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RESEARCH

Robotic ventral rectopexy videos on youtube: reliability of quality and educational value assessment among raters with different degrees of surgical experience

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Abstract

Purpose Robotic ventral rectopexy (RVR) has gained acceptance as a minimally invasive approach for treating rectal prolapse and rectocele. Although numerous surgical videos have been published, their educational quality remains underexplored. This study aimed to evaluate the overall quality, adherence to reporting guidelines, and educational value of the most-viewed RVR videos on YouTube, as rated by surgical trainees, fellows, and senior surgeons.

Methods The 25 most-viewed YouTube videos on RVR were selected and assessed for adherence to LAP-VEGaS and consensus reporting guidelines, overall quality, and educational value. Surgeons' performance was evaluated using the Global Evaluative Assessment of Robotic Skills (GEARS) scale. A Bayesian ordinal regression model analyzed factors influencing video quality and utility ratings.

Results Video quality and educational value varied significantly among viewer groups. Only 40% of videos underwent peer review before publication. Adherence to reporting guidelines was low (median conformity rate: 13.5%-16.7%). Inter-rater reliability differed across GEARS domains, with senior surgeons rating video quality and utility more critically than trainees and fellows. Videos with more likes and shorter online duration were more likely to be rated as high-quality.

Conclusions Online surgical videos on RVR offer easily accessible but potentially unreliable educational resources and exhibit significant variability in quality and guideline adherence. Structured, peer-reviewed video-based educational programs and standardized reporting practices are crucial for improving the educational impact of online surgical videos.

Keywords Robotic rectopexy · Ventral rectopexy · Educational videos · YouTube · Surgical videos

Background

Robotic surgery has rapidly expanded across various surgical fields, including oncological and non-oncological procedures [1–4]. This minimally invasive approach has recently been adopted for ventral rectopexy to treat rectal prolapse and rectocele [5–9]. While it appears to be a valuable alternative to laparoscopy or open surgery, robotic surgery demands specialized training and advanced surgical skills [10–12]. Surgeons increasingly rely on surgical videos for education and training across various specialties [13–15]. These are most of the time available online, with YouTube being one of the accessed sources. However, the effectiveness of these videos as learning tools depends on their quality and may be influenced by the viewer's surgical experience, potentially hindering the ability to discern critical steps or accurately evaluate surgical techniques [16, 17]. Furthermore, the lack of peer review or quality control for most online surgical videos raises concerns about their educational value and the potential for disseminating substandard practices [18, 19].

Given the recent adoption of robotic ventral rectopexy (RVR) and the lack of studies evaluating the quality of related educational videos, this study aimed to assess and compare how surgical residents, fellows, and senior surgeons rate the quality of the 25 most viewed RVR videos available on YouTube.

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Extended author information available on the last page of the article

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Methods

Study design

A video search was conducted on YouTube (https://www.youtube.com) on October 12th, 2024, using the search term"robotic rectopexy". Videos were sorted by view count and the following inclusion criteria were applied: (1) uploaded between 2012 and 2024; (2) created by medical professionals or for a professional audience; (3) presented in English; (4) depicted a live surgery recorded using a robotic camera; (5) focused on a single rectopexy procedure (excluding animations, schematics, or multiple procedures) performed on adult patients (aged ≥ 18 years); and (6) involved a robotic multiport abdominal rectopexy. Ethical approval was not required as the study focused on publicly available surgical videos.

Evaluation of video quality

Each selected video was evaluated for the following variables: (i) video characteristics; (ii) surgeon performance using the Global Evaluative Assessment of Robotic Skills (GEARS) scale [20, 21]; (iii) procedural and technical aspects; (iv) overall video quality (image, text, and sound) and educational utility; and (v) adherence to the LAParoscopic Surgery Video Educational Guidelines (LAP-VEGaS) [22] and reporting guidelines for surgical videos with educational purposes [23]. Video characteristics included the country of origin, upload date, number of days online, number of views, likes, comments, and video length (minutes). The GEARS scale, which assesses depth perception, bimanual dexterity, efficiency, tissue handling, autonomy, and robotic control, was used to rate surgeon performance during the RVR on a 5-point Likert scale (1 = worst, 5 = best) [20, 21].

For procedural aspects, five key steps of RVR were assessed:

1) Peritoneal incision and presacral fascia isolation
2) J-shaped incision in the right pelvic peritoneum
3) Incision of Denonvilliers' fascia and the rectovaginal septum
4) Mesh fixation (if used) to the anterior rectal wall and/or posterior vaginal fornix and sacrum
5) Peritoneal closure

Documentation and rating of patient positioning and trocar placement were also performed if shown. Overall video quality was rated as good, moderate, or poor, based on image clarity, presence of descriptive text or audio commentary, and sound quality. The overall educational utility of each video for residents was also rated as good, moderate, or poor.

Metrics (ii), (iii), and (iv) were independently and blindly assessed by three general surgery residents (AM, VS, PC), three fully qualified fellows in digestive surgery (CAS, FM, VL), and three senior surgeons (> 100 laparoscopic/robotic surgeries) with expertise in minimally invasive rectopexy (NdeA, AS, VC). Adherence to the LAP-VEGaS guidelines (37 items) [22] and the consensus guidelines for reporting robotic surgery videos for educational purposes (36 items) [23] were evaluated by an independent examiner (AM).

Statistical Analysis

Descriptive statistics are presented as frequencies (n) and percentages (%) for categorical variables and as medians with interquartile ranges (IQR) for continuous variables. Inter-rater agreement among surgeons was assessed using Krippendorff's alpha (KF) for ordinal scores [24]. KF values were interpreted as follows: ≥ 0.8, strong; 0.6–0.8, moderate; 0.4–0.6, marginal; and < 0.4, poor inter-rater reliability [24].

