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ORIGINAL RESEARCH

Knowledge, Attitudes, and Practices of Cardiac Healthcare Workers Toward Thoracoscopic Surgery in Xinjiang: A Cross-Sectional Study

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Purpose: Thoracoscopic cardiac surgery can achieve better patient outcomes than median sternotomy, but it is a complex procedure with pros and cons. This study investigated the Knowledge, attitude, and practice (KAP) of cardiac healthcare workers (HWs) toward thoracoscopic surgery in Xinjiang.

Methods: This cross-sectional study was conducted from September 2023 to May 2024 at the Department of Cardiac Surgery, First Affiliated Hospital of Xinjiang Medical University, and enrolled HWs working in cardiac surgery (convenience sampling). An investigator-designed questionnaire was used to collect the demographic and KAP data. The effects of demographic factors on KAP were analyzed using multivariable analyses. Relationships among KAP dimensions were examined using a structural equation modeling (SEM) analysis.

Results: The analysis included 194 participants. The mean knowledge, attitude, and practice scores were 12.97±5.74 (/24, 54.04%), 26.11 ±2.57 (/35, 74.60%), and 30.70±9.34 (/45, 68.22%), indicating poor knowledge, positive attitudes, and poor practices. Having a doctoral degree (OR=25.7, 95% CI: 1.59–416, P=0.022) and no experience in applying thoracoscopic cardiac surgery for patient treatment (OR=0.05, 95% CI: 0.01–0.31, P=0.001) were independently associated with knowledge. Being a nurse (OR=0.48, 95% CI: 0.24–0.94, P=0.034) was independently associated with attitudes. The knowledge scores (OR=1.17, 95% CI: 1.05–1.30, P=0.003), the attitude scores (OR=1.45, 95% CI: 1.22–1.73, P<0.001), and working in the cardiology (OR=0.17, 95% CI: 0.03–0.95, P=0.044), anesthesiology (OR=0.20, 95% CI: 0.05–0.77, P=0.019), and the operating room (OR=0.04, 95% CI: 0.00–0.32, P=0.002) departments were independently associated with practice. Knowledge influenced attitude (β=0.08, P=0.010), attitude influenced practice (β=0.98, P<0.001), and knowledge influenced practice (β=0.90, P<0.001).

Conclusion: Cardiac HWs in Xinjiang had poor knowledge, positive attitudes, and poor practice regarding thoracoscopic cardiac surgery.

Keywords: cardiac surgery, knowledge, attitude, practice, healthcare workers, thoracoscopy

Introduction

The recent decade has seen numerous improvements in cardiac surgery, leading to higher safety, reduced trauma, faster rehabilitation, and better cosmetic outcomes.[1] Those improvements translated into the development of cardiac thoracoscopic surgery, including partial sternotomies, small incisions, video-assisted procedures, total thoracoscopy, and robot-assisted procedures.[2] Many studies showed that compared with median sternotomy, these minimally invasive procedures are safe, feasible, and effective, decrease the need for blood transfusion, and improve rehabilitation.[3–7] Still, the learning curve is steep, the technical requirements are high, specialized equipment is needed, and the costs are higher.[1]

Of course, thoracoscopic cardiac surgery will require knowledge of the procedures and the willingness to use them. Since there are advantages to using thoracoscopic cardiac surgery, examining the knowledge, attitude, and practice (KAP) of the

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cardiac healthcare workers toward the procedure could provide the barriers that affect its application. Continuing education activities could then be implemented to correct knowledge gaps and improve attitudes. A KAP study is a structured survey method that provides quantitative and qualitative data about the gaps, misunderstandings, and misconceptions regarding a given subject in a specific population.[8,9] There are currently no studies on the KAP of cardiac healthcare workers toward thoracoscopic cardiac surgery. One study reported that most European thoracic surgeons were unaware of ergonomics and related physical discomfort during thoracoscopic surgery.[10] Still, it has been highlighted that knowledge must be sufficient before performing thoracotomy and thoracoscopy and that proper attitudes must be cultivated by demystifying the apparent complexity of thoracoscopy.[11]

Therefore, this study aimed to investigate the KAP of cardiac healthcare workers in Xinjiang regarding thoracoscopic cardiac surgery. The results could help identify the gaps and barriers to deploying thoracoscopic cardiac surgery in Xinjiang and develop continuing education activities and policies.

Methods

Study Design and Participants

This cross-sectional study was conducted from September 2023 to May 2024 at the Department of Cardiac Surgery, First Affiliated Hospital of Xinjiang Medical University, and enrolled healthcare workers working in cardiac surgery (convenience sampling). The study was approved by the ethics committee of (K202309-02). Informed consent was provided by all participants before completing the questionnaire.

The inclusion criterion was healthcare workers involved in cardiac surgery (ie, cardiac surgeons, cardiologists, anesthetists, critical care physicians, and operating room medical staff) from the Xinjiang region. The exclusion criteria were individuals not related to the field of cardiovascular diseases.

Questionnaire

The questionnaire was designed by the investigators based on the literature.[3,5,10,11] The questionnaire was revised according to the comments from three experts in cardiac surgery. A pilot test was conducted with 46 respondents, and the reliability coefficient was 0.918.

The final questionnaire was in Chinese and encompassed four domains: demographic information (age, gender, marital status, highest education level, hospital grade, professional title, position, years of work experience, history of training in thoracoscopic cardiac surgery, and history of applying thoracoscopic cardiac surgery treatments), knowledge dimension, attitude dimension, and practice dimension.

The knowledge dimension comprised 13 questions, including 12 proper knowledge questions and one trap question. "No understanding at all" was scored 0 points, "some understanding" was scored 1 point, and "thorough understanding" was scored 2 points, for a total score range of 0–24 points. The trap question was a question that was obviously false. It was set up to make sure the participants were actually reading the questions. Hence, questionnaires with "true" to the trap question were excluded. In the present study, the trap question was 3×7+6=26, true or false.

