

Knowledge, Attitudes, and Practices of Physicians Regarding Targeted Drug Therapy for Lung Cancer

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Purpose: This study aimed to examine the KAP of physicians regarding targeted drug therapy for lung cancer in China.

Methods: This cross-sectional study enrolled physicians working in hospitals in Nanyang. A self-administered questionnaire was developed (Cronbach's $\alpha=0.912$) to collect the demographic information and KAP.

Results: This study included 191 valid questionnaires. Most participants were male (70.2%) and aged 36–50 (55.5%). The median knowledge score was 29 (24–31) (/36, 80.6%), the mean attitude score was 42 (39–44) (/50, 84.0%), and the mean practice score was 28 (26–29) (/30, 93.3%), indicating sufficient knowledge, positive attitudes, and proactive practice. The female gender (OR=5.291, 95% CI: 1.426–19.634, $P=0.013$), working in non-public tertiary hospitals (OR=0.053, 95% CI: 0.008–0.360, $P=0.003$), and working in medical oncology (OR=10.764, 95% CI: 2.638–43.922, $P=0.001$) were independently associated with adequate knowledge. Only the knowledge scores (OR=1.121, 95% CI: 1.036–1.212, $P=0.004$) were independently associated with a positive attitude. Only the attitude scores (OR=1.895, 95% CI: 1.333–2.694, $P<0.001$) were independently associated with proactive practice.

Conclusion: Physicians working in thoracic surgery, respiratory medicine, or medical oncology displayed sufficient knowledge, positive attitude, and proactive practice toward targeted therapy for lung cancer.

Keywords: knowledge, attitude, practice, lung cancer, targeted therapy, physician

Introduction

Lung cancer is the most common cancer worldwide, with an estimated 2,480,301 new cases in 2022 (12.4% of all cancers), and with the highest contribution to cancer-related mortality, with 1,817,172 deaths (18.7% of all cancer-related deaths).¹ Lung cancer is an umbrella term that encompasses several types of disease with different biology (mainly non-small cell lung cancer (NSCLC), with 85–90% of cases, and small cell lung cancer (SCLC)), and patients with the same cancer subtype display different tumor biology due to the presence of various driver mutations (eg, EGFR, ALK, PI3K/AKT/mTOR, RAS-MAPK, RET, MET, BRAF, and NTRK/ROS1) in the tumor.^{2–4} Fortunately, in the era of precision medicine, several of those mutated genes are actionable and can be targeted with drugs against EGFR (erlotinib, gefitinib, afatinib, dacomitinib, and osimertinib), ALK (crizotinib, ceritinib, alectinib, brigatinib, ensartinib, and lorlatinib), RET (selpercatinib and pralsetinib), MET (capmatinib and repotinib), BRAF (dabrafenib and trametinib), NTRK (larotrectinib and entrectinib), and ROS1 (crizotinib, ceritinib, lorlatinib, and entrectinib).^{2–4} Despite the efficacy of such drugs, in 33 states in the United States of America (USA), only 66% of the patients with EGFR- or ALK-mutated lung cancer in 2020–2021 received a targeted therapy.⁵ Immunotherapy is also a novel type of targeted therapy that specifically inhibits the tumor's immune escape (ie, the ability of a tumor to induce immune tolerance toward cancer cells).^{3,4} The 5-year survival of patients with NSCLC is 19%, while the 5-year survival of patients with SCLC is 6.3%.^{6,7}

Still, appropriate knowledge of these drugs is necessary for their correct use or to consider referring a patient to a specialist who will provide targeted therapy. The prescription of targeted therapy is based on the indications, the

mutations, resistance development, and prognosis.⁸ Knowledge, attitude, and practice (KAP) is a structured survey method used to investigate the gaps, misunderstandings, and misconceptions toward a specific subject that can constitute barriers to the correct application of the subject in a specific population.^{9,10} Very little data are available in the literature regarding the KAP toward targeted therapies among specialists. Even for traditional chemotherapy, very few studies examined the oncologists' KAP toward specific subjects such as resistance.^{11–13} Previous studies revealed variable KAP toward lung cancer biomarker testing among pulmonologists in the United States of America (USA)^{14,15} and Canada.¹⁶ The KAP toward targeted therapy among physicians is unknown.