A Bayesian ordinal regression model was developed to analyze video quality and utility for trainees. The dependent variable, overall video quality, was treated as an ordinal variable with levels of"poor,""moderate,"and"good."A cumulative logit link function was employed, suitable for ordered outcomes. Fixed effects included group (fellows, seniors, trainees), number of views, number of days the video was online until October 12, 2024, and number of likes. Random effects were included for evaluator-specific differences (id) and video assessment evaluation (video id) to account for hierarchical structures and individual variability. Weakly informative priors were used, with a normal (0, 2) prior for fixed effects and an exponential (2) prior for the standard deviations of random effects.

Bayesian inference was performed using Markov Chain Monte Carlo sampling, with 2000 total iterations per chain, including a 500-iteration warm-up period. Four chains were run in parallel to ensure a robust exploration of the posterior distribution. Model convergence was visually inspected using trace plots. Posterior estimates were summarized with 95% credible intervals (CrI), and Bayesian p-values (calculated as the proportion of the posterior distribution supporting the parameter's direction) were reported.

Analyses were conducted using R (version 4.3.2) [25] with the brms [26] and irr [27] packages.

Table 1 Characteristics of the 25 selected videos on robotic ventral rectopexy (ordered by number of visualizations on October 12, 2024)

N°	Title and URL	Views (N°)	Source	Country	Days online (N°)	Length (min)	Image Quality	Comments (N°)	Likes (N°)
1	ACPGBI 2018: Robotic Ventral Mesh Rectopexy https://www.youtube.com/watch?v=CPEs7hnNCLY	27332	Tertiary hospital	UK	2233	5.23	Good	7	145
2	Robotic rectopexy for full thickness rectal prolpase https://www.youtube.com/watch?v=GggG0pVOtYI	15020	Unknown	USA	1322	6.24	High	16	119
3	Robotic Ventral Mesh Rectopexy Technique for Rectal Intussusception with Rectocele https://www.youtube.com/watch?v=_−9YQWrq_50	6967	Tertiary hospital	Turkey	2700	3.59	Poor	Disabled	16
4	Robotic rectopexy for full thickness rectal prolpase https://www.youtube.com/watch?v=Ua69-WjnoEw	6176	Unknown	USA	1189	11.27	High	10	61
5	Robotic Rectopexy for Rectal Prolapse https://www.youtube.com/watch?v=5_l-k6qca_I&t=67s	6133	Unknown	USA	1739	6.58	High	2	47
6	Robotic Ventral Mesh Rectopexy https://www.youtube.com/watch?v=KBZAE_HfJlY	5919	Tertiary hospital	USA	2752	3.53	Poor	Disabled	14
7	Robotic Rectopexy for Rectal Prolapse https://www.youtube.com/watch?v=GP3qVCQnyJY	5708	Secondary hospital	USA	4111	5.22	Good	1	4
8	Robotic ventral rectopexy (RvR) for rectal prolapse and obstructive defecation-english https://www.youtube.com/watch?v=KEPEgu3f0sw	5093	Private hospital	Australia	2824	26.14	Good	Disabled	20
9	Robotic ventral mesh Rectopexy and sacrocolpopexy https://www.youtube.com/watch?v=V3OfmYRFlpc	5077	Tertiary hospital	USA	1038	10.55	High	Disabled	0
10	Robotic rectopexy—rectal prolpase. https://www.youtube.com/watch?v=IJfgUvxoTkM	4326	Unknown	USA	1133	9.28	High	10	42
11	Robotic sutured rectopexy for external full-thickness rectal prolapse https://www.youtube.com/watch?v=en0OilSPkwc	3393	Unknown	Unknown	1567	4.54	Good	0	26
12	Robotic ventral re-rectopexy for symptomatic rectocele recurrence A video vignette. https://www.youtube.com/watch?v=yLEwvEAJCto	2938	Tertiary hospital	Switzerland	1567	8.14	Good	0	15
13	Robotic Ventral Mesh Rectopexy for Rectal Prolapse https://www.youtube.com/watch?v=S1y6DE2bHf8	2695	Tertiary hospital	India	3254	9.58	Poor	1	13
14	Robotic mesh rectopexy for rectal prolapse: the Geneva technique https://www.youtube.com/watch?v=xw-_lL135ds	2659	Tertiary hospital	Switzerland	446	9.19	Poor	0	27
15	Robotic ventral rectopexy https://www.youtube.com/watch?v=3hlJ3S_g73s	2625	Tertiary hospital	Italy	3548	8.50	High	Disabled	5
16	Robotic Redo Mesh Rectopexy https://www.youtube.com/watch?v=uuDsT07YGMM	2530	Private hospital	India	4495	9.26	Poor	2	3
17	Robotic Proctopexy (rectal Prolapse) https://www.youtube.com/watch?v=bCJNRqgz8XA	1869	Unknown	USA	886	7.58	High	Disabled	38

Table 1 (continued)