The attitude dimension included seven questions scored using a 5-point Likert scale. For questions A1, A2, A3, A6, and A7, the scoring ranged from strongly agree (5 points) to strongly disagree (1 point), indicating a positive to negative attitude. For questions A4 and A5, the scoring was reversed, ranging from strongly agree (1 point) to strongly disagree (5 points), indicating a negative to positive attitude. The total score range was 7–35 points.

The practice dimension comprised nine questions, also using a 5-point Likert scale, with a maximum of 45. The responses were scored based on the frequency of proactive behavior, ranging from always (5 points) to never (1 point), with a total score range of 7–35 points.

For all three dimensions, a scoring threshold of >70% for each dimension was established to define adequate knowledge, positive attitudes, and proactive practices.[12,13]

Study Course

This multicenter study enrolled participants at several hospitals, including the First Affiliated Hospital of Xinjiang Medical University, Xinjiang Uygur Autonomous Region People's Hospital, Huanghe Road Central Hospital of Xinjiang Uygur Autonomous Region, the Third People's Hospital of Xinjiang Uygur Autonomous Region, Wuhan Asia Heart Hospital of Xinjiang Uygur Autonomous Region, the First People's Hospital of Kashgar, the Second People's Hospital of Kashgar, the First People's Hospital of Hotan, and the People's Hospital of Ayush. The director of the cardiac surgery department of each hospital was contacted. He was responsible for contacting the participants at his hospital and distributing the QR codes. The questionnaires were distributed to the study participants via a WeChat QR code using the Questionnaire Star platform. All questionnaire items were mandatory for submission. A given IP address could be used only once to submit a questionnaire. Questionnaires with an incorrect answer to the trap question, questionnaires with response time <50 s or >1800 s (determined by the online survey system), or questionnaires filled with an obvious pattern (eg, all first choices) were considered invalid and were excluded from the analysis.

Sample Size Calculation

The number of questionnaires required should be 5–20 times the number of KAP items in the questionnaire.[14,15] Given that there were 12, 7, and 9 knowledge, attitude, and practice items, respectively, for a total of 26 KAP items, at least 130 (26×5) questionnaires were needed.

Statistical Analysis

Descriptive analyses were performed on the demographic data and KAP scores of the participants, using means ± standard deviations to present the data. For group comparisons, Student's *t*-test (two groups) and analysis of variance (ANOVA) (more than two groups) were used for normally distributed data, while non-parametric tests were used for data that did not conform to normal distribution. Categorical data were presented as n (%). Multivariable regression was conducted with the KAP scores as dependent variables to analyze the relationship between demographic data and KAP scores. The KAP scores were categorized based on the 70th percentile of their distributions. Variables with $P<0.05$ in the univariable analyses were included in the multivariable analyses. Spearman correlation analysis was used to examine the correlations between knowledge, attitude, and practice scores. A structural equation modeling (SEM) analysis was performed to examine the relationships among KAP dimensions based on the hypotheses that H1) knowledge influences attitude, H2) knowledge influences practice, and H3) attitude influences practice. A mediation analysis was performed to examine the direct and indirect influences. P-values were reported to three decimals, with $P<0.05$ considered statistically significant. The analyses were performed using SPSS 22 for all analyses except SEM (IBM, Armonk, NY, USA) and AMOS 22 for SEM (IBM, Armonk, NY, USA).

Results

Characteristics of the Participants

A total of 221 questionnaires were returned. After excluding 27 questionnaires with incorrect responses to the trap question, 194 valid questionnaires were included in the analysis. Among the 194 participants, 102 (52.58%) were male, and the largest age subgroup was 31–40 years (49.48%). The majority of the participants were married (74.23%), had a bachelor's degree (55.15%), were working in tertiary hospitals (97.94%), had a junior title (41.75%), were physicians (48.97%), were working in the cardiothoracic surgery department (49.48%), had >10 years of experience (49.48%), had no training in thoracoscopic cardiac surgery (60.31%), and had experience in applying thoracoscopic cardiac surgery (60.31%) (Table 1).

Knowledge

The mean knowledge score was 12.97±5.74, on a theoretical maximum of 24 (54.04%), indicating poor knowledge. In addition, 40 participants (20.62%) had a knowledge score >70%. The knowledge scores were associated with gender ($P=0.001$), job ($P=0.001$), departments ($P<0.001$), attended training related to thoracoscopic cardiac surgery ($P<0.001$),