Therefore, this study aimed to examine the KAP of physicians regarding targeted drug therapy for lung cancer in China. The results could identify gaps in knowledge that could be addressed to improve the KAP of the specialists, including patient management.

Materials and Methods

Study Design, Setting, and Target Population

This cross-sectional study enrolled physicians working in hospitals of Nanyang between February and March 2023. Nanyang is a prefecture-level city in the southwest of Henan province, China, with a four-season humid subtropical climate. It has a population of 9,713,112 and a per-capita gross domestic product of CNY 31,010 (about USD 4669). Nanyang has a long history of education and academia.

Sample Size

The sample size was determined based on the requirement of 5–10 participants per survey item.¹⁷ Hence, this survey had 34 items, and the required sample size was 170–340 participants.

Ethical Considerations

The study was approved by the medical ethics committee of the First Affiliated Hospital of Nanyang Medical College. All participants provided informed consent.

Questionnaire Design

The questionnaire was designed with reference to published relevant literature and guidelines.^{6,18–21} A questionnaire had to be developed because no prior studies with similar questionnaires were available. In addition, KAP questionnaires have to be adapted to the local practice and policies. The first draft of the questionnaire was designed and revised based on the comments from three experts. The three experts were thoracic surgeons with >20 years of experience. The results of a small pretest (n=32) had a Cronbach's α of 0.912, suggesting good consistency.

Final Questionnaire

The final questionnaire was in Chinese and included 44 items over four dimensions (Supplement material). The basic information consisted of 10 items, the knowledge dimension consisted of 18 items, the attitude dimension consisted of 10 items, and the practice dimension consisted of six items. For the knowledge items, K1–12 were scored 2 points for “know well”, one point for “partially know”, and 0 points for “do not know”; K13–18 were multiple choice questions, with 2 points for choosing all correct answers, 1 point for choosing some of them, and 0 points for choosing wrong answers or “not sure”. The total knowledge scores ranged 0–36. The attitude and practice items were mainly scored on a 5-point Likert scale, ranging from very positive (5) to very negative (1), with scores ranging 10–50 for the attitude dimension and 6–30 for the practice dimension. Scores $\geq 80\%$ of the total theoretical score of knowledge, attitude, and practice were considered “adequate knowledge”, “positive attitude”, and “proactive practice”.²²

Recruitment Process

The participant inclusion criteria were 1) obtained a degree certificate from junior college or above, 2) fully qualified physician, 3) working in thoracic surgery, respiratory medicine, or medical oncology, and 4) agreed to participate in this scientific research. The exclusion criteria were 1) rotating physicians or 2) trainees.

The questionnaire was uploaded to the Wenjuanxing platform, an electronic questionnaire link was generated, and the participants were recruited by convenience sampling through WeChat groups, phone calls, and face-to-face invitations to disseminate the questionnaire link. If the participant was enrolled online, he/she had to read the text explaining the study. Then, the participant had access to the electronic consent form. Signing the consent form was necessary to have access to the survey itself. If the participant was approached in person, the investigator explained the study to the potential participant. The individual was then invited to scan the QR code. The remaining steps were the same as above. If questions were encountered in the process of answering the questionnaire, members of the research team were responsible for answering them in time.

Quality Control

Participants who participated in the questionnaire through the WeChat group were verified by telephone and confirmed genuine. Once all data were collected, the questionnaires were checked for quality by a member of the research team. The questionnaires with obvious logical errors or a pattern of choosing the same options were considered invalid.

