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Educational quality of YouTube videos on video assisted thoracoscopic segmentectomy

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Video-assisted thoracoscopic segmentectomy (VATS) is increasingly performed as a parenchyma-sparing procedure for early-stage lung cancer, yet standardized educational resources remain limited. YouTube is widely accessed by surgeons and trainees, but the educational quality of its content is largely unregulated. This study systematically evaluated YouTube videos on VATS segmentectomy using the validated LAParoscopic surgery Video Educational GuidelineS (LAP-VEGaS) tool. A structured search was performed on June 12, 2025, and 34 videos with ≥ 2500 views were included. Two experienced thoracic surgeons independently assessed all videos, and inter-rater agreement was measured using Cohen's kappa. The mean LAP-VEGaS score was 6.6 (range 2–14), with only 23.5% of videos reaching the validated threshold (≥ 11) for adequate educational quality. No significant correlation was observed between LAP-VEGaS scores and popularity metrics such as views, likes, or duration, although narration was strongly associated with higher scores. To our knowledge, this is the first study systematically evaluating VATS segmentectomy videos on YouTube using LAP-VEGaS. These findings demonstrate that most YouTube videos on VATS segmentectomy are educationally inadequate and highlight the need for peer-reviewed, curated repositories to ensure reliable and high-quality training materials for thoracic surgical education.

Keywords VATS segmentectomy, Surgical education, YouTube, LAP VEGaS, Video assessment, Thoracic surgery

Abbreviations

VATS	Video-Assisted Thoracoscopic Surgery
LAP-VEGaS	LAParoscopic surgery Video Educational GuidelineS
NSCLC	Non-Small Cell Lung Cancer
LDCT	Low-Dose Computed Tomography
IRB	Institutional Review Board

The widespread implementation of low-dose computed tomography (LDCT) screening has significantly increased the detection of early-stage non-small cell lung cancer (NSCLC), particularly stage IA tumors[1,2]. This shift has sparked renewed interest in parenchyma-sparing procedures such as segmentectomy, which has shown non-inferior or even superior survival outcomes compared to lobectomy in recent randomized trials[3–5]. Consistent with this evidence, the most recent NCCN® guidelines advocate for sublobar resection, preferably segmentectomy, in patients with peripheral T1a-bN0 NSCLC (clinical stage IA1–IA2, ≤ 2 cm)[6].

Simultaneously, video-assisted thoracoscopic surgery (VATS) has become a preferred minimally invasive technique for anatomical resections. As VATS segmentectomy gains broader clinical adoption, ensuring adequate surgical training and procedural standardization has become increasingly important[7].

Digital platforms like YouTube have emerged as widely used, accessible resources for surgical education. However, the educational quality of user-uploaded content remains largely unregulated and frequently lacks critical surgical details, peer review, or adherence to validated reporting guidelines[8–11].

To our knowledge, no previous study has systematically evaluated the educational quality of YouTube videos on VATS segmentectomy using the LAP-VEGaS criteria.This study aims to systematically evaluate the quality and educational value of YouTube videos on VATS segmentectomy, using established assessment frameworks to highlight current strengths, limitations, and opportunities for improvement.

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Materials and methods

To identify the most accessible and widely viewed educational content on VATS segmentectomy, a structured search was performed on YouTube® (http://www.youtube.com) on June 12, 2025, using the keyword "VATS segmentectomy". The search was performed only once and was not repeated at later time points, as our goal was to capture a cross-sectional snapshot of the content available on that specific date. All video characteristics (URL, title, views, likes, duration, and other metadata) were extracted and documented at the time of search. In alignment with previous studies on surgical video quality, the results were sorted by view count, as users are more likely to engage with highly viewed videos. To ensure representativeness, we applied a minimum threshold of 2500 views as a pragmatic visibility cut-off. While prior studies in thoracic and general surgery did not use the same numeric value, they employed popularity-based inclusion criteria (e.g., selecting the most-viewed videos), and our approach follows this principle[12,13]. We acknowledge that this may have excluded recently uploaded but potentially high-quality videos. A total of four videos were excluded from the final analysis: one due to its nature as a patient information video, and three because they depicted robotic segmentectomy procedures, which did not align with the study's focus on thoracoscopic techniques. This approach aimed to capture a realistic and representative sample of the most frequently accessed YouTube videos relevant to video-assisted thoracoscopic segmentectomy. After full review, a final cohort of 34 educational videos was included for comprehensive analysis.

Each video was independently screened by two experienced thoracic surgeons to determine eligibility and relevance. The following metadata were systematically extracted for each video: Title, URL, number of views, upload duration (in days), video length (in seconds), number of subscribers, image quality (e.g., 1080p, 720p), country of origin and likes. Publisher identity was categorized as individual or institutional, based on channel information and video presentation. The resected segment was classified according to the anatomical label provided by the video title or operative footage.