Table 1 Characteristics of the Participants and KAP Scores

N=194	n (%)	Knowledge Score		Attitude Score		Practice Score	
		Mean±SD	P	Mean±SD	P	Mean±SD	P
Total scores		12.97±5.74		26.11±2.57		30.70±9.34	
Knowledge score >70%	40 (20.62)	/		/		/	
Attitude score >70%	133 (68.56)	/		/		/	
Practice score >70%	106 (54.64)	/		/		/	
Age (years)			0.214		0.211		0.992
25–30	53 (27.32)	11.86±5.89		25.79±2.62		30.49±9.81	
31–40	96 (49.48)	13.10±5.40		26.27±2.42		30.90±9.10	
41–50	34 (17.53)	13.55±6.62		26.52±2.51		30.44±9.91	
>50	11 (5.67)	15.36±4.29		25±3.54		30.72±8.36	
Gender			0.001		0.082		0.147
Male	102 (52.58)	14.10±5.98		26.38±2.61		31.46±9.46	
Female	92 (47.42)	11.71±5.20		25.81±2.51		29.85±9.17	
Marital status			0.353		0.872		0.452
Unmarried	43 (22.16)	11.62±5.54		26.16±2.60		29.23±10.1	
Married	144 (74.23)	13.32±5.81		26.08±2.59		30.96±9.04	
Divorced or widowed	7 (3.61)	14±4.47		26.42±2.14		34.28±10.1	
Education			0.107		0.438		0.261
Technical school or below	/						
Junior college	17 (8.76)	11.29±4.74		25.70±2.46		31.70±7.71	
Bachelor's degree	107 (55.15)	12.44±5.59		25.96±2.72		29.47±9.73	
Master's degree	50 (25.77)	14.1±5.49		26.3±2.25		32.32±8.52	
Doctoral degree	20 (10.31)	14.4±7.33		26.8±2.62		32.35±10.0	
Level of hospital worked in			0.711		0.712		0.034
Tertiary hospital	190 (97.94)	13.01±5.79		26.12±2.59		30.8±9.27	
Secondary hospital	3 (1.55)	11±1.73		25.33±1.15		19.66±3.05	
Primary hospital	1 (0.52)	12±00		27±00		45±00	
Other	/						
Professional title			0.225		0.596		0.768
None	16 (8.25)	10.5±6.28		25.37±2.68		28±10.7	
Junior	81 (41.75)	12.38±5.48		26.07±2.64		31.19±9.65	
Intermediate	55 (28.35)	13.34±5.33		26.30±2.12		30.96±8.67	
Associate senior	23 (11.86)	14.95±6.07		26.26±2.37		30.56±8.46	
Senior	19 (9.79)	14.10±6.49		26.15±3.57		30.26±10.2	
Job			0.001		0.033		0.011
Physician	95 (48.97)	14.44±5.48		26.56±2.20		32.95±8.26	
Deputy head of the department	20 (10.31)	11.75±5.55		25.95±3.57		26.5±9.40	
Deputy director	1 (0.52)	24±00		29±00		38±00	
Nurse	77 (39.69)	11.33±5.59		25.54±2.63		28.89±9.99	
Head nurse	1 (0.52)	13±00		27±00		32±00	
Departments			<0.001		0.255		<0.001
Cardiothoracic surgery	96 (49.48)	15.07±5.75		26.48±2.52		34.53±7.16	
Cardiology	16 (8.25)	8.625±4.31		26.25±2.67		24.56±8.32	
Thoracic surgery	7 (3.61)	8.857±6.01		24.85±2.34		23±10.0	
Intensive care medicine	39 (20.1)	11.12±5.04		25.46±2.58		29.46±10.1	
Anesthesiology	19 (9.79)	12.78±3.80		25.68±2.33		27.36±8.60	
Cardiothoracic surgery and operating room nursing	17 (8.76)	11.35±5.38		26.35±2.93		24.58±10.3	
Work experience (years)			0.344		0.148		0.534
1–3	41 (21.13)	12.43±6.09		26.26±2.39		31.46±10.2	
4–6	31 (15.98)	12.25±5.34		25.45±2.33		30.09±8.40	
7–10	26 (13.4)	11.92±5.09		25.84±2.44		29.23±10.2	
>10	96 (49.48)	13.71±5.85		26.33±2.74		30.96±9.02	

(*Continued*)

Table 1 (Continued).

N=194	n (%)	Knowledge Score		Attitude Score		Practice Score	
		Mean±SD	P	Mean±SD	P	Mean±SD	P
Attended training related to thoracoscopic cardiac surgery			<0.001		0.931		<0.001
Yes	77 (39.69)	15.72±5.52		26.24±2.58		35.22±8.09	
No	117 (60.31)	11.16±5.14		26.02±2.57		27.72±8.93	
Experience in applying thoracoscopic cardiac surgery for patient treatment			<0.001		0.097		<0.001
Yes	117 (60.31)	15.05±5.58		26.36±2.54		33.76±8.20	
No	77 (39.69)	9.818±4.40		25.72±2.58		26.05±9.07	

and experience in applying thoracoscopic cardiac surgery for patient treatment (P<0.001) (Table 1). The scores were poor for all knowledge items, with the majority of participants responding that they had some knowledge of all items and with <23% having good knowledge. The item with the highest "good knowledge" rate was K8 (22.68%). The item with the lowest "good knowledge" rate was K1 (17.53%) (Table 2).

Attitudes

The mean attitude score was 26.11±2.57, on a theoretical maximum of 35 (74.60%), indicating a positive attitude; 133 participants (68.56%) had an attitude score >70%. The attitude scores were associated with the participant's job (P=0.033) (Table 1). The item with the most positive attitude was A2 (91.23%), while the item with the lowest score was A3 (18.56%) (Table 3).

Table 2 Distribution of the KAP Scores in the Knowledge Dimension

Knowledge	n (%)		
	No Knowledge at All	Some Knowledge	Very Knowledgeable
1. Thoracoscopic technology is the fundamental platform for contemporary minimally invasive cardiovascular surgery. Apart from robot-assisted cardiac surgery, pure thoracoscopic surgery can be divided into thoracoscopic-assisted minimally invasive cardiac surgery and fully thoracic cardiac surgery.	12 (6.19)	148 (76.29)	34 (17.53)
2. Are you aware of the basic requirements for medical institutions performing thoracoscopic cardiac surgery? (1) Third-grade medical institutions capable of routinely performing a certain number of conventional cardiac surgeries, with a registered cardiac surgery department approved by the health administrative department; (2) Equipped with equipment related to full thoracoscopic cardiac surgery and extracorporeal defibrillation and cardiopulmonary resuscitation devices; (3) Having intensive care units capable of meeting the requirements for treating critically ill patients and related auxiliary departments.	17 (8.76)	135 (69.59)	42 (21.65)
3. Do you know the technical preparations and basic requirements for thoracic cardiac surgeons? (1) Holding a Physician's Practicing Certificate with specialization in cardiothoracic surgery; (2) Holding a senior technical position of associate professor or above with years of experience in cardiac surgery, proficient in handling routine cardiac surgeries; (3) Proficiency in basic knowledge and principles of thoracoscopic surgery, completion of thoracoscopic surgical simulation, animal experiments, and specialized clinical training.	27 (13.92)	129 (66.49)	38 (19.59)

(*Continued*)

Table 2 (Continued).