Statistical Analysis

SPSS 22.0 (IBM Corp., Armonk, NY, USA) was used for statistical analysis. The continuous variables were expressed using means $\pm$ standard deviations and analyzed using Student's *t*-test (comparisons between two groups) or ANOVA (comparisons among multiple groups). The categorical variables were expressed using *n* (%) and analyzed using the chi-square test. Univariate and multivariate logistic regression analyses were used to identify factors associated with adequate knowledge, positive attitude, and proactive practice. Variables with a $P < 0.05$ in the univariable logistic regression analyses were included in the multivariable regression analyses. Odds ratios (ORs) and 95% confidence intervals (95% CIs) were calculated. Two-sided *P*-values < 0.05 were considered statistically significant.

Results

Demographic Characteristics

A total of 204 questionnaires were returned (response rate of 100%). Sixty participants were enrolled from WeChat groups, 40 by phone calls, and 104 by face-to-face invitations. After excluding eight invalid and five incomplete questionnaires, 191 valid questionnaires (93.6%) were included in the analysis. [Table 1](#) presents the characteristics of the participants. The participants were working in thoracic surgery (39.3%), respiratory medicine (18.3%), or medical oncology (42.4%). Most participants were male (70.2%), aged 36–50 (55.5%), with a junior college or undergraduate degree (53.9%), working in tertiary public hospitals (87.6%), working in medical oncology departments (42.4%), with a vice senior or senior title (56.5%), with ≥ 10 years of working experience (74.4%), with a history of administering target therapy (91.6%), with a history of conducting research on targeted therapy (57.6%), and received training on targeted therapy in lung cancer (89.0%).

Knowledge, Attitudes, and Practice

The distribution of the scores is shown in [Table 2](#). The median knowledge score was 29 (24–31) (/36, 80.6%), the mean attitude score was 42 (39–44) (/50, 84.0%), and the mean practice score was 28 (26–29) (/30, 93.3%), indicating sufficient knowledge, positive attitudes, and proactive practice ([Tables 1 and 2](#)).

In the knowledge dimension, the item with the highest correct rate was K9 (know: 83.8%; know a little: 14.14%; “Targeted drugs have some toxic side effects, including rash, diarrhea, liver damage and, in some patients, interstitial pneumonia”). The