Given the absence of a universally accepted, segmentectomy-specific video evaluation tool, we selected the LAParoscopic surgery Video Educational GuidelineS (LAP-VEGaS) criteria to systematically assess video quality. This validated framework has been widely applied in previous studies to evaluate technical accuracy, anatomical clarity, and procedural coherence in laparoscopic and thoracoscopic surgical videos. LAP-VEGaS was considered particularly appropriate for this study due to its structured emphasis on stepwise intraoperative education, which aligns with the core instructional goals of thoracic surgical training. Its standardized nature also allows for reproducibility and comparability across studies assessing the educational value of online surgical content.

This study exclusively analyzed publicly accessible surgical videos that did not involve identifiable human subjects or patient data. In accordance with established ethical standards for research involving open-source content, institutional review board (IRB) approval was not required.

Software and statistical analysis

All statistical analyses were performed using SPSS version 27 (Statistical Package for the Social Sciences). A two-tailed p value of <0.05 was considered indicative of statistical significance. All videos were independently evaluated by two experienced thoracic surgeons with extensive practice in minimally invasive anatomic resections, both of whom are actively engaged in resident teaching. The evaluators were blinded to the identity and institutional affiliation of the video uploaders and used the LAP-VEGaS scoring system.Inter-rater agreement for categorical assessments was measured using Cohen's kappa (κ) coefficient, and any discrepancies were resolved through consensus-based discussion. Descriptive statistics were generated for all video characteristics and scoring variables. To assess the assumption of normality, both the Kolmogorov–Smirnov and Shapiro–Wilk tests were conducted. Non-parametric correlations between the educational quality score (LAP-VEGaS) and video popularity metrics (e.g., number of views, number of likes, video duration) were assessed using Spearman's rank correlation coefficient (ρ).

Results

This study aimed to evaluate the educational quality of widely viewed YouTube videos on VATS segmentectomy using the LAP-VEGaS criteria. The complete list of videos selected through the structured selection process described above, ranked by number of views, is presented in Table 1. For each video, the table provides data on the number of views, upload duration (in days), video length (in seconds), image quality, number of likes, number of subscribers, country of origin, and type of YouTube channel.

A total of 34 videos were included in the final analysis (Fig. 1). The earliest video was uploaded in November 2011, while the most recent was published in November 2021. Among these, 24 videos (70.6%) were uploaded by personal YouTube channels, whereas 10 videos (29.4%) originated from institutional sources.

In terms of geographic distribution, the majority of videos originated from China ($n=10$, 29.4%), followed by Spain and the United States (each $n=8$, 23.5%). Additional contributing countries included Australia and Italy (each $n=2$, 5.9%), as well as the United Kingdom, Germany, India, and Israel (each $n=1$, 2.9%). These findings indicate that most of the content was produced by individual users and was predominantly concentrated in China, Spain, and the United States (Table 2).

Regarding the type of commentary, 20 videos (58.8%) lacked any form of audio or written narration. 7 videos (20.6%) included only audio narration, while 2 videos (5.9%) provided only written commentary. In 5 videos (14.7%), both audio and written explanations were available. Notably, the surgeon contributing the highest number of videos had a YouTube channel with 17,300 subscribers, and 15 videos from this channel were included in the study.