Knowledge	n (%)		
	No Knowledge at All	**Some Knowledge**	**Very Knowledgeable**
4. Do you know what special equipment and basic requirements medical institutions need to perform thoracic cardiac surgery? (1) Having a thoracoscopic surgery room capable of meeting clinical requirements for thoracoscopic cardiac surgery; (2) Possessing thoracoscopic equipment and surgical instruments certified by the National Medical Products Administration; (3) Having endoscopic disinfection and sterilization facilities and a hospital infection management system.	21 (10.82)	132 (68.04)	41 (21.13)
5. Do you know the indications for thoracic cardiac surgery? (1) Atrial septal defect repair; (2) Partial atrioventricular septal defect repair; (3) Partial anomalous pulmonary venous connection correction; (4) Triatrial heart correction; (5) Tricuspid valve malformation correction; (6) Ventricular septal defect repair; (7) Ruptured aortic sinus repair; (8) Patent ductus arteriosus ligation or clipping; (9) Mitral valve replacement or repair; (10) Tricuspid valve replacement or repair; (11) Benign cardiac tumor resection; (12) Surgical treatment of atrial fibrillation; (13) Aortic valve replacement (thoracoscopic assisted); (14) Coronary artery bypass grafting (thoracoscopic assisted).	15 (7.73)	139 (71.65)	40 (20.62)
6. Do you know the contraindications for thoracic cardiac surgery? (1) Body weight < 15 kg or severe obesity for extracorporeal inner vision surgery; (2) Severe chest wall deformities such as pectus excavatum, where the heart is completely located in the left chest and optimal surgical field exposure cannot be achieved; (3) Severe pleural adhesions obstructing the approach; (4) Severe vascular diseases including diseases of the abdominal aorta, iliac artery, or femoral artery, or severe aortic atherosclerosis, aortic diameter > 40 mm, aortic stenosis, or arterial duct calcification; (5) New York Heart Association functional class IV, low cardiac output syndrome, and concurrent liver or kidney dysfunction, recent neurological symptoms such as a history of embolism; (6) Congenital shunt heart disease with severe pulmonary arterial hypertension showing bidirectional shunt or cyanosis, or other severe intracardiac abnormalities; (7) Atrial fibrillation complicated with pericarditis, coronary heart disease, left atrial thrombosis, contraindicated for thoracoscopic ablation under extracorporeal circulation.	22 (11.34)	136 (70.1)	36 (18.56)
7. Do you know the preparations required before thoracic cardiac surgery for patients? (Preoperative routine femoral and venous ultrasound examination, exclude vascular diseases or deformities, and pay attention to exclude combined deformities and lesions that cannot be treated with thoracoscopic surgery, prepare for intraoperative extracorporeal circulation catheterization when the left superior vena cava persists.)	23 (11.86)	134 (69.07)	37 (19.07)
8. Do you know the patient's positioning during surgery is supine, with the right side slightly elevated by 20° to 30°? (1) The right upper limb is raised and fixed towards the head side, with the upper arm protected by soft padding to prevent overextension and nerve injury; (2) The right upper limb is separated from the lateral position and fixed to the edge of the surgical table, fully exposing the surgical area in either way.	23 (11.86)	127 (65.46)	44 (22.68)
9. Do you know the chest wall layout during full thoracic cardiac surgery? (1) Three-hole style: the first hole on the right chest wall is located between the third ribs beside the sternum, the second hole on the right axillary line between the fourth ribs, and the third hole on the right anterior axillary line between the fifth ribs; (2) Two-hole style: the first hole on the right axillary line between the fourth ribs, and the second hole on the right anterior axillary line between the fifth ribs.	30 (15.46)	122 (62.89)	42 (21.65)

(*Continued*)

Table 2 (Continued).

Knowledge	n (%)		
	No Knowledge at All	**Some Knowledge**	**Very Knowledgeable**
10. Do you know how to perform cardiac arrest and myocardial protection during surgery? (A specially designed long infusion needle is inserted through the fourth intercostal space on the right axillary line, and it penetrates the center of the aortic root purse-string suture. The insertion depth was 4 mm, properly fixed, and connected to the myocardial protection fluid infusion device after venting. Generally, extended aortic (or Chitwood) clamping through the second operation hole on the right anterior axillary line blocks the ascending aorta. Infuse myocardial protection fluid through the aortic root, with infusion volume, pressure, components, and temperature consistent with traditional open-heart surgery. Place ice water around the heart.)	43 (22.16)	111 (57.22)	40 (20.62)
11. Do you know how to perform cardiac de-airing and rebeating during surgery? (Before restoring cardiac beating, maintain a low head position, stop left atrial suction, deflate the lung before closing the left atrial incision, expand the lung, squeeze the heart, de-airing the aortic root, and the heart can be successfully rebeated. If sustained ventricular fibrillation occurs, defibrillation is performed via chest external electrical shock. Carbon dioxide gas is filled in the thoracic cavity during surgery.)	29 (14.95)	123 (63.4)	42 (21.65)
12. Do you know the main complications during surgery and their prevention and treatment measures? (Complications of femoral and venous catheterization, bleeding at the aortic root and superior vena cava catheterization sites, bleeding at the chest wall incision, pulmonary complications.)	26 (13.4)	127 (65.46)	41 (21.13)

Table 3 Distribution of the KAP Scores in the Attitude Dimension

Attitude	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. You consider thoracoscopic surgery to have advantages such as minimal incisions, mild pain, rapid postoperative recovery, a wide field of vision for precise operations, preservation of respiratory function, and minimal blood loss.	84 (43.3)	95 (48.97)	12 (6.19)	3 (1.55)	/
2. You believe thoracoscopic cardiac surgery suits China's national conditions and requires more cardiac surgeons to understand and master this technique.	79 (40.72)	98 (50.52)	16 (8.25)	1 (0.52)	/
3. You believe that thoracoscopic cardiac surgery imposes higher training and skill requirements on surgeons, making its application and promotion challenging.	46 (23.71)	69 (35.57)	43 (22.16)	31 (15.98)	5 (2.58)
4. You feel anxious about the higher operational risks associated with thoracoscopic cardiac surgery.	26 (13.4)	38 (19.59)	55 (28.35)	64 (32.99)	11 (5.67)
5. You believe a limited patient understanding of thoracoscopic cardiac surgery restricts its application and promotion.	43 (22.16)	79 (40.72)	40 (20.62)	30 (15.46)	2 (1.03)
6. You believe that thoracoscopic cardiac surgery can benefit patients significantly.	72 (37.11)	105 (54.12)	16 (8.25)	1 (0.52)	/
7. You consider it crucial to recommend thoracoscopic cardiac surgery to patients.	71 (36.6)	103 (53.09)	19 (9.79)	1 (0.52)	/

Practices

The mean practice score was 30.70±9.34, on a theoretical maximum of 45 (68.22%), indicating poor practice; 106 participants (54.64%) had practice scores >70%). The practice scores were associated with hospital level (P=0.034), job (P=0.011), departments (P<0.001), attended training related to thoracoscopic cardiac surgery (P<0.001), and experience in applying thoracoscopic cardiac surgery for patient treatment (P<0.001) (Table 1). The practice item with the highest score was P7 (62.37%), while the lowest score was observed for P3 (29.38%) (Table 4).