N°	Title and URL	Views (N°)	Source	Country	Days online (N°)	Length (min)	Image Quality	Comments (N°)	Likes (N°)
18	Robotic Sacrocolpopexy with Rectopexy for Combined Treatment of Rectal and Pelvic Organ Prolapse https://www.youtube.com/watch?v=5jO6oqUo2d4	1654	Unknown	USA	3681	6.18	Poor	0	5
19	Robotic Proctopexy https://www.youtube.com/watch?v=XbAaPCDrmgA	1457	Unknown	USA	734	11.19	High	Disabled	26
20	A primary and a recurrent case of full rectal prolapse treated with robotic ventral mesh rectopexy https://www.youtube.com/watch?v=LQ-zgFrJdgE	1417	Tertiary hospital	UK	869	10.00	Good	0	11
21	Robotic suture rectopexy for complete rectal prolapse by dr. Sumanta Dei https://www.youtube.com/watch?v=DAmjM8d3jWI	1386	Private hospital	India	43	11.06	High	17	53
22	Robotic rectopexy for recurrent rectal prolapse. Previous Altemeire https://www.youtube.com/watch?v=O0FOj10w8CM	1369	Unknown	USA	957	8.31	High	Disabled	29
23	Robotic ventral rectopexy with folded single mesh (RvR-FSM) suspension for pelvic organ prolapse https://www.youtube.com/watch?v=nMEAyqBB7l0	1247	Tertiary hospital	Italy	794	5.13	Good	0	19
24	Doç. Dr. F Ayça Gültekin: Robotic Ventral Mesh Rectopexy: Technical Video https://www.youtube.com/watch?v=3AeEqPaVOIE	1077	Tertiary hospital	France	3605	5.45	Good	0	1
25	Robotic Ventral Rectopexy. Rectal prolapse-rectocele and obstructive defecation Dr Hector Valenzuela https://www.youtube.com/watch?v=WK8m6ZZR724	1080	Unknown	Mexico	1186	15.53	High	Disabled	9

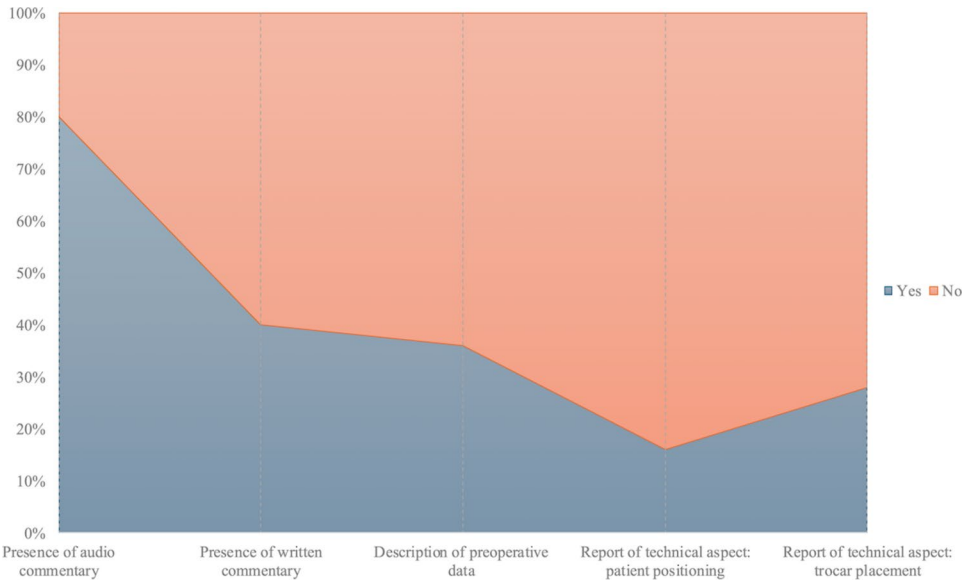


Fig. 1 Percentage of videos presenting educational content

Results

Video selection, characteristics, and technical aspects

The initial search of the YouTube channel yielded numerous videos on RVR. After sorting by view count, the 25 most-viewed original videos meeting the predefined selection criteria were included in this study. Their characteristics are summarized in Table 1. The majority of the videos (44%) originated from North America, followed by Europe (32%), Asia (12%), Central America (4%), and Oceania (4%). Sixty percent were produced by individual surgeons on private channels, while the remaining 40% were created by academic institutions (hospitals, journals, and scientific societies). The median time the videos had been online was 1946.9 days (range: 43–4495 days). The median duration was 8 min and 54 s (range: 3:53–26:14). The videos received a median of four comments (range: 0–17), though comments were disabled on 36% of them. They also garnered a median of 29.9 likes (range: 0–145); specific dislike counts are no longer provided by YouTube. Regarding video quality, 6 (24%) were rated as poor, 8 (32%) as good, and 11 (44%) as high definition. In terms of educational content, 20 (80%) included audio or written commentary, while 10 (40%) provided detailed case descriptions with preoperative data (Fig. 1). Only 16% described the technical aspects of the procedure, and 28% showed trocar placement (Fig. 1). Overall, only 10 (40%) videos underwent a standardized peer-review process before being published on a scientific journal platform.

Adherence to LAP-VEGaS and Consensus Guidelines for Reporting Robotic Surgery Videos

The 37 items of the LAP-VEGaS guidelines are reported in Table S1 (Supplementary Materials). Adherence to the LAP-VEGaS guidelines was generally low, with a median conformity rate of 13.5% (IQR: 8.1). The highest levels of adherence were observed in videos #1, 8, 12, 14, and 24, reaching the highest conformity of 21.6%.

The 36 items of the consensus guidelines on how to report robotic surgery videos for educational purposes are reported in Table S2 (Supplementary Materials). The median conformity rate was 16.7% (IQR: 13.9). The highest levels of adherence were observed in videos #1, 3, 8, 9, 12, 14, and 24, reaching at most 22.2%.

GEARS assessment

Detailed GEARS assessments are reported in Table 2. KF indicated poor agreement among trainees, fellows, and seniors in the domains of force control (KF = 0.32), tissue handling (KF = 0.37), autonomy (KF = 0.12), and robot control (KF = 0.42). Marginal agreement was observed in the domains of depth perception (KF = 0.48), bimanual skill (KF = 0.56), and efficiency (KF = 0.52).