Rank	Video title	No. of visualizations	No. of days online	Length(s)	Image quality	No. of likes	Number of subscribers	Country of origin	Types of channel
1	Uniportal VATS anatomic right segmentectomy S6 (NON EDITED SURGERY)	10,453	2792	876	1080p	92	17.3 K	China	Personal
2	NON EDITED Uniportal VATS right anterior segmentectomy S3	9182	2585	2061	720p	67	17.3 K	Spain	Personal
3	NON EDITED Uniportal VATS right posterior segmentectomy S2	8898	2574	1540	720p	73	17.3 K	Spain	Personal
4	VATS Right Upper Lobe Anterior (S3) Segmentectomy	8106	3398	381	1080p	36	77.2 K	USA	Institutional
5	Uniportal VATS left apico-posterior anatomic segmentectomy (S1-2)	5647	3323	373	720p	23	17.3 K	Spain	Personal
6	VATS Segmentectomy	5618	1911	975	720p	55	3.39 K	USA	Personal
7	Step-by-Step Thoracoscopic Right Upper Lobe Posterior Segmentectomy	5564	2821	422	480p	41	77.2 K	USA	Institutional
8	Unisurgeon Uniportal VATS anatomic right apical segmentectomy S1 (NO ASSISTANT)	5383	3064	298	1080p	36	17.3 K	China	Personal
9	VATS Thoracoscopic Segmentectomy for Giant Bulla - Dr. (Prof.) Arvind Kumar	4877	3381	286	480p	42	181 K	India	Personal
10	Non edited Uniportal VATS left upper anterior segmentectomy S3 (Live surgery from Catania in HD 4 K)	4462	2351	2091	720p	50	17.3 K	Italy	Personal
11	Single Port VATS Left Upper Anatomic Segmentectomy (Real speed, NOT EDITED, 31 min)	4090	4383	1889	240p	19	17.3 K	Spain	Personal
12	Thoracoscopic Segmentectomy for Pulmonary Sequestration	3831	3782	361	1080p	18	77.2 K	USA	Institutional
13	Uniportal VATS right lower anatomic segmentectomy S9-10 (sparing S6)	3781	1886	837	480p	45	17.3 K	Spain	Personal
14	Uniportal VATS anatomic right upper lobe posterior segmentectomy (S2)	3704	3846	240	480p	14	17.3 K	Spain	Personal
15	Minimally invasive VATS left upper lobe apical trisegmentectomy	3674	3561	543	1080p	8	21.6 K	Australia	Institutional
16	Right Upper Lobe Apical (S1) Segmentectomy Utilizing ICG Technology (Single port)	3556	1315	905	720p	38	77.2 K	USA	Institutional
17	Uniportal VATS Right Apical Segmentectomy	3475	3294	464	720p	15	77.2 K	Israel	Institutional
18	Uniportal VATS left anatomic anterobasal segmentectomy S8 (Live surgery to Milan during the EACTS)	3392	2399	2418	720p	36	17.3 K	Italy	Personal
19	VATS segmentectomy for pulmonary metastasis	4406	3565	530	1080p	16	21.6 K	Australia	Institutional
20	VATS Pulmonary Lobectomy : Left Basal Trisegmentectomy	4289	4921	724	480p	13	4.13KK	England	Personal
21	Uniportal VATS left upper anterior segmentectomy (segment 3)	3276	3857	308	1080p	16	17.3 K	China	Personal
22	VATS Left Apicoposterior (S1 + 2) segmentectomy	3272	3199	572	480p	19	341	China	Personal
23	VATS Right Anterior (S3) Segmentectomy	3172	3199	472	480p	18	341	China	Personal
24	VATS Posterior Segmentectomy of the Right Upper Lobe	3167	3588	372	720p	10	77.2 K	USA	Institutional
25	VATS Left S6 Segmentectomy	3057	3199	513	480p	21	341	China	Personal
26	VATS Left Lower Lobe Superior Segmentectomy for Stage I Lung Cancer by Servet Bolukbas	3015	3510	581	480p	7	688	Germany	Institutional
27	VATS Left Lingular (S4 + 5) Segmentectomy	2977	3199	419	480p	18	341	China	Personal
28	VATS Right Apical (S1) Segmentectomy	2903	3199	443	480p	12	341	China	Personal
29	VATS Left S8 Lung Segmentectomy With Radiological Coil and ICG	2719	1588	268	2160p	13	77.2 K	USA	Institutional
30	Uniportal VATS right upper anterior segmentectomy (S3)	2655	3146	291	1080p	12	17.3 K	China	Personal
31	Uniportal VATS left lower posterobasal anatomic segmentectomy (S10)	2649	1652	378	720p	36	17.3 K	Spain	Personal
32	Blackmon VATS RUL S3 Segmentectomy	2634	1878	816	720p	38	3.39 K	USA	Personal
33	Uniportal VATS anatomic right basal bisegmentectomy S9-10	2627	2826	393	1080p	14	17.3 K	China	Personal
34	Uniportal VATS bilobectomy and superior lower lobe segmentectomy	2551	4413	251	480p	14	17.3 K	Spain	Personal

Table 1. Videos analyzed and main characteristics.

The most frequently resected segments were the right upper anterior segment ($n=5$, 14.7%), right apical segment ($n=4$, 11.8%), right posterior segment of the upper lobe ($n=4$, 11.8%), and right superior segment of the lower lobe ($n=3$, 8.8%) (Fig. 2).

The median number of views was determined to be 3615.0, with a standard deviation of 2026.01; the minimum and maximum values were 2551.0 and 10,453.0, respectively. Regarding the online availability duration of the videos (in days), the median was 3199.0 days, with a standard deviation of 837.03; the minimum and maximum durations were 1315.0 and 4921.0 days, respectively. For video lengths (in seconds), the median duration was 468.0 s, with a standard deviation of 586.83; the minimum and maximum durations were 240.0 and 2418.0 s, respectively. In terms of the number of likes, the median value was 19.0, with a standard deviation of 20.33; the minimum was 7.0 and the maximum was 92.0 (Table 3).

To evaluate the relationship between video characteristics and the number of views, statistical analyses were performed (Table 4). The interpretation of the correlation coefficients in this study was based on the classification proposed by Schober et al.[14]. According to Spearman correlation analysis, a weak positive correlation was