Table 4 Distribution of the KAP Scores in the Practice Dimension

Practice	Always	Often	Sometimes	Occasionally	Never
1. You actively seek information about thoracoscopic cardiac surgery through various channels such as books, the internet, and literature.	32 (16.49)	54 (27.84)	57 (29.38)	42 (21.65)	9 (4.64)
2. You engage in discussions with other healthcare professionals regarding your experiences in applying thoracoscopic cardiac surgery to treat cases.	31 (15.98)	54 (27.84)	52 (26.8)	45 (23.2)	12 (6.19)
3. You participate in training courses related to thoracoscopic cardiac surgery.	24 (12.37)	33 (17.01)	45 (23.2)	52 (26.8)	40 (20.62)
4. You conduct detailed assessments for each patient undergoing thoracoscopic cardiac surgery.	50 (25.77)	44 (22.68)	40 (20.62)	38 (19.59)	22 (11.34)
5. In your practice, when you identify patients who meet the treatment criteria for thoracoscopic cardiac surgery, you recommend this treatment option to them.	51 (26.29)	65 (33.51)	43 (22.16)	22 (11.34)	13 (6.7)
6. You provide detailed information to patients about whether thoracoscopic cardiac surgery is necessary and discuss the risks and benefits of the treatment.	59 (30.41)	54 (27.84)	34 (17.53)	31 (15.98)	16 (8.25)
7. You provide preoperative emotional support and psychological intervention for patients undergoing thoracoscopic cardiac surgery.	66 (34.02)	55 (28.35)	31 (15.98)	30 (15.46)	12 (6.19)
8. You educate patients about the benefits of thoracoscopic cardiac surgery as part of their health education.	63 (32.47)	57 (29.38)	33 (17.01)	26 (13.4)	15 (7.73)
9. You consciously monitor the latest developments in patients' conditions and assess whether their physical condition warrants thoracoscopic cardiac surgery.	62 (31.96)	51 (26.29)	37 (19.07)	27 (13.92)	17 (8.76)

Correlations

The knowledge scores were correlated to the attitude (r=0.186, P=0.009) and practice (r=0.560, P<0.001) scores. The attitude scores were correlated to the practice (r=0.367, P<0.001) scores (Table 5).

Multivariable Analysis

Having a doctoral degree (OR=25.7, 95% CI: 1.59–416, P=0.022) and no experience in applying thoracoscopic cardiac surgery for patient treatment (OR=0.05, 95% CI: 0.01–0.31, P=0.001) were independently associated with the knowledge scores (Table 6). Being a nurse (OR=0.48, 95% CI: 0.24–0.94, P=0.034) was independently associated with the attitude scores (Table 7). The knowledge scores (OR=1.17, 95% CI: 1.05–1.30, P=0.003), the attitude scores (OR=1.45, 95% CI: 1.22–1.73, P<0.001), and working in the cardiology (OR=0.17, 95% CI: 0.03–0.95, P=0.044), anesthesiology (OR=0.20, 95% CI: 0.05–0.77, P=0.019), and the operating room (OR=0.04, 95% CI: 0.00–0.32, P=0.002) departments were independently associated with the practice scores (Table 8).

SEM and Mediation Analyses

The fit indexes of the SEM model were good (Table 9). In the SEM (total effects) (Figure 1), knowledge influenced attitude (β=0.08, P=0.010), attitude influenced practice (β=0.98, P<0.001), and knowledge influenced practice (β=0.90, P<0.001) (Table 10). In the mediation analysis, knowledge directly influenced attitudes (β=0.08, P=0.010), attitude directly influenced practice (β=0.97, P<0.001), and knowledge influenced practice directly (β=0.89, P<0.001) and indirectly (β=0.07, P=0.023) (Table 11).

Table 5 Correlation Analysis

	Knowledge	Attitudes	Practice
Knowledge	1		
Attitudes	0.1860 (P=0.0094)	1	
Practice	0.5603 (P<0.001)	0.3669 (P<0.001)	1

Table 6 Univariable and Multivariable Analyses of the Knowledge Dimension

Knowledge	Univariable		Multivariable	
	OR (95% CI)	P	OR (95% CI)	P
Age (years)				
25–30				
31–40	1.48 (0.60,3.63)	0.392		
41–50	1.73 (0.58,5.16)	0.325		
>50	3.21 (0.76,13.5)	0.112		
Gender				
Male				
Female	0.34 (0.15,0.73)	**0.006**	0.35 (0.11,1.09)	0.072
Marital status				
Unmarried				
Married	2.34 (0.85,6.44)	0.097		
Divorced or widowed	1.26 (0.12,12.8)	0.841		
Education				
Technical school or below				
Junior college				
Bachelor's degree	3.45 (0.43,27.6)	0.243	3.06 (0.33,28.0)	0.321
Master's degree	5.05 (0.60,42.1)	0.135	2.37 (0.22,24.7)	0.469
Doctoral degree	10.6 (1.17,97.1)	**0.036**	25.7 (1.59,416.)	**0.022**
Level of hospital worked in				
Tertiary hospital				
Secondary hospital	(empty)			
Primary hospital	(empty)			
Other				
Professional title				
None				
Junior	1.46 (0.29,7.16)	0.639		
Intermediate	1.75 (0.34,8.86)	0.499		
Associate senior	3.06 (0.54,17.2)	0.204		
Senior	3.23 (0.55,18.9)	0.194		
Job				
Physician				
Deputy head of the department	0.46 (0.12,1.73)	0.256	0.34 (0.04,2.53)	0.296
Deputy director	(empty)		(empty)	
Nurse	0.39 (0.17,0.88)	**0.024**	0.85 (0.22,3.17)	0.81
Head nurse	(empty)		(empty)	
Departments				
Cardiothoracic surgery				
Cardiology	(empty)			
Thoracic surgery	0.38 (0.04,3.34)	0.387		
Intensive care medicine	0.26 (0.08,0.81)	**0.02**		
Anesthesiology	0.43 (0.11,1.60)	0.21		
Cardiothoracic surgery and operating room nursing	0.49 (0.13,1.85)	0.297		
Work experience (years)				
1–3				
4–6	0.79 (0.23,2.71)	0.712		
7–10	0.53 (0.12,2.24)	0.395		
>10	1.37 (0.55,3.38)	0.488		

(*Continued*)

Table 6 (Continued).