Video quality

Regarding overall video quality, only four videos (16%) received unanimous agreement from all raters (all raters evaluated videos #8, 16, 18, and 24 as poor quality). Results are displayed in Table 3. Overall video quality was scored as good (3 points), moderate (2 points), or poor (1 point).

Table 2 GEARS assessment of the 25 selected videos on robotic rectopexy

	Depth perception			Bimanual skill			Efficiency			Force control			Tissue handling			Autonomy			Robot control		
N°	trainees	fellows	seniors	trainees	fellows	seniors	trainees	fellows	seniors	trainees	fellows	seniors	trainees	fellows	seniors	trainees	fellows	seniors	trainees	fellows	seniors
1	4 (0.5)	4 (1)	3 (1)	3 (0.5)	4 (1)	3 (1)	4 (0.5)	4 (1)	3 (1)	3 (0)	4 (1)	3 (1)	3 (0)	4 (1)	3 (1)	5 (0.5)	5 (0.5)	3 (1)	4 (0.5)	5 (1)	4 (0.5)
2	5 (1)	5 (0)	5 (0.5)	5 (1)	5 (0)	5 (0.5)	5 (0.5)	5 (0.5)	5 (0.5)	4 (1)	5 (0.5)	4 (0)	4 (1)	4 (0)	4 (0.5)	5 (0.5)	5 (0)	4 (0)	4 (1)	5 (0)	4 (0)
3	3 (0.5)	4 (1)	4 (0.5)	3 (0.5)	3 (0.5)	3 (0.5)	3 (0.5)	3 (0.5)	3 (0.5)	3 (0)	3 (0.5)	3 (0.5)	3 (0.5)	3 (0)	3 (0.5)	4 (0.5)	5 (1)	3 (0.5)	3 (0)	3 (0.5)	3 (0.5)
4	5 (0)	4 (0.5)	5 (0.5)	5 (0)	4 (0.5)	5 (0.5)	4 (0.5)	3 (1)	5 (0.5)	4 (1)	4 (0.5)	5 (0.5)	4 (1)	4 (1)	5 (0.5)	5 (0)	5 (0)	5 (0.5)	4 (0.5)	5 (0.5)	5 (0.5)
5	5 (1)	4 (0)	4 (0)	5 (1)	4 (0)	3 (0.5)	4 (0.5)	4 (0)	4 (0)	4 (0.5)	4 (0)	4 (0)	4 (0.5)	3 (0.5)	3 (0.5)	5 (0.5)	5 (0.5)	4 (0)	4 (1)	4 (0.5)	4 (0)
6	2 (0.5)	2 (1)	2 (0)	3 (0.5)	2 (0)	3 (0.5)	2 (0.5)	2 (0)	3 (0.5)	3 (0)	2 (0.5)	2 (0.5)	3 (0.5)	2 (0.5)	3 (0.5)	4 (0.5)	5 (1.5)	3 (0.5)	3 (1)	2 (0.5)	3 (0.5)
7	1 (0.5)	2 (0)	2 (0)	1 (0.5)	2 (0)	2 (0)	1 (0.5)	2 (0.5)	2 (0)	2 (0.5)	2 (0)	3 (0.5)	2 (0)	2 (0.5)	3 (0.5)	3 (0.5)	5 (1.5)	2 (0)	2 (1)	2 (0)	2 (0.5)
8	3 (1)	3 (0.5)	3 (0)	3 (0.5)	4 (1)	3 (0.5)	3 (1)	3 (0.5)	2 (0)	2 (0.5)	2 (0.5)	3 (0.5)	3 (0.5)	2 (0.5)	2 (0)	4 (0.5)	5 (1.5)	2 (0)	3 (0.5)	1 (0.5)	2 (0.5)
9	4 (0.5)	5 (1)	3 (0.5)	4 (0.5)	4 (0.5)	3 (0.5)	4 (0)	4 (0)	3 (0.5)	4 (0.5)	4 (0)	2 (1)	4 (0.5)	4 (0)	3 (0.5)	5 (0.5)	5 (1)	3 (0.5)	4 (0.5)	4 (0.5)	3 (0.5)
10	5 (1)	4 (0)	3 (0.5)	5 (0.5)	4 (0)	3 (0.5)	5 (1)	4 (0)	3 (0.5)	4 (0.5)	4 (0.5)	2 (1)	3 (0.5)	3 (0.5)	2 (1)	5 (0.5)	5 (0)	3 (0.5)	3 (1.5)	3 (0.5)	3 (0.5)
11	3 (0)	4 (0.5)	2 (1)	3 (0.5)	3 (0.5)	2 (0.5)	3 (1)	4 (0.5)	2 (0.5)	3 (0.5)	3 (1)	3 (0)	3 (0.5)	3 (1)	2 (0.5)	3 (0.5)	5 (1)	2 (0.5)	3 (0.5)	3 (0.5)	3 (0)