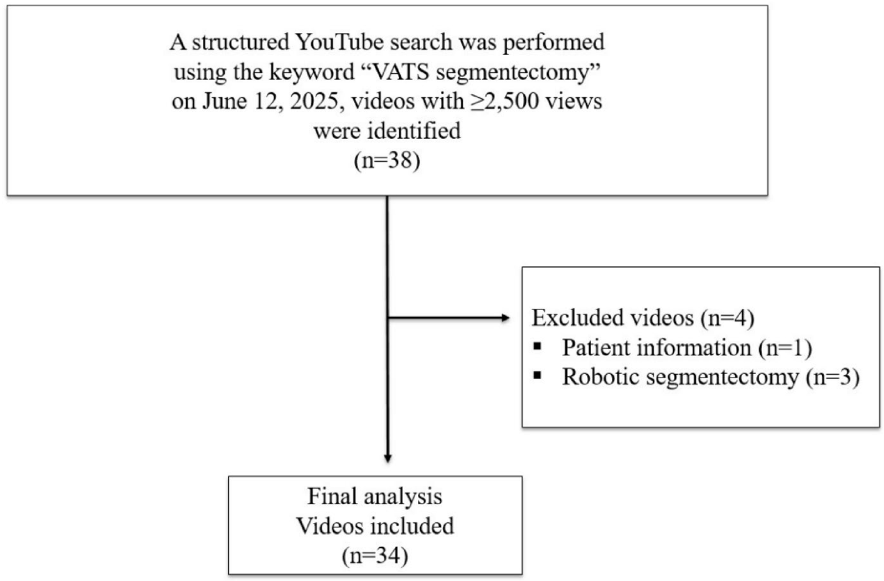

Fig. 1. Flow chart of videos included in the current study.

	Number (%)
Channel type	
Institutional	10(29.4%)
Personal	24(70.6%)
Total	34(100%)
Country of origin	
Australia	2(5.9%)
China	10(29.4%)
England	1(2.9%)
Germany	1(2.9%)
India	1(2.9%)
Italy	2(5.9%)
Spain	8(23.5%)
USA	8(23.5%)
Israel	1(2.9%)
Total	34(100%)

Table 2. Detail of the videos.

observed between video length (in seconds) and the number of views, and this relationship was statistically significant (rs = 0.340; $p = 0.049$). This finding suggests a slight tendency for longer videos to receive more views, although the strength of the association remains limited. A moderate positive correlation was found between the number of likes and view counts, and this association was highly statistically significant (rs = 0.612; $p < 0.001$). This indicates that videos with more likes are generally associated with higher numbers of views. A weak positive correlation was also identified between the number of subscribers and the number of views; however, this association did not reach statistical significance (rs = 0.291; $p = 0.095$). Similarly, a negligible positive correlation was detected between the duration of online availability (in days) and view counts, but this relationship was not statistically significant (rs = 0.011; $p = 0.951$). Regarding image quality, a weak positive correlation with view counts was observed; however, this association was also not statistically significant (rs = 0.104; $p = 0.560$). In addition, other variables—such as channel type ($p = 0.821$), country of origin ($p = 0.797$), and resected segment ($p = 0.893$)—were not significantly associated with the number of views.

In the evaluation conducted according to the LAP-VEGaS guideline, a total of 9 criteria were considered. Each criterion was scored as "Not presented (0)," "Partially presented (+1)," or "Fully presented (+2)," resulting in a total possible score ranging from 0 to 18 (Table 5).

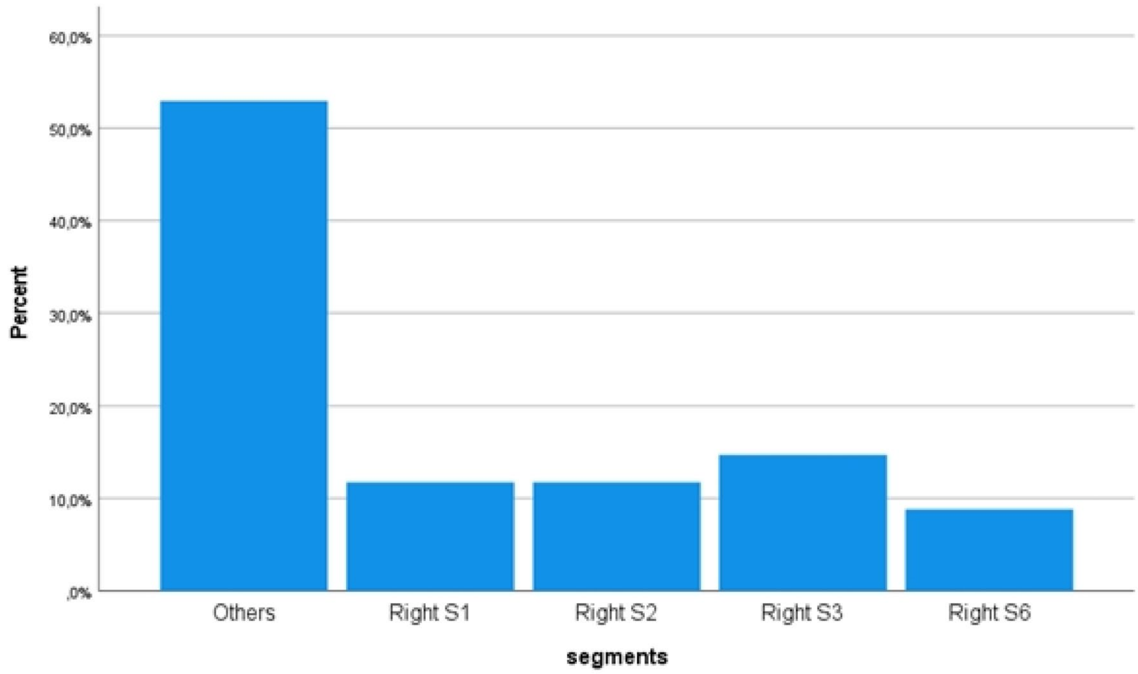

Fig. 2. The distribution of the most frequently resected segments.