Knowledge	Univariable		Multivariable	
	OR (95% CI)	P	OR (95% CI)	P
Attended training related to thoracoscopic cardiac surgery				
Yes				
No	0.23 (0.11,0.48)	**<0.001**	0.41 (0.16,1.02)	0.056
Experience in applying thoracoscopic cardiac surgery for patient treatment				
Yes				
No	0.05 (0.01,0.23)	**<0.001**	0.05 (0.01,0.31)	**0.001**

Notes: Bold indicates statistically significant values.
Abbreviations: OR, odds ratio; CI, confidence interval.

Table 7 Univariable and Multivariable Analyses of the Attitude Dimension

Attitude	Univariable		Multivariable	
	OR (95% CI)	P	OR (95% CI)	P
Knowledge score	1.06 (1.00,1.12)	**0.039**	1.04 (0.98,1.10)	0.145
Age (years)				
25–30				
31–40	1.40 (0.69,2.83)	0.35		
41–50	2.33 (0.86,6.35)	0.096		
>50	0.72 (0.19,2.69)	0.634		
Gender				
Male				
Female	0.67 (0.36,1.24)	0.208		
Marital status				
Unmarried				
Married	0.92 (0.44,1.93)	0.832		
Divorced or widowed	1.08 (0.18,6.32)	0.929		
Education				
Technical school or below				
Junior college				
Bachelor's degree	1.03 (0.35,3.01)	0.954		
Master's degree	1.27 (0.39,4.07)	0.685		
Doctoral degree	3.09 (0.63,15.0)	0.162		
Level of hospital worked in				
Tertiary hospital				
Secondary hospital	0.92 (0.08,10.3)	0.948		
Primary hospital	(empty)			
Other				
Professional title				
None				
Junior	1.55 (0.52,4.62)	0.427		
Intermediate	1.89 (0.60,5.96)	0.274		
Associate senior	2.20 (0.56,8.56)	0.254		
Senior	2.17 (0.52,9.01)	0.283		
Job				
Physician				
Deputy head of the department	0.95 (0.31,2.92)	0.94	1.07 (0.34,3.33)	0.899
Deputy director	(empty)		(empty)	
Nurse	0.42 (0.22,0.81)	**0.01**	0.48 (0.24,0.94)	**0.034**
Head nurse	(empty)		(empty)	

(*Continued*)

Table 7 (Continued).

Attitude	Univariable		Multivariable	
	OR (95% CI)	P	OR (95% CI)	P
Departments				
Cardiothoracic surgery				
Cardiology	2.46 (0.52,11.6)	0.254		
Thoracic surgery	0.26 (0.05,1.26)	0.095		
Intensive care medicine	0.45 (0.20,0.99)	0.048		
Anesthesiology	0.48 (0.17,1.34)	0.163		
Cardiothoracic surgery and operating room nursing	0.84 (0.27,2.63)	0.772		
Work experience (years)				
1–3				
4–6	0.44 (0.16,1.19)	0.109		
7–10	0.69 (0.23,2.00)	0.498		
>10	0.93 (0.41,2.13)	0.877		
Attended training related to thoracoscopic cardiac surgery				
Yes				
No	1.08 (0.58,2.00)	0.803		
Experience in applying thoracoscopic cardiac surgery for patient treatment				
Yes				
No	0.62 (0.33,1.15)	0.131		

Notes: Bold indicates statistically significant values.
Abbreviations: OR, odds ratio; CI, confidence interval.

Table 8 Univariable and Multivariable Analyses of the Practice Dimension

Practice	Univariable		Multivariable	
	OR (95% CI)	P	OR (95% CI)	P
Knowledge score	1.25 (1.15,1.35)	**<0.001**	1.17 (1.05,1.30)	**0.003**
Attitude score	1.42 (1.23,1.63)	**<0.001**	1.45 (1.22,1.73)	**<0.001**
Age (years)				
25–30				
31–40	0.87 (0.44,1.72)	0.699		
41–50	0.70 (0.29,1.68)	0.438		
>50	0.59 (0.16,2.18)	0.431		
Gender				
Male				
Female	0.49 (0.28,0.88)	**0.018**	0.53 (0.18,1.56)	0.25
Marital status				
Unmarried				
Married	0.90 (0.45,1.80)	0.787		
Divorced or widowed	1.97 (0.34,11.3)	0.444		
Education				
Technical school or below				
Junior college				
Bachelor's degree	0.77 (0.27,2.17)	0.634		
Master's degree	1.88 (0.61,5.80)	0.267		
Doctoral degree	1.65 (0.43,6.20)	0.458		

(*Continued*)

Table 8 (Continued).