12	2 (1)	4 (0.5)	2 (1)	3 (1)	3 (0)	3 (0.5)	3 (0.5)	3 (0.5)	3 (0.5)	4 (1)	3 (0.5)	4 (0)	4 (1)	3 (0.5)	3 (0.5)	4 (0.5)	5 (0.5)	3 (0.5)	4 (1)	3 (0.5)	3 (0.5)
13	2 (0.5)	3 (0.5)	2 (0.5)	2 (0.5)	2 (0.5)	2 (0)	1 (0.5)	2 (1)	1 (0.5)	2 (1)	3 (0.5)	2 (0.5)	2 (1.5)	3 (1)	2 (0.5)	3 (0.5)	5 (1.5)	1 (1)	1 (0.5)	4 (1.5)	2 (0.5)
14	4 (1)	4 (1)	3 (0.5)	4 (1)	4 (1.5)	3 (0.5)	2 (1.5)	4 (0.5)	3 (0.5)	3 (1.5)	3 (1)	3 (0.5)	3 (1.5)	4 (1)	3 (0.5)	5 (1)	5 (1)	3 (0.5)	5 (1)	4 (1)	3 (0.5)
15	3 (0.5)	3 (1)	3 (1)	3 (0)	3 (0.5)	3 (0)	3 (0.5)	3 (0)	2 (1)	4 (1)	3 (0)	3 (0)	4 (1)	3 (0)	3 (0)	4 (0.5)	5 (1)	3 (0)	3 (0.5)	3 (0.5)	3 (0.5)
16	2 (1)	2 (1)	2 (0)	1 (0.5)	2 (0.5)	1 (0.5)	1 (0.5)	2 (0)	2 (0)	2 (1)	2 (0.5)	3 (1)	1 (1.5)	2 (0.5)	1 (0.5)	3 (1)	5 (2)	2 (0.5)	1 (0.5)	1 (0.5)	2 (0.5)
17	5 (0)	4 (0)	3 (0.5)	5 (0.5)	4 (0.5)	3 (0.5)	5 (0.5)	4 (0.5)	3 (0.5)	4 (0.5)	4 (1)	2 (1)	5 (0.5)	5 (0.5)	3 (0.5)	5 (0)	5 (0)	3 (0.5)	5 (0)	4 (0.5)	3 (0)
18	3 (0.5)	2 (0.5)	2 (0.5)	3 (0)	2 (0)	2 (0.5)	3 (0.5)	2 (0.5)	3 (0.5)	3 (1)	1 (0)	2 (1)	2 (0.5)	1 (0)	2 (0.5)	4 (0)	5 (1)	2 (0.5)	3 (0.5)	1 (0.5)	2 (0.5)
19	5 (0.5)	4 (0.5)	2 (1)	5 (0.5)	4 (0)	3 (0.5)	5 (1)	4 (0)	3 (1)	5 (0.5)	4 (1)	2 (1)	4 (1)	4 (0.5)	2 (1)	5 (0.5)	5 (0.5)	3 (0.5)	5 (0.5)	4 (0.5)	3 (0.5)
20	4 (0)	4 (0.5)	3 (0.5)	4 (0.5)	3 (0.5)	2 (1)	3 (0.5)	3 (0)	2 (1)	3 (0.5)	3 (0)	2 (1)	3 (1)	3 (0.5)	2 (1)	5 (0.5)	5 (0.5)	2 (1)	4 (0.5)	3 (1)	2 (1)
21	4 (1)	4 (0.5)	2 (1)	4 (0.5)	4 (0.5)	3 (0.5)	4 (0.5)	4 (0.5)	3 (0.5)	4 (0)	4 (0.5)	3 (0.5)	4 (0)	4 (0.5)	2 (1)	5 (0.5)	5 (1)	3 (0.5)	4 (0.5)	4 (1.5)	2 (1)
22	5 (1)	4 (0)	2 (1)	5 (1)	4 (0.5)	3 (0.5)	5 (1)	4 (0)	2 (1)	5 (0.5)	4 (0.5)	2 (1)	4 (0.5)	4 (0)	2 (1)	5 (0.5)	5 (0.5)	2 (1)	5 (0.5)	4 (0.5)	2 (1)
23	3 (1)	3 (0.5)	2 (1)	3 (1)	3 (0.5)	2 (1.5)	2 (1)	3 (0.5)	3 (1)	4 (0.5)	4 (0)	2 (1)	4 (0.5)	3 (0.5)	2 (0.5)	4 (0.5)	5 (0.5)	2 (0.5)	4 (0.5)	3 (0.5)	2 (0.5)
24	3 (0.5)	3 (0.5)	2 (0.5)	2 (0.5)	3 (0)	2 (0.5)	3 (0.5)	3 (0.5)	3 (0)	3 (1)	3 (1)	2 (0.5)	3 (1)	3 (0.5)	2 (0.5)	4 (0.5)	5 (1)	2 (0.5)	3 (0.5)	3 (0.5)	2 (1)
25	4 (0.5)	3 (0)	3 (0.5)	3 (1)	3 (0.5)	2 (1)	4 (0.5)	3 (1)	2 (0.5)	3 (0.5)	2 (0.5)	2 (1)	3 (0.5)	3 (0.5)	2 (0.5)	4 (1)	5 (1)	2 (0.5)	3 (1)	3 (1)	2 (0.5)
KF	0.48 (0.33–0.66)			0.56 (0.41–0.73)			0.52 (0.37–0.7)			0.32 (0.19–9.51)			0.37 (0.23–0.56)			0.12 (0.03–0.28)			0.42 (0.27–0.61)		