Video features	Median	Std. deviation	Range	Minimum	Maximum
No. of visualizations	3615.0	2026.01	7902.0	2551.0	10,453.0
No. of days online	3199.0	837.03	3606.0	1315.0	4921.0
Length(s)	468.0	586.83	2178.0	240.0	2418.0
No. of likes	19.0	20.33	85.0	7.0	92.0

Table 3. Video features.

Dependent variable	Independent variable	Test used	*p* value	Significance	rs value
No. of visualizations	Length (s)	Spearman's correlation test	0.049	Significant	0.340
	No. of likes	Spearman's correlation test	< 0.001	Highly significant	0.612
	Number of subscribers	Spearman's correlation test	0.095	Not significant	0.291
	No. of days online	Spearman's correlation test	0.951	Not significant	0.011
	Types of channel	Mann–Whitney U test	0.821	Not significant	-
	Image quality	Spearman's correlation test	0.560	Not significant	0.104
	Country of origin	Kruskal Wallis Test	0.797	Not significant	-
	Resected segment	Kruskal Wallis Test	0.893	Not significant	-

Table 4. Statistical analysis of video characteristics with number of visualizations.

Among the 34 videos analyzed in our study, total scores ranged between 2.00 and 14.00, with a mean score of 6.56 ± 3.96. The median score was calculated as 4.00 (Table 6). The fact that the median is lower than the mean indicates a positively skewed distribution, suggesting that the majority of videos demonstrated low compliance with LAP-VEGaS criteria.

In the validity analysis of the LAP-VEGaS video assessment tool, a total score of ≥ 11 has been recommended as the threshold for sufficient educational quality for publication[15]. In our study, only 8 out of 34 videos (23.5%) achieved a score above this threshold. This finding indicates that the vast majority of the videos are educationally inadequate according to the LAP-VEGaS standards.

Specifically, the standardized step-by-step presentation of the surgical procedure (LAP-VEGaS Item 4) was included in only 41.2% of the videos. The highest level of compliance with the LAP-VEGaS criteria was observed in video number 6, which achieved 77% of the total possible score. In contrast, videos numbered 11, 13, and 14 demonstrated the lowest compliance, each with only 11% of the total score.

LAP-VEGaS criteria
1-Authors and Institution information. Title of the video including name of the procedure and pathology treated
2-Formal presentation of the case, including patient details and imaging, indication for surgery, comorbidities and previous surgery. Patient anonymity is maintained
3-Position of patient, access ports, extraction site and surgical team
4-The surgical procedure is presented in a standardised step by step fashion
5-The intraoperative fndings are clearly demonstrated, with constant reference to the anatomy
6-Relevant outcomes of the procedure are presented, including operating time, postoperative morbidity and histology when appropriate
7-Additional graphic aid is included such as diagrams, snapshots and photos to demonstrate anatomical landmarks, relevant or unexpected fnding, or to present additional educational content
8-Audio/written commentary in English language is provided
9-The image quality is appropriate with constant clear view of the operating feld. The video is fuent with appropriate speed

Table 5. LAP-VEGAS criteria.

LAP-VEGaS Score	Mean	Median	Std. deviation	Minimum	Maximum
	6.56	4.00	3.96	2.00	14.00

Table 6. Descriptive statistics of LAP-VEGaS scores for evaluated Videos.

LAP-VEGaS Score	Variable	Test used	*p* value	Significance
	No. of visualizations	Spearman correlation	0.860	Not significant
	No. of likes	Spearman correlation	0.700	Not significant
	Length(s)	Spearman correlation	0.773	Not significant
	Narration (yes/no)	Kruskal–Wallis	< 0.001	Significant
	Voice narration vs. no narration	Pairwise comparison	< 0.001	Significant
	Text narration vs. no narration	Pairwise comparison	0.008	Significant
	Combined narration vs. no narration	Pairwise comparison	< 0.001	Significant

Table 7. Correlation between LAP-VEGaS score and video characteristics.

The relationships between the LAP-VEGaS score and various video characteristics were evaluated using Spearman correlation analysis (Table 7). According to the results, a positive but negligible correlation was found between the number of views and the LAP-VEGaS score; however, this relationship was not statistically significant (rs = 0.031; $p = 0.860$). A negative, negligible correlation was observed between the number of likes and the LAP-VEGaS score, which was also not statistically significant (rs = −0.069; $p = 0.700$). A positive but again negligible correlation was found between video duration (in seconds) and the LAP-VEGaS score, and this finding was likewise not statistically significant (rs = 0.051; $p = 0.773$). These results indicate that quantitative characteristics such as number of views, number of likes, and video duration are not significantly associated with the educational quality of the videos as assessed by the LAP-VEGaS criteria. In addition, narration demonstrated a strong association with educational quality. Narration was significantly associated with higher LAP-VEGaS scores (Kruskal–Wallis, $p < 0.001$). Pairwise comparisons showed that videos with voice narration ($p < 0.001$), text narration ($p = 0.008$), and combined narration ($p < 0.001$) all had higher scores than non-narrated videos, with no significant differences among the narrated groups.