Practice	Univariable		Multivariable	
	OR (95% CI)	P	OR (95% CI)	P
Level of hospital worked in				
Tertiary hospital				
Secondary hospital				
Primary hospital				
Other				
Professional title				
None				
Junior	1.38 (0.47,4.04)	0.555		
Intermediate	1.29 (0.42,3.94)	0.653		
Associate senior	0.76 (0.21,2.76)	0.688		
Senior	1.11 (0.29,4.20)	0.877		
Job				
Physician				
Deputy head of the department	0.27 (0.09,0.75)	**0.012**	0.45 (0.10,1.89)	0.279
Deputy director				
Nurse	0.40 (0.21,0.74)	**0.004**	1.16 (0.33,4.05)	0.807
Head nurse				
Departments				
Cardiothoracic surgery				
Cardiology	0.07 (0.02,0.29)	**<0.001**	0.17 (0.03,0.95)	0.044
Thoracic surgery	0.13 (0.02,0.73)	**0.02**	0.58 (0.07,4.83)	0.618
Intensive care medicine	0.28 (0.13,0.62)	**0.002**	0.65 (0.23,1.78)	0.408
Anesthesiology	0.19 (0.06,0.55)	**0.002**	0.20 (0.05,0.77)	**0.019**
Cardiothoracic surgery and operating room nursing	0.10 (0.03,0.34)	**<0.001**	0.04 (0.00,0.32)	**0.002**
Work experience (years)				
1–3				
4–6	0.49 (0.18,1.29)	0.153		
7–10	0.54 (0.19,1.49)	0.236		
>10	0.46 (0.21,1.00)	0.051		
Attended training related to thoracoscopic cardiac surgery				
Yes				
No	0.30 (0.16,0.57)	**<0.001**	0.62 (0.24,1.58)	0.323
Experience in applying thoracoscopic cardiac surgery for patient treatment				
Yes				
No	0.25 (0.14,0.47)	**<0.001**	0.56 (0.22,1.44)	0.236

Notes: Bold indicates statistically significant values.
Abbreviations: OR, odds ratio; CI, confidence interval.

Table 9 Fit Indexes of the SEM Analysis

Indicators	Reference	Results
RMSEA	<0.08 Good	0.000
SRMR	<0.08 Good	0.000
TLI	>0.8 Good	1.000
CFI	>0.8 Good	1.000

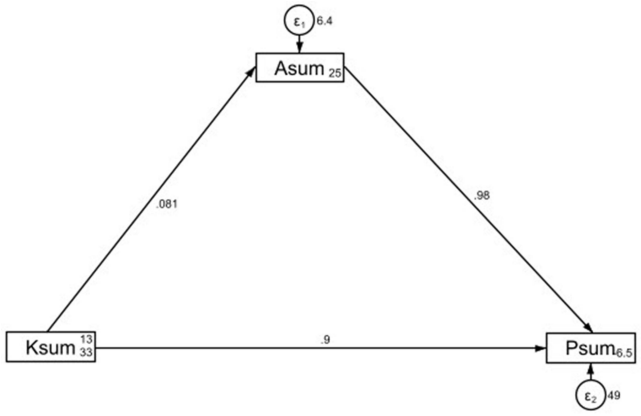

Figure 1 Structural equation modeling.

Discussion

Thoracoscopic cardiac surgery can achieve better patient outcomes than median sternotomy, but it is a complex procedure with pros and cons. This multicenter cross-sectional study investigated the KAP of cardiac healthcare workers in Xinjiang regarding thoracoscopic cardiac surgery. The results showed that cardiac healthcare workers in Xinjiang had poor knowledge, positive attitudes, and poor practice regarding thoracoscopic cardiac surgery. Improving knowledge should improve both attitudes and practices. This study identified important knowledge gaps that could be improved.

Thoracoscopy is a complex intervention with a steep learning curve. Molnar et al[11] advocated that knowledge must be sufficient before performing thoracoscopy procedures; in addition, proper attitudes must be cultivated by demystifying the apparent complexity of thoracoscopy. The present study showed that the knowledge scores toward thoracoscopy were poor among cardiac healthcare workers in Xinjiang. All knowledge items had poor scores, indicating that continuing education about thoracoscopy, in general, should be designed and implemented in the cardiac healthcare community. On the other hand, the attitudes were favorable, indicating that the participants could be tempted to suggest and/or perform thoracoscopy given the opportunity. Still, the present study did not investigate whether the participants had access to the equipment and whether their hospital had policies for or against thoracoscopy for cardiac surgery. Of course, material and/or institutional barriers would hinder the performance of thoracoscopy and the participants' interest in the procedure.

Table 10 SEM Analysis Parameters

		β	P>|z|
Asum <-	Ksum	0.08	0.01
Psum <-	Asum	0.98	<0.001
	Ksum	0.90	<0.001

Table 11 Mediation Analysis

Model Paths		Total Effects		Direct Effect		Indirect Effect	
		β (95% CI)	P	β (95% CI)	P	β (95% CI)	P
Asum <-	Ksum	0.08 (0.01,0.14)	0.01	0.08 (0.01,0.14)	0.01		
Psum <-	Asum	0.97 (0.58,1.36)	<0.001	0.97 (0.58,1.36)	<0.001		
	Ksum	0.97 (0.79,1.16)	<0.001	0.89 (0.72,1.07)	<0.001	0.07 (0.01,0.14)	0.023

Abbreviation: CI, confidence interval.

Thoracoscopy can be performed robotically, which requires expensive equipment, but it can also be performed by video, which is less expensive.[1,11] Only one study reported about the KAP toward an aspect of thoracoscopic surgery, and not about the KAP of thoracoscopy cardiac surgery, ie, that most European thoracic surgeons were unaware of the ergonomics and physical comfort during thoracoscopic surgery.[10]

Higher education and experience in thoracoscopic cardiac surgery were independently associated with better knowledge scores. Nurses had lower attitude scores, possibly because they were not making decisions about treatments and surgical methods. Working in the cardiothoracic surgery department was associated with higher practice scores, which is consistent with the fact that it is the department where thoracoscopic procedures would actually be performed.

The multivariable, SEM, and mediation analyses support the idea that knowledge influences attitude and practice and that attitude influences practice. It is consistent with the KAP theory, which stipulates that knowledge is the basis for practice, while attitude is the force driving practice.[8,9] Hence, improving the knowledge of thoracoscopic cardiac surgery should translate into better attitude and practice.