Data are presented as medians and interquartiles

KF stands for Krippendorff's alpha

Table 3 Overall video quality assessment (good, moderate, or poor)

Video N°	General Surgery Trainees			Fully Qualified Fellows			Senior Surgeons		
	Examiner 1	Examiner 2	Examiner 3	Examiner 5	Examiner 6	Examiner 7	Examiner 8	Examiner 9	Examiner 10
1	Good	Moderate	Poor	Moderate	Good	Good	Moderate	Moderate	Moderate
2	Good	Moderate	Moderate	Good	Moderate	Good	Good	Good	Good
3	Moderate	Poor	Poor	Poor	Moderate	Moderate	Moderate	Moderate	Moderate
4	Good	Good	Good	Good	Moderate	Moderate	Good	Good	Good
5	Moderate	Moderate	Good	Good	Moderate	Moderate	Moderate	Moderate	Moderate
6	Poor	Moderate	Poor	Poor	Poor	Poor	Poor	Poor	Poor
7	Poor	Moderate	Moderate	Poor	Poor	Poor	Poor	Poor	Poor
8	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor
9	Moderate	Good	Moderate	Good	Good	Good	Moderate	Moderate	Moderate
10	Good	Moderate	Good	Good	Moderate	Moderate	Moderate	Moderate	Moderate
11	Poor	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
12	Moderate	Good	Moderate	Good	Good	Moderate	Moderate	Moderate	Moderate
13	Poor	Moderate	Moderate	Poor	Moderate	Poor	Poor	Poor	Poor
14	Moderate	Good	Good	Moderate	Good	Good	Moderate	Moderate	Moderate
15	Moderate	Moderate	Poor	Moderate	Moderate	Poor	Moderate	Moderate	Moderate
16	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor
17	Good	Good	Good	Good	Good	Good	Moderate	Moderate	Moderate
18	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor
19	Good	Good	Moderate	Good	Good	Good	Moderate	Moderate	Moderate
20	Moderate	Good	Moderate	Good	Moderate	Moderate	Moderate	Moderate	Moderate
21	Good	Good	Good	Moderate	Good	Good	Moderate	Moderate	Moderate
22	Good	Good	Moderate	Moderate	Moderate	Good	Poor	Poor	Poor
23	Moderate	Good	Poor	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
24	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor
25	Moderate	Good	Good	Moderate	Poor	Moderate	Poor	Poor	Poor
KF	0.55 (0.3–0.74)			0.71 (0.52–0.84)			1 (1–1)		

The overall video quality was scored as good (3 points), moderate (2 points) or poor (1 point). KF, Krippendorff's alpha

Inter-rater reliability was highest among senior surgeons (25/25 videos [100%] received equivalent ratings from all three examiners, KF = 1), followed by fellows (11/25 videos [44%], KF = 0.71) and trainees (6/25 videos [24%], KF = 0.55).

Based solely on the assessments of senior surgeons, the selected videos were divided into two groups: moderate/good quality (n = 16) and poor quality (n = 9). The number of days online, number of likes, and median GEARS score were significantly associated with good/moderate video quality (Table 4).

Table 5 shows the results of the Bayesian model used to profile perceived video quality. Both fellows and trainees demonstrated a significantly higher probability of perceiving videos as high-quality (Table 5, Panel A). The model revealed that perceived video quality decreased slightly with increasing days online. However, other engagement metrics, such as the number of likes or views, did not exhibit a significant relationship with quality. The figure in Table 5, Panel B, highlights distinct differences in how videos are perceived by seniors, fellows, and trainees, with senior surgeons tending to rate video quality lower.

Video utility for trainees

Table 6 reports the Bayesian model findings concerning perceived video utility for trainees. Fellows and trainees had a higher probability of perceiving videos as having high utility (Table 6, Panel A). The probability of being perceived as high-utility decreased with increasing days online. Senior surgeons had a higher probability of rating videos as having low utility (Table 6, Panel B). Trace plots for both Bayesian models demonstrated suitable convergence, showing no specific patterns (Figure S1, Supplementary Materials).

Table 4 Factors associated with overall video quality

	Moderate/Good Quality Videos ($n = 16$)	Poor Quality Videos ($n = 9$)	p value binary logistic regression	Odds ratio
Visualizations [median(range)]	31.700 (17.700–61.400)	25.300 (13.700–50.900)	0.213	0.98 (0.95–1.02)
Days online [median(range)]	3.18 (2.33–4.41)	8.91 (7.53–10.1)	**0.004**	1.63 (1.14–2.33)
Length (min) [median(range)]	8.32 (5.99–10.1)	6.18 (3.53–9.26)	0.258	0.99 (0.83–1.17)
Comments [median(range)]	2.00 (0.00–10.0)	1.00 (0.00–1.00)	0.407	0.75 (0.46–1.22)
Likes [median(range)]	26.5 (15.8–48.5)	9.00 (4.00–14.0)	**0.012**	0.91 (0.84–1.00)
GEARS score [median(range)]	20.0 (17.9–21.6)	15.0 (14.5–16.0)	**0.002**	0.55 (0.34–0.89)
Utility score*	7 (43.8)	8 (88.9)	0.116	NE
• **Poor**	8 (50)	1 (11.1)		
• **Moderate**	1 (6.25)	0 (0)		
• **Good**				
LAP-VEGaS conformity* [mean(SD)]	5.00 (4.00–7.00)	4.00 (4.00–6.00)	0.885	0.98 (0.66–1.45)
International multidisciplinary consensus statement by Celentano et al.* [mean(SD)]	6.00 (5.00–10.0)	5.00 (4.00–6.00)	0.316	0.86 (0.61–1.21)
Presence of audio commentary [n(%)]	14 (87.5%)	6 (66.7%)	0.312	0.31 (0.03–2.51)
Presence of written commentary [n(%)]	7 (43.8%)	3 (33.3%)	0.691	0.66 (0.10–3.69)
Description of preoperative data [n(%)]	5 (31.2%)	4 (44.4%)	0.671	1.72 (0.29–10.1)
Description of technical aspect: patient positioning [n(%)]	2 (12.5%)	2 (22.2%)	0.602	1.94 (0.17–22.1)
Description of technical aspect: trocar placement [n(%)]	4 (25.0%)	3 (33.3%)	0.673	1.48 (0.21–9.61)
Image quality	2 (12.5%)	4 (44.4%)	0.16	0.40 (0.04–3.48)[+]
• **Poor**	5 (31.2%)	3 (33.3%)		2.98 (0.32–37.4)[§]
• **Good**	9 (56.2%)	2 (22.2%)		
• **High definition**				

