese medical students. In addition, it also assessed students' confidence in communicating with patients. The research results indicate that the majority of participants have comprehensive

**Table 5** The Correlation Between Thyroid Cancer Knowledge, Clinical Communication Confidence and Years of Study

	r	P value*
Thyroid cancer knowledge	0.042	0.526
Clinical communication confidence	0.264	<0.001

**Note:** \*Linear correlation analysis.

prevention knowledge on TC, but lack correct awareness of thyroid screening. Furthermore, it is worth noting that a lack of clinical communication confidence among medical students seems to be common.

Although this study shows that most of the participants had a good knowledge level of TC, few of them (4.4%) regularly performed thyroid self-examination. We do not recommend thyroid testing for other populations. However, due to their profession, medical students need to know the screening process. In this survey, 84.5% of participants knew about TC, and the majority (67.7%) of them learned about thyroid disease through medical courses. This demonstrated the importance of theoretical teaching in medical education. Unexpectedly, quite a few students (35.8%) thought biopsy was the most common diagnostic method for screening TC when examining thyroid nodules, while others (26.1%) chose thyroid ultrasonography. The accuracy was lower than that in the survey in both Saudi Arabia and China.<sup>11,15</sup> This shows that medical students lack knowledge regarding TC screening.

Encouragingly, most of the participants had good knowledge on cancer prevention, and quite a few medical students could identify the typical symptoms of TC, such as neck lump (81.4%), hoarseness (67.3%), and difficulty swallowing (76.5%). These results are much higher than those of a study carried out in Saudi Arabia, which reported that an unexplained lump or swelling (65.24%), a persistent cough or hoarseness (43.97%), and persistent difficulty in swallowing (54.6%) as the early signs of TC.<sup>15</sup> Consistent with previous studies, most believed that smoking or exposure to second-hand smoke increases the risk of TC.<sup>15</sup> It is easy to agree that smoking is a major risk factor for various types of cancer and a poor prognosis, but a recent cohort study showed that current smoking was associated with a reduced risk of TC in Korean men.<sup>16</sup> In addition, there is evidence that smoking leads to higher levels of thyroid hormones, which causes the development of hyperthyroidism or other thyroid diseases.<sup>17</sup> Although this is a controversial topic, we cannot deny that smoking cessation has more benefits overall.

Similar to other studies, our investigation found that females have significantly higher TC knowledge scores.<sup>15</sup> Studies have shown that female medical students have better learning plans and higher learning motivation.<sup>18,19</sup> On the other hand, it is a fact that the global incidence and mortality rate of TC is higher in women than in men.<sup>20</sup> Therefore, it is not surprising that female medical students have a deeper understanding and pay greater attention to TC. Our results showed that there was a statistically significant difference in TC knowledge in terms of major, with clinical medicine majors having more knowledge. A survey conducted by other medical schools in China may explain this phenomenon. The authors concluded that receiving clinical teaching can significantly improve the cognitive level of TC among medical students, and clinical medical students have more opportunities to interact with patients.<sup>11</sup> In addition, we found that participants who chose “others around those who had suffered from the disease” had higher TC knowledge scores, and most of them (79.3%) agreed that having a close relative with cancer would increase the risk of developing cancer. Therefore, they may be more alert to enhancing disease prevention.

It should be noted that medical students are viewed as trusted sources of health-related information. To some extent, the communication confidence of medical students will affect the doctor-patient relationship. Our research found that clinical communication confidence was correlated with years of study, and this ability varied in different years of study with an upward trend from year 1 to year 8 ( $P < 0.05$ ,  $R = 0.261$ ). This may be due to the accumulation of medical knowledge and clinical experience. Therefore, compared with non-thyroid surgery students, it is easy to understand that thyroid surgery students have higher communication confidence. Compared with postgraduate students, undergraduates



were weak in clinical communication. In recent years, some medical colleges in China have set up CST elective courses for clinical medicine undergraduates to improve their communication skills and confidence. However, it should be emphasized that there is no systematic and comprehensive CST in compulsory courses, and students' enthusiasm for elective courses is low.<sup>21</sup> Diversified compulsory courses should be included in the training plan in the future curriculum. The Chinese undergraduate medical education standards-clinical medicine issued by the Ministry of Education stipulates that medical schools must ensure students acquire comprehensive clinical skills. It is recommended that undergraduate medical students begin clinical practice as soon as possible.<sup>13</sup> Furthermore, our research found that senior students who engage in clinical work earlier have higher communication confidence. We suggest that schools offer clinical courses and practical activities earlier to enhance students' clinical communication confidence. A recent study in the Chinese Mainland showed that a majority of Chinese physicians were trained in communication skills and showed a highly positive attitude towards CST.<sup>22</sup> Generally speaking, graduate students seem to lack such training. In earlier years, three years of standardized residency training were implemented to compensate for weaknesses in undergraduate clinical education by the Chinese government.<sup>12</sup> In fact, many hospitals lack systematic training in their communication skills but rely more on social experience from communicating with patients. To adapt to the clinical environment and improve communication initiatives, hospitals need to develop CST programs for graduate students and introduce professional communication assessment tools.<sup>21,23,24</sup>

There are some limitations in the present study. Our investigation was limited to Chongqing Medical University, which cannot represent all medical schools in China. We expect to expand our research scope in the future. At the same time, the results were based on an online self-completed questionnaire, which may have increased the possibility of social desirability bias and underestimated medical students' true ability for cancer awareness and communication skills. Furthermore, our research shows that graduate students have high confidence in clinical communication. Thus, training measures are more applicable to undergraduate students. Despite its limitations, we emphasize that medical students at different stages do not completely grasp the knowledge on thyroid diseases. We believe that our study can provide ideas for the future reform of CST courses.

## Data Sharing Statement

The raw data supporting the conclusions of this article will be made available by the corresponding authors, without undue reservation.

## Ethics Approval and Informed Consent

The studies involving human participants were reviewed and approved by the First Affiliated Hospital of Chongqing Medical University.

## Consent for Publication

The authors agree to publish any information about the article.

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## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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The authors report no conflicts of interest in this work.

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