Table I Characteristics of the Participants and KAP Scores

Variables	n (%)	Knowledge Score		Attitude Score		Practice Score	
		Mean±SD/ Median (IQR)	P	Mean±SD/ Median (IQR)	P	Mean±SD/ Median (IQR)	P
Total	191	29 (24, 31)		42 (39, 44)		28 (26, 29)	
Gender			0.010		0.077		0.896
Male	134 (70.2)	28 (24, 30)		42 (38.75, 43)		28 (26, 29)	
Female	57 (29.8)	30 (28, 32)		43 (40, 44)		28 (26, 29)	
Age, years			0.005		0.005		<0.001
21–35	38 (19.9)	21.5 (13, 30)		41 (36, 43)		26 (22, 28)	
36–50	106 (55.5)	29 (27, 30.25)		42 (40, 44)		28 (27, 29)	
≥51	47 (24.6)	29 (27, 31)		42 (38, 43)		28 (27, 29)	
Education			0.003		<0.001		<0.001
Junior college/undergraduate	103 (53.9)	28 (19, 31)		41 (38, 43)		27 (24, 29)	
Postgraduate	88 (46.1)	29 (28, 30.75)		42.5 (41, 44)		28 (28, 29)	
Nature of institution			<0.001		<0.001		<0.001
Public tertiary	168 (87.6)	29 (27, 31)		42 (39, 44)		28 (27, 29)	
Non-public tertiary	23 (12.4)	14 (6, 23)		37 (35, 41)		23 (21, 26)	
Department			<0.001		<0.001		<0.001
Respiratory medicine	35 (18.3)	26 (19, 29)		40 (37, 42)		26 (22, 28)	
Medical oncology	81 (42.4)	30 (28, 33)		43 (42, 44.5)		29 (28, 29)	
Thoracic surgery	75 (39.3)	27 (22, 30)		41 (38, 43)		28 (25, 29)	
Professional title			<0.001		<0.001		<0.001
None	8 (4.2)	17.25±11.68		36.25±6.61		23.63±4.41	
Junior	23 (12.0)	19.52±9.72		38.39±5.17		23.65±4.83	
Intermediate	52 (27.2)	25.60±8.44		41.25±3.74		26.85±3.08	
Vice senior/senior	108 (56.5)	28.56±4.23		41.91±2.58		27.92±1.79	
Years of work experience in clinical practice			0.002		<0.001		<0.001
<5 years	28 (14.7)	21.5 (13.25, 30)		41 (36, 42.75)		26 (22, 28)	
≥5 but <10 years	21 (11.0)	28 (18, 30)		41 (37.5, 42)		28 (23, 29)	
≥10 years	142 (74.4)	29 (27, 31)		42 (39, 44)		28 (27, 29)	
Administered targeted therapy to lung cancer patients in your clinical practice			<0.001		<0.001		<0.001
Yes	175 (91.6)	27.66±5.62		41.63±3.10		27.43±2.48	
No	16 (8.4)	10.19±7.44		34.88±5.20		21.50±4.68	
Conducted any research on targeted therapy for lung cancer therapy			<0.001		0.100		0.001
Yes	110 (57.6)	29 (27, 31)		42 (39, 44)		28 (27, 29)	
No	81 (42.4)	27 (18.5, 30)		42 (38, 43)		27 (24, 29)	
Received any training on the topic of targeted therapy for lung cancer therapy			<0.001		<0.001		<0.001
Yes	170 (89.0)	27.75±5.30		41.65±3.00		27.54±2.39	
No	21 (11.0)	13.57±10.84		36.38±5.93		22.05±4.38	

Note: Bolded figures indicate that the P-value is less than 0.05, indicating statistical differences.

item with the lowest correct rate was K8 (do not know: 10.0%, “There are several fourth-generation targeted drugs for lung cancer that have already been tested in clinical trials”. ([Supplementary Table S1](#)). [Supplementary Tables S2](#) and [S3](#) present the distributions of the answers to the attitude and practice items.

Multivariable Analyses

The female gender (OR=5.291, 95% CI: 1.426–19.634, P=0.013), non-public tertiary hospitals (OR=0.053, 95% CI: 0.008–0.360, P=0.003), and medical oncology (OR=10.764, 95% CI: 2.638–43.922, P=0.001) were independently

Table 2 Distribution of the KAP Scores

	Range	n (%)
Knowledge	[28, 36]	120 (62.8)
	[0, 28]	71 (37.2)
Attitude	[39, 50]	133 (69.6)
	[10, 39]	58 (30.4)
Practice	[24, 30]	155 (81.2)
	[6, 24]	36 (18.9)

associated with adequate knowledge (Table 3). Only the knowledge scores (OR=1.121, 95% CI: 1.036–1.212, P=0.004) were independently associated with a positive attitude (Table 4). Only the attitude scores (OR=1.895, 95% CI: 1.333–2.694, P<0.001) were independently associated with proactive practice (Table 5).