Limitations

This study had limitations. Although the number of participants met the sample size requirements, the participants represented only a small proportion of the cardiac healthcare workers in Xinjiang and an even smaller proportion of the Chinese ones, limiting generalizability. The questionnaire was designed by the investigators according to local practice and policies, limiting generalizability and exportability. The design was cross-sectional, and the data represent a single point in time. Nevertheless, the present study could be used as a historical baseline for future intervention studies. Cross-sectional studies cannot be used to evaluate causality. SEM analyses allow some surrogate of causality, but the results must be interpreted cautiously as the causality is statistically inferred rather than observed.[16–18] Finally, all KAP studies are at risk of the social desirability bias,[19,20] ie, the participants can respond to what they know they should do instead of what they are doing.

Future Directions

In future studies, a KAP educational intervention should be designed and investigated to improve the KAP of cardiac healthcare workers regarding thoracoscopic cardiac surgery.

Conclusion

In conclusion, cardiac healthcare workers in Xinjiang had poor knowledge, positive attitudes, and poor practice regarding thoracoscopic cardiac surgery. Improving knowledge should improve both attitudes and practices. This study identified important knowledge gaps that could be improved.

Data Sharing Statement

All data generated or analyzed during this study are included in this published article.

Ethics Approval and Consent to Participate

All procedures were performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. The study was approved by the ethics committee of (K202309-02). Written informed consent was provided by all participants before completing the questionnaire.

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Disclosure

All authors declare that they have no competing interests.

References

1. Doenst T, Diab M, Sponholz C, Bauer M, Farber G. The Opportunities and Limitations of Minimally Invasive Cardiac Surgery. *Dtsch Arztebl Int*. 2017;114(46):777–784. doi:10.3238/arztebl.2017.0777
2. Jung JC, Kim KH. Minimally Invasive Cardiac Surgery versus Conventional Median Sternotomy for Atrial Septal Defect Closure. *Korean J Thorac Cardiovasc Surg*. 2016;49(6):421–426. doi:10.5090/kjtcs.2016.49.6.421
3. Chen B, Wang T, Xu Z, et al. Technique and early outcomes of total thoracoscopic double-valve replacement. *JTCVS Tech*. 2024;24:41–49. doi:10.1016/j.xjtc.2024.01.019
4. Kim DC, Chee HK, Song MG, et al. Comparative analysis of thoracotomy and sternotomy approaches in cardiac reoperation. *Korean J Thorac Cardiovasc Surg*. 2012;45(4):225–229. doi:10.5090/kjtcs.2012.45.4.225
5. Liu J, Chen B, Zhang -Y-Y, et al. Mitral valve replacement via minimally invasive totally thoracoscopic surgery versus traditional median sternotomy: a propensity score matched comparative study. *Ann Translat Med*. 2019;7(14):341. doi:10.21037/atm.2019.07.07
6. Mohammed H, Yousuf Salmasi M, Caputo M, Angelini GD, Vohra HA. Comparison of outcomes between minimally invasive and median sternotomy for double and triple valve surgery: a meta-analysis. *J Card Surg*. 2020;35(6):1209–1219. doi:10.1111/jocs.14558
7. Chaves AJJ, Avelino PS, Lopes JB. Comparison of the Effects of Full Median Sternotomy vs. Mini-Incision on Postoperative Pain in Cardiac Surgery: a Meta-Analysis. *Braz J Cardiovasc Surg*. 2024;39(4):e20230154. doi:10.21470/1678-9741-2023-0154
8. Andrade C, Menon V, Ameen S, Kumar Praharaj S. Designing and Conducting Knowledge, Attitude, and Practice Surveys in Psychiatry: practical Guidance. *Indian J Psychol Med*. 2020;42(5):478–481. doi:10.1177/0253717620946111
9. World Health Organization. Advocacy, communication and social mobilization for TB control: a guide to developing knowledge, attitude and practice surveys. Available from: http://whqlibdoc.who.int/publications/2008/9789241596176_eng.pdf. Accessed November 22, 2022. 2008.
10. Welcker K, Kesieme EB, Internullo E, Kranenburg van Koppen LJ. Ergonomics in thoracoscopic surgery: results of a survey among thoracic surgeons. *Interact Cardiovasc Thorac Surg*. 2012;15(2):197–200. doi:10.1093/icvts/ivs173
11. Molnar TF. (Video Assisted) thoracoscopic surgery: getting started. *J Minim Access Surg*. 2007;3(4):173–177. doi:10.4103/0972-9941.38912
12. He J, Yang W, He Q, et al. Chinese pregnant women's knowledge, attitude, and practice of self-protection against coronavirus disease 2019 during the post-pandemic period: a structural equation modeling-based survey. *Int J Disaster Risk Reduct*. 2023;87:103559. doi:10.1016/j.ijdrr.2023.103559
13. Kaliyaperumal K. Guideline for conducting a knowledge. *Lattitude and Practice AECS Illumination*. 2004;4:7–9.
14. Naqvi AA, Hassali MA, Rizvi M, et al. Validation of the General Medication Adherence Scale in Pakistani Patients With Rheumatoid Arthritis. *Front Pharmacol*. 2020;11:1039. doi:10.3389/fphar.2020.01039
15. Ni P, Chen JL, Liu N. Sample size estimation for quantitative studies in nursing research. *Chin J Nurs*. 2010;45(04):378–380.
16. Beran TN, Violato C. Structural equation modeling in medical research: a primer. *BMC Res Notes*. 2010;3:267. doi:10.1186/1756-0500-3-267
17. Fan Y, Chen J, Shirkey G. Applications of structural equation modeling (SEM) in ecological studies: an updated review. *Ecol Process*. 2016;5(1):19. doi:10.1186/s13717-016-0063-3
18. Kline RB. *Principles and Practice of Structural Equation Modeling (Fifth Edition)*. New York: The Guilford Press; 2023.
19. Bergen N, Labonte R. "Everything Is Perfect, and We Have No Problems": detecting and Limiting Social Desirability Bias in Qualitative Research. *Qual Health Res*. 2020;30(5):783–792. doi:10.1177/1049732319889354
20. Latkin CA, Edwards C, Davey-Rothwell MA, Tobin KE. The relationship between social desirability bias and self-reports of health, substance use, and social network factors among urban substance users in Baltimore, Maryland. *Addict Behav*. 2017;73:133–136. doi:10.1016/j.addbeh.2017.05.005