Discussion

While online video platforms provide valuable supplementary resources for surgical education, they cannot replace the structured, supervised, and hands-on training that remains fundamental to formal fellowship programs. Nevertheless, surgical videos—particularly those on YouTube—are now widely used by surgeons and trainees worldwide as accessible educational tools. Our study therefore aimed to evaluate whether such freely available resources align with established standards of surgical education. In contrast to most previous studies—which either lacked a standardized selection protocol or relied on randomly selected video samples—we adopted a reproducible strategy based on the analysis of the top 100 most-viewed videos returned by the YouTube search engine[8,13,16]. As YouTube does not disclose the total number of search results for any given query, we prioritized relevance based on view counts and applied predefined inclusion and exclusion criteria to ensure methodological rigor and comparability.

In the literature, various assessment tools have been used to evaluate the educational quality of surgical videos on YouTube, each with distinct strengths and intended purposes. In addition to the LAParoscopic surgery Video Educational GuidelineS (LAP-VEGaS)[15], alternative frameworks include the Critical View of Safety (CVS)[17], the Journal of the American Medical Association (JAMA) Benchmark Criteria[18] and the

Global Quality Score (GQS)[19]. While JAMA and GQS mainly assess general reliability, readability, and patient-centered information, CVS is procedure-specific for laparoscopic cholecystectomy. If these instruments had been applied, the results would likely have favored videos with polished presentation or general reliability rather than intraoperative didactic quality, and CVS is not directly transferable to thoracic surgery. By contrast, LAP-VEGaS focuses on intraoperative anatomy, stepwise education, and technical detail, aligning more closely with the instructional goals of thoracic surgical training. In the original validation of the LAP-VEGaS tool, ROC analysis demonstrated that a score of ≥ 11 correlated strongly with expert recommendations for acceptance of a video for publication or conference presentation (sensitivity 94%, specificity 73%). This validated threshold represents adequate educational quality and was therefore adopted in our study to benchmark the performance of VATS segmentectomy videos[15].

A recent systematic review by Gorgy et al. (2023) further reinforces this choice by highlighting the widespread application of LAP-VEGaS in assessing video-based surgical education[9]. Of the 29 studies included in the review, nine specifically applied the LAP-VEGaS criteria, all of which uniformly reported that the majority of YouTube videos failed to meet acceptable educational standards. These studies consistently identified critical deficiencies such as inadequate demonstration of segmental anatomy, omission of key procedural steps, lack of pre- and postoperative context, and insufficient didactic narration. For instance, Balta et al. found low LAP VEGaS and CVS adherence in thoracoscopic lobectomy videos, mirroring broader concerns about the unregulated nature of publicly available surgical content[12].

Taken together, these findings underscore the importance of applying structured, validated tools like LAP-VEGaS not only to evaluate but also to guide the production of high-quality surgical videos that meet the expectations of formal training environments.

With the increasing adoption of VATS segmentectomy as a parenchyma-sparing approach for early-stage NSCLC, the need for high-quality educational content has never been greater. In this study, we evaluated publicly available YouTube videos on VATS segmentectomy using the standardized educational (LAP-VEGaS) tool. Our findings reveal that the majority of these videos lack essential components needed to support effective surgical training, raising significant concerns about their pedagogical value.

While YouTube provides global accessibility and a vast repository of surgical content, our analysis echoes previous studies suggesting that popularity does not equate to educational quality. Similar to the findings of Ferhatoglu et al.[20] and Coşgun et al.[21], we observed no significant correlation between view count or likes and LAP-VEGaS scores. This discrepancy highlights a fundamental limitation of using unfiltered platforms for professional education. Popularity metrics such as views and likes are likely driven by factors independent of pedagogical rigor, including editing style, production quality, uploader or institutional reputation, attention-grabbing titles and thumbnails, language accessibility (e.g., English narration or subtitles), and algorithmic exposure. In some cases, prominent surgeons may attract large audiences regardless of adherence to structured educational standards. These dynamics explain why highly viewed videos may not necessarily represent high-quality educational resources, a pattern consistently reported across other surgical specialties[22,23].

Our findings align with prior research in other specialties, including general surgery and urology, where YouTube videos have also been found to be deficient in both content completeness and safety representation[8,10,22,23]. In thoracic surgery, where procedures often involve nuanced 3D anatomy, the absence of structured narration, clear visual aids, and postoperative outcomes further limits the educational potential of such videos. Our analysis shows that narration, regardless of format, is associated with superior educational quality. This practical insight suggests that including clear narration should be considered an essential element when producing surgical educational videos.