Table 3 Analysis of the Factors Associated with Adequate Knowledge

Variables	OR (95% CI)	P
Gender		
Male	Ref.	
Female	5.291 (1.426–19.634)	0.013
Age		
21–35	Ref.	
36–50	2.971 (0.411–21.475)	0.281
≥51	2.276 (0.248–20.910)	0.467
Education		
Junior college/undergraduate	Ref.	
Postgraduate	0.847 (0.337–2.129)	0.725
Nature of institution		
Public tertiary	Ref.	
Non-public tertiary	0.053 (0.008–0.360)	0.003
Department		
Respiratory medicine	Ref.	
Medical oncology	10.764 (2.638–43.922)	0.001
Thoracic surgery	1.161 (0.378–3.560)	0.794
Professional title		
None	0.331 (0.012–9.497)	0.518
Junior	0.716 (0.052–9.889)	0.803
Intermediate	Ref.	
Vice senior/senior	1.154 (0.324–4.110)	0.825
Years of work experience		
<5 years	Ref.	
≥5 but <10 years	0.808 (0.052–12.439)	0.879
≥10 years	4.371 (0.177–107.830)	0.367
Conducted any research on targeted therapy for lung cancer therapy		
Yes	Ref.	
No	0.649 (0.267–1.577)	0.340
Received any training on the topic of targeted therapy for lung cancer therapy		
Yes	Ref.	
No	0.322 (0.053–1.957)	0.218

Note: Bolded figures indicate that the P-value is less than 0.05, indicating statistical differences.

Table 4 Analysis of the Factors Associated with Positive Attitude

Variables	OR (95% CI)	P
Knowledge Score	1.121 (1.036–1.212)	0.004
Age		
21–35	Ref.	
36–50	0.285 (0.052–1.570)	0.149
≥51	0.204 (0.033–1.276)	0.089
Education		
Junior college/undergraduate	Ref.	
Postgraduate	2.348 (0.933–5.911)	0.070
Nature of institution		
Public tertiary	Ref.	
Non-public tertiary	1.946 (0.502–7.534)	0.335
Department		
Respiratory medicine	Ref.	
Medical oncology	2.891 (0.898–9.304)	0.075
Thoracic surgery	0.822 (0.302–2.235)	0.701
Your years of work experience in clinical practice		
<5 years	Ref.	
≥5 but <10 years	1.007 (0.185–5.476)	0.994
≥10 years	6.137 (0.956–39.395)	0.056
Administered targeted therapy to lung cancer patients in your clinical practice		
Yes	Ref.	
No	2.021 (0.845–4.834)	0.114
Received any training on the topic of targeted therapy for lung cancer therapy		
Yes	Ref.	
No	0.226 (0.051–1.009)	0.051

Note: Bolded figures indicate that the P-value is less than 0.05, indicating statistical differences.

Table 5 Analysis of the Factors Associated with Good Practice

Variables	OR (95% CI)	P
Knowledge Score	1.095 (0.968–1.237)	0.148
Attitude Score	1.895 (1.333–2.694)	<0.001
Age		
21–35	Ref.	
36–50	12.206 (0.865–172.251)	0.064
≥51	20.050 (0.852–471.706)	0.063
Education		
Junior college/undergraduate	Ref.	
Postgraduate	0.687 (0.133–3.535)	0.653
Nature of institution		
Public tertiary	Ref.	
Non-public tertiary	0.276 (0.034–2.241)	0.228
Department		
Respiratory medicine	Ref.	
Medical oncology	4.350 (0.526–35.966)	0.173
Thoracic surgery	2.086 (0.404–10.779)	0.380
Professional title		
None	3.061 (0.036–259.781)	0.622
Junior	1.642 (0.074–36.599)	0.754
Intermediate	Ref.	
Vice senior/senior	1.192 (0.152–9.363)	0.867

(Continued)

Table 5 (Continued).

Variables	OR (95% CI)	P
Your years of work experience in clinical practice		
<5 years	Ref.	
≥5 but <10 years	1.286 (0.062–26.804)	0.871
≥10 years	0.395 (0.010–14.900)	0.616
Administered targeted therapy to lung cancer patients in your clinical practice		
Yes	Ref.	
No	6.587 (0.264–164.093)	0.251
Conducted any research on targeted therapy for lung cancer therapy		
Yes	Ref.	
No	0.491 (0.098–2.457)	0.387
Received any training on the topic of targeted therapy for lung cancer therapy		
Yes	Ref.	
No	0.272 (0.023–3.168)	0.298

Note: Bolded figures indicate that the P-value is less than 0.05, indicating statistical differences.