GEARS Global Evaluative Assessment of Robotic Skills, *LAP-VEGaS* Laparoscopic surgery video educational guidelines, *NE* not estimable

[*] Calculated on the mean/mode of the 3 senior surgeons' assessment

[+] High definition versus good image quality

[§] Poor versus good image quality

Discussion

This study analyzed the quality and educational value of RVR videos available on YouTube, a widely used platform for surgical education. Our findings reveal significant variability in terms of video quality and perceived educational value among different viewer groups (trainees, fellows, and senior surgeons), as well as in adherence to reporting guidelines. These results align with previous research that demonstrated significant heterogeneity in the quality of educational surgical videos available online, particularly those that lacked peer review or standardized evaluation criteria [18, 28, 29].

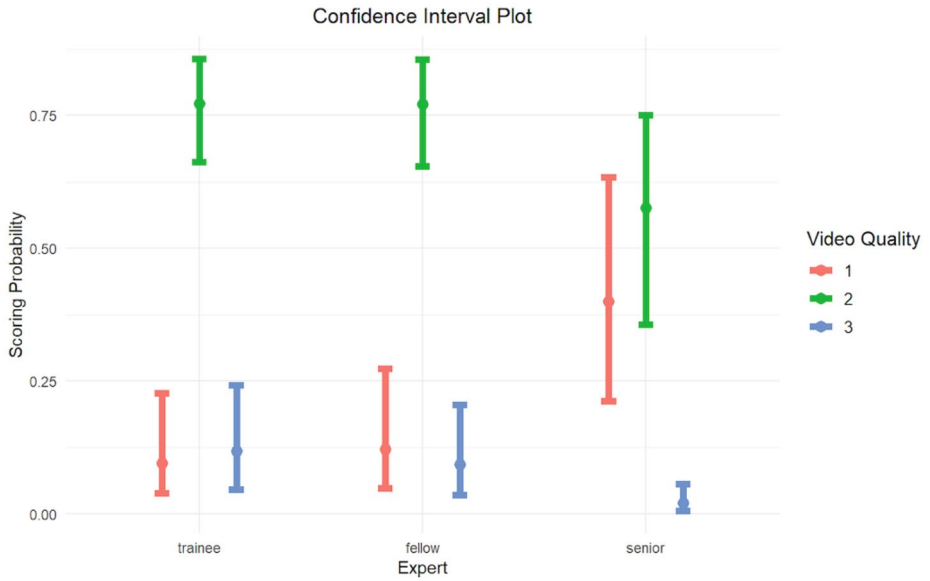
The discrepancy in perceived video quality and utility between senior surgeons and trainees/fellows is a noteworthy finding. Senior surgeons were more critical in their evaluations, often rating videos lower in quality and educational utility compared to less experienced viewers. This suggests that trainees and fellows may be less capable of discerning when assessing online educational resources, leading them to potentially adopt suboptimal techniques or develop misconceptions. The variability in video quality observed in this study is consistent with studies reporting that a lack of standardization significantly impacts on the educational value of surgical videos [29, 30]. Our data revealed that senior surgeons rated videos more critically, which aligns with studies demonstrating that experienced surgeons prioritize technical accuracy and adherence to best practices over production quality [31]. Furthermore, our analysis revealed a negative correlation between the time a video remained online and its perceived quality and utility. This might be attributed to several factors, including advancements in surgical techniques and technology over time, rendering older videos less relevant or even outdated. It is also possible that newer videos benefit from improved production quality and a greater awareness of educational principles among creators.

Table 5 Bayesian Model for Video Quality

Panel A. Model video quality

Effect	OR	lower	upper	P Bayesian
Fellow vs. senior	4.83	2.15	11.1	**<0.001**
Trainee vs. senior	6.26	2.83	15.13	**<0.001**
Number of visualizations	1.00	0.99	1.00	0.31
Number of day online	0.997	0.996	0.998	**<0.001**
Number of like	1.01	0.96	1.07	0.30

Panel B. Predicted probabilities of video quality



The overall video quality was scored as good (3 points), moderate (2 points) or poor (1 points). Significant p values are highlighted in bold

GEARS were developed as a standardized tool to objectively evaluate the technical proficiency and cognitive skill set of robotic surgeons, providing a robust framework for assessing various domains of surgical performance, such as depth perception, bimanual dexterity, efficiency, force sensitivity, and autonomy [20, 21, 32]. Nevertheless, the limited agreement among trainees, fellows, and senior surgeons on several GEARS domains in our study underscores the inherent subjectivity in assessing surgical skills, even when using standardized tools. This observation stresses the importance of incorporating formal video-based education curricula into surgical training programs, providing trainees and fellows with standardized skills to evaluate online content critically and mitigating the risks of adopting suboptimal or unsafe techniques.