The use of the LAP-VEGaS framework allowed for a detailed evaluation of educational quality, yet even this tool may not fully capture procedural accuracy. A technically flawed video may score high on structure alone. Therefore, we propose that future frameworks incorporate dual-layered evaluation—assessing both educational formatting and procedural correctness, perhaps through peer-review by specialty societies.

To improve the educational value of surgical videos, we propose a concise checklist for content creators derived from LAP-VEGaS criteria and our findings. This checklist is designed for individual creators and includes: (i) providing case context while ensuring patient anonymity, (ii) presenting procedures in a standardized step-by-step fashion, (iii) continuous narration or on-screen annotation of anatomical landmarks, (iv) integration of pre- and postoperative context and outcomes, and (v) the use of diagrams or graphic aids. Collaboration with professional societies to establish peer review and endorsement mechanisms would further support creators in aligning their videos with formal training standards. A full version of this checklist is provided in Supplementary Table S1.

Given these findings, we strongly advocate for the development of centralized, peer-reviewed surgical video repositories curated by academic institutions or professional societies. YouTube remains an open-access platform without standardized submission criteria or quality control, making its content heterogeneous in educational value. In contrast, peer-reviewed surgical video repositories such as WebSurg, the Journal of Medical Insight (JOMI), and CTSNet Video Library provide curated content with expert peer review, structured didactic presentation, and disclosure standards. These platforms emphasize accuracy, reproducibility, and instructional clarity, which enhances their value as reliable educational resources compared with user-uploaded content on YouTube. To further maximize their educational value for trainees, curated repositories should incorporate specific features such as a standardized stepwise structure aligned with consensus checklists, mandatory narration or annotation of anatomical landmarks, provision of pre- and postoperative context, reporting of outcomes, and structured metadata (e.g., patient positioning, port placement, instruments used). Additional elements such as multilingual captions, conflict-of-interest disclosure, and visible endorsement by professional societies would enhance credibility and help learners readily identify trustworthy content. Platforms such as the

AATS Video Library and the ESTS Learning Portal represent promising steps in this direction and may serve as models for future educational ecosystems.

Limitations

This study has several limitations. The analysis was restricted to English-language videos, which may have excluded high-quality content in other languages. The scoring process was inherently subjective, although this was mitigated by dual-rater review. We acknowledge that the ≥ 2500 views threshold, while improving ecological validity for frequently accessed content, may have excluded newly uploaded but potentially high-quality videos. Because our analysis was based on a single search at one time point, reproducibility may be affected, as repeated searches could yield different results due to the dynamic and evolving nature of YouTube. However, to mitigate this, all video characteristics and metrics were documented at the time of search. Furthermore, although the LAP-VEGaS tool is validated for assessing educational quality, it does not directly measure procedural accuracy, and technically flawed videos may still achieve high structural scores. Finally, the cross-sectional design does not account for the dynamic nature of YouTube content, which is continually evolving.

Conclusion

While YouTube offers an accessible and popular platform for surgical learning, most videos on VATS segmentectomy do not meet minimal standards for structured surgical education. A shift toward validated, peer-reviewed educational content is necessary to ensure safe dissemination of operative knowledge in thoracic surgery.