Discussion

The results indicate that physicians working in thoracic surgery, respiratory medicine, or medical oncology displayed sufficient knowledge, positive attitude, and proactive practice toward targeted therapy for lung cancer.

Combined with the high attitude and practice scores but the insufficient knowledge scores, these results suggest that the physicians could be performing some acts based on experience and habits without knowing exactly why they do it. Indeed, KAP increased with participants' age group, education, and years of experience, as previously observed.^{14–16} Most participants were undergraduates but were administering targeted therapies to their patients, participated in research on targeted therapy, and received training on targeted therapy. Such training is essential to grasp the subtleties of treatment resistance and how to deal with it.²³ The knowledge items on treatment resistance scored relatively low, but the physicians with ≥10 years of experience scored better than the less experienced ones for many of these items. Previous studies revealed variable KAP toward lung cancer biomarker testing among pulmonologists in North America.^{14–16} Testing for biomarkers is primordial to the selection of adequate targeted therapy. Unfortunately, the present study did not include items on biomarkers and their testing.

In the present study, several knowledge items were found to be insufficient, including items about the molecular indications for targeted therapy, the mutations involved in therapy resistance, the drugs that can be used in case of resistance, and the state of development of new targeted therapies. Understanding treatment resistance is crucial since treatment failure is often due to inadequate strategy preparation.²⁴ In the multivariable analyses, the knowledge score was independently associated with the attitude score, and the attitude score was independently associated with the practice score. Hence, improving knowledge (through lectures, simulations, apprenticeship, and other relevant training) should improve the attitudes and practice toward targeted therapy in lung cancer. Physicians in the medical oncology department had higher knowledge scores, which is unsurprising considering the nature of their job and patient population. Physicians in non-public tertiary hospitals had lower knowledge scores, but it might be due to the nature of their tasks and responsibilities.

This study has some limitations. Although some physicians had a major practice in other hospitals, most had their main practice at the study hospital. Including only the hospitals in Nanyang led to a relatively small sample size when considering the number of physicians involved in lung cancer management in China. It is possible that directly contacting some participants could have introduced bias, but it was necessary to ensure participation. The questionnaire was designed by local investigators based on international guidelines from authoritative institutions, but it was inevitably biased by local practice, policies, and guidelines. Finally, all KAP studies are affected by the social desirability bias, in which the participants can be tempted to answer what they know to be the desired response instead of what they are actually doing.^{25,26} Considering that most participants were experienced physicians and the attitude and practice scores were high, that bias must be considered.

Conclusion

The results indicate that physicians working in thoracic surgery, respiratory medicine, or medical oncology display sufficient knowledge, positive attitudes, and proactive practice toward targeted therapy for lung cancer. Nevertheless, the take-home message is that despite generally sufficient knowledge, specific items require improvement. Educational and motivational interventions should be designed to improve the KAP of physicians regarding targeted therapies for lung cancer. Since this study only included physicians involved in the treatment of respiratory diseases, the results raise questions regarding whether or not other physicians have sufficient KAP for targeted therapy for lung cancer.

Data Sharing Statement

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Ethics Approval

This work has been carried out in accordance with the Declaration of Helsinki (2000) of the World Medical Association. This study was approved by the Neurosurgery Medical Ethics Committee of the First Affiliated Hospital of Nanyang Medical College [2023-xxghk046], and all participants provided written informed consent.

Author Contributions

All authors made a significant contribution to the study, including study conception, study design, study execution, or acquisition of data, analysis, interpretation, or in all these areas. All authors participated in drafting, writing, substantially revising, or critically reviewing the article. All authors have agreed on the journal to which the article will be submitted. All authors reviewed and agreed on all versions of the article before submission, during revision, the final version accepted for publication, and any significant changes introduced at the proofing stage. All authors agree to take responsibility and be accountable for the contents of the article.

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Disclosure

The authors declare that they have no competing interests.

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