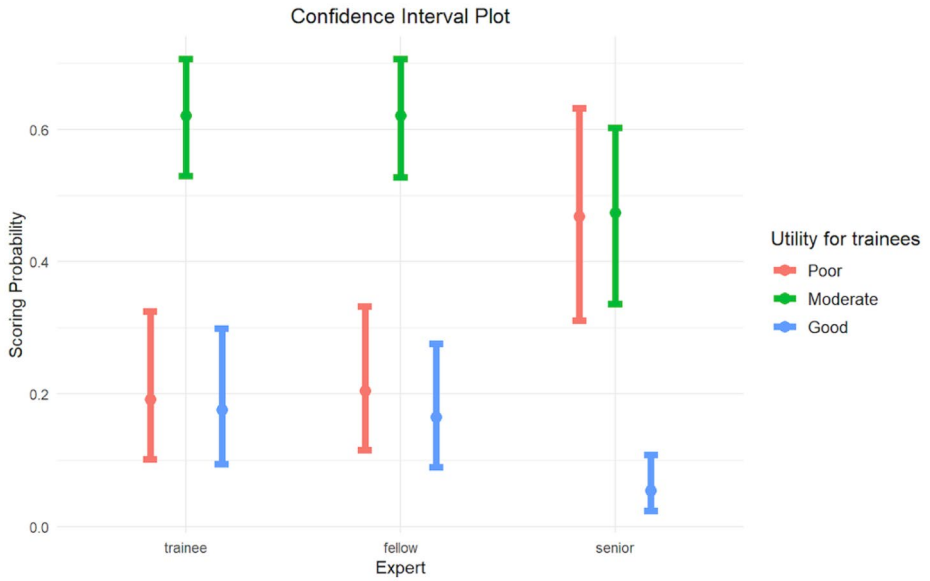
Given the visual nature of surgery, videos are particularly beneficial for laparoscopic and robotic surgery training by providing direct insights into surgical perspectives, anatomical structures, and procedural steps. This represents a valuable tool at all professional career levels, from residents and trainees to consultant surgeons. YouTube is a widely used platform for accessing surgical videos due to its free and readily available content [14, 31, 33–36]. However, videos are often ranked by popularity and view counts rather than educational merit, increasing the risk of exposure to suboptimal techniques or safety breaches. The lack of peer-reviewed content among the most-viewed videos is concerning, particularly as YouTube remains a widely accessed platform for surgical education. Several authors highlighted that the overall quality of YouTube videos is generally acceptable, but the reliability and educational value are often lacking, especially among the most popular content [17–19, 30, 37]. Our study found that only four out of ten (40%) videos underwent a standardized peer-review process before their publication on YouTube. This highlights a notable gap in implementing rigorous quality control measures for video-based scientific content and the need for robust peer review processes and institutional oversight in maintaining the educational integrity of surgical videos [28]. Initiatives like the INtraoperative Video-Enhanced

Table 6 Bayesian model for Video Utility for trainees

Panel A. Model video utility for trainees

Effect	OR	lower	upper	P Bayesian
Fellow vs. senior	3.44	1.78	6.81	**<0.001**
Trainee vs. senior	3.73	1.85	7.6	**<0.001**
Number of visualizations	1.00	0.99	1.00	0.12
Number of day online	0.99	0.998	0.999	**<0.001**
Number of like	0.99	0.96	1.03	0.34

Panel B. Predicted probabilities of video utility for trainees



The overall video quality was scored as good (3 points), moderate (2 points) or poor (1 points). Significant p values are highlighted in bold

Surgical Training (INVEST) program have shown promise in improving technical skills through structured video-based learning [38]. Indeed, van Det et al. demonstrated that structured intraoperative video-based coaching improved surgical performance and skills during the early learning phase of laparoscopic cholecystectomy [38]. Moreover, Crisostomo-Wynne et al. compared the most popular videos of robotic prostatectomy on YouTube with two professionally curated sources, namely the American Urologic Association (AUA) Surgical Video library and the DaVinci Surgical Community (DVS) using the GEARS criteria for assessing surgical quality [39]. The overall GEARS scores showed no substantial difference between the YouTube videos and the AUA video library, whereas it had significantly higher scores than the DVS videos.

The LAP-VEGaS and Consensus Guidelines for Reporting Robotic Surgery Videos have been introduced to standardize the reporting of laparoscopic and robotic surgery videos for educational purposes, to improve video quality, and to ensure consistent evaluation among surgeons with varying levels of experience [22, 23]. The generally low adherence to the LAP-VEGaS [22] and consensus guidelines for reporting robotic surgery videos [23] in our study is relevant. Only a small proportion of videos met a reasonable threshold of conformity with these guidelines, highlighting a need for greater awareness and implementation of standardized reporting in surgical video production. This finding mirrors trends seen in previous studies that have documented suboptimal reporting quality in online surgical videos across various specialties [17, 30]. This shortfall highlights the necessity of increasing awareness and implementation of these guidelines among content creators to ensure video quality and educational value [18, 23, 35].

Limitations

This study has several limitations. First, the video search and evaluation were limited to YouTube, and thus the findings cannot be generalized to all surgical videos available online. Not exploring other video sources may have potentially

excluded other relevant videos on RVR hosted on other platforms, whose quality and educational value remain to be investigated. Then, the assessment of educational utility was based on subjective ratings, albeit from experts, fellows, and trainees.

Conclusion

In conclusion, this study highlights that the overall quality and educational value of the most viewed videos on RVR available on YouTube are highly variable. Online videos represent an easily accessible but potentially unreliable resource for surgical education, particularly on platforms like YouTube. Thus, caution is warranted when using these videos for self-learning, especially among trainees, fellows, and inexperienced surgeons. There is a compelling need for greater adherence to standardized reporting guidelines and formal peer-review mechanisms to improve the educational value and ensure safe surgical practice. Structured video-based education programs and the development of more objective assessment tools can help mitigate these challenges and ensure that online resources effectively contribute to surgical training and ultimately, patient safety. Future research should focus on developing and validating tools to improve the quality of online surgical videos and enhance their educational value.

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Declarations

Competing interests The authors declare no competing interests.

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