Data availability

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

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References

1. Chen, C-L. et al. Changes in staging and management of Non-Small cell lung cancer (NSCLC) patients following the implementation of low-dose chest computed tomography (LDCT) screening at Kaohsiung medical university hospital. *Cancers (Basel)* **16**. https://doi.org/10.3390/cancers16223727 (2024).
2. Bhamani, A. et al. Low-dose CT for lung cancer screening in a high-risk population (SUMMIT): a prospective, longitudinal cohort study. *Lancet Oncol.* **609-19** https://doi.org/10.1016/S1470-2045(25)00082-8 (2025).
3. Saji, H. et al. Segmentectomy versus lobectomy in small-sized peripheral non-small-cell lung cancer (JCOG0802/WJOG4607L): a multicentre, open-label, phase 3, randomised, controlled, non-inferiority trial. *Lancet* **399**, 1607–1617. https://doi.org/10.1016/S0140-6736(21)02333-3 (2022).
4. Altorki, N. et al. Lobectomy, segmentectomy, or wedge resection for peripheral clinical T1aN0 non–small cell lung cancer: a post hoc analysis of CALGB 140503 (Alliance). *J. Thorac. Cardiovasc. Surg.* **167**, 338–347e1. https://doi.org/10.1016/j.jtcvs.2023.07.008 (2024).
5. Huang, L. et al. Unforeseen nodal upstaging in patients undergoing segmentectomy without frozen section: a multicenter retrospective cohort study. *Surg. Endosc.* **39**, 2296–2303. https://doi.org/10.1007/s00464-025-11612-9 (2025).
6. National Comprehensive Cancer Network. NCCN Clinical Practice Guidelines in Oncology: non-small cell lung cancer. Version 4.2025. Plymouth Meeting, PA: NCCN. https://www.nccn.org/professionals/physician_gls/pdf/nscl.pdf. Accessed July n.d. (2025). https://doi.org/10.1016/j.med.2025.03.002
7. Watanabe, T. et al. Tips and tricks of uniportal video-assisted thoracoscopic surgery complex segmentectomy. *J. Vis. Surg.* **11**, 0–2. https://doi.org/10.21037/jovs-25-8 (2025).
8. De'Angelis, N. et al. Educational value of surgical videos on youtube: quality assessment of laparoscopic appendectomy videos by senior surgeons vs. novice trainees. *World J. Emerg. Surg.* **14**, 1–11. https://doi.org/10.1186/s13017-019-0241-6 (2019).
9. Gorgy, A. et al. Evaluating the educational quality of surgical YouTube® videos: a systematic review. *Health Sci. Rev.* **5**, 100067. https://doi.org/10.1016/j.hsr.2022.100067 (2022).
10. El-mahrouk, M. et al. YouTube for surgical training and education in donor nephrectomy: friend or foe? (2025). https://doi.org/10.1177/23821205241301552
11. Irani, S. & Nasirmohtaram, S. Evaluation of the quality of educational YouTube videos on endoscopic choanal Atresia. *J. Rhinol.* **32**, 36–39. https://doi.org/10.18787/jr.2024.00037 (2025).
12. Balta, C., Kuzucuoğlu, M. & Can Karacaoglu, I. Evaluation of YouTube videos in video-assisted thoracoscopic pulmonary lobectomy education. *J. Laparoendosc. Adv. Surg. Technol.* **30**, 1223–1230. https://doi.org/10.1089/lap.2020.0140 (2020).
13. Chen, Z. et al. Estimating the quality of YouTube videos on pulmonary lobectomy. *J. Thorac. Dis.* **11**, 4000–4004. https://doi.org/10.21037/jtd.2019.08.81 (2019).
14. Schober, P., Boer, C. & Schwarte, L. A. Correlation coefficients: appropriate use and interpretation. *Anesth. Analg.* **126**(5), 1763–1768 (2018).
15. Celentano, V. et al. Development and validation of a recommended checklist for assessment of surgical videos quality: the laparoscopic surgery video educational guidelines (LAP-VEGaS) video assessment tool. *Surg. Endosc.* **35**, 1362–1369. https://doi.org/10.1007/s00464-020-07517-4 (2021).
16. Macleod, M. G. et al. YouTube as an information source for femoroacetabular impingement: a systematic review of video content. *Arthrosc. J. Arthrosc. Relat. Surg.* **31**, 136–142. https://doi.org/10.1016/j.arthro.2014.06.009 (2015).
17. Strasberg, S. M., Hertl, M. & Soper, N. J. An analysis of the problem of biliary injury during laparoscopic cholecystectomy. *J. Am. Coll. Surg.* **180**, 101–125 (1995).
18. Silberg, W. M., Lundberg, G. D. & Musacchio, R. A. Assessing, controlling, and assuring the quality of medical information on the internet: caveant lector et viewor—let the reader and viewer beware. *JAMA* **277**, 1244–1245. https://doi.org/10.1001/jama.1997.03540390074039 (1997).
19. Bernard, A. et al. A systematic review of patient inflammatory bowel disease information resources on the world wide web. *Am. J. Gastroenterol.* **102**(9), 2070–2077 (2007).

20. Ferhatoglu, M. F., Kartal, A., Ekici, U. & Gurkan, A. Evaluation of the reliability, utility, and quality of the information in sleeve gastrectomy videos shared on open access video sharing platform YouTube. *Obes. Surg.* **29**, 1477–1484. https://doi.org/10.1007/s11695-019-03738-2 (2019).
21. Coşgun, T. & Tezel, Ç. T. D. Are YouTube videos useful in robot-assisted segmentectomy education? *Thorac. Cardiovasc. Surg.* **73**, 325–330. https://doi.org/10.1055/a-2513-9522 (2025).
22. Halloran, S. et al. YouTube videos contain poor and biased thoracic surgery educational content. *Surg. Pract. Sci.* **11**, 100133. https://doi.org/10.1016/j.sipas.2022.100133 (2022).
23. Chavira, A. M. et al. The educational quality of the critical view of safety in videos on YouTube® versus specialized platforms: which is better? Critical view of safety in virtual resources. *Surg. Endosc.* **36**, 337–345. https://doi.org/10.1007/s00464-021-08286-4 (2022).

Author contributions

NCY and AG conducted the video search, data extraction, and preliminary analysis. MO contributed to study conception, design, statistical analysis, and critical revision of the manuscript. NCY drafted the initial version of the manuscript. AG assisted in data interpretation and manuscript editing. All authors read and approved the final version of the manuscript.

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Declarations

Competing interests

The authors declare no competing interests.

Ethics approval and consent to participate

Not applicable. This study analyzed publicly accessible, anonymized data from YouTube and did not involve human participants.

Consent for publication

Not applicable. No individual person's data are included in this article.

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