

National Survey of Spanish Gynecologic Surgeons Regarding the Clinical, Educational and Professional Impact of Robotic Surgery

Sara García-Álvarez

Universitat de València

Santiago Domingo

Hospital Universitari i Politècnic La Fe

Alberto Muñoz

Marqués de Valdecilla University Hospital

Sergi Fernández-González

Bellvitge University Hospital

Anna Torrent

Hospital Universitario Son Espases

Laura Cánovas

Hospital Universitario Virgen de la Arrixaca

Jordi Ponce

Bellvitge University Hospital

Víctor Lago

victor.lago.leal@hotmail.com

Hospital Universitari i Politècnic La Fe

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Abstract

Background

Robotic surgery is reshaping minimally invasive gynecology; however, systematic characterisation of how Spanish gynecologists perceive its clinical, educational, and professional implications has been lacking. We aimed to describe these perceptions and identify training gaps and professional attitudes in this national surgical community.

Methods

A cross-sectional anonymous online survey was distributed in November 2025 by GERGIN (Grupo Español de Robótica Ginecológica), a working group of the Spanish Society of Obstetrics and Gynaecology (SEGO), to all 120 registered members. Two thematic blocks were analysed: (1) professional profile and surgical activity (items 1–10); and (2) clinical, educational, and professional impact (items 11–22), assessed with 7-point Likert scales and categorical responses. Descriptive statistics were applied. Minimum required sample: 83 valid responses (95% CI, $\pm 6\%$ margin); the 82 responses obtained correspond to a $\pm 6.1\%$ margin. The study is reported according to the CHERRIES checklist.

Results

Of 120 eligible members, 82 responded (68.3%). The cohort was gender-balanced (50% female), mean age 44.7 ± 7.9 years, 44.4% with more than five years of robotic experience, 42.7% having performed more than 100 cases. Da Vinci Xi was used by 98.8%. Patient recovery benefit was rated positively (mean 5.20/7; 76.8% ≥ 5). Near-unanimous consensus endorsed clear ergonomic improvement (98.8%). A dichotomy emerged in training: robotic surgery enhanced anatomical education (mean 5.07/7) but reduced residents' intraoperative exposure (mean 2.66/7) and did not accelerate the learning curve (mean 2.44/7). Cost (80.5%) and OR availability (70.7%) were the dominant perceived limitations.

Conclusions

Spanish gynecologists endorse robotic surgery's clinical and ergonomic benefits while recognising an educational paradox: anatomical teaching improves but operative exposure for trainees is reduced. Structured robotic residency curricula, dual-console availability, and simulation-based competency frameworks are urgently needed.

Introduction

Robotic-assisted surgery has emerged as one of the most transformative developments in minimally invasive gynecology over the past two decades. Platforms such as the da Vinci Surgical System (Intuitive Surgical, Sunnyvale, CA) integrate three-dimensional high-definition optics, articulated instruments with seven degrees of freedom, tremor filtration, and an ergonomic console that substantially reduces physical strain compared with conventional laparoscopy [1–3]. These properties have driven rapid diffusion in gynecologic oncology, where the technical demands of radical hysterectomy, staging lymphadenectomy, and cytoreductive surgery benefit most from enhanced dexterity and visualisation.

In Spain, the implementation of robotic gynecological surgery has evolved rapidly over the past two decades. Its adoption has been primarily driven by regional healthcare policies and investment decisions made by the autonomous communities, leading to heterogeneous implementation across the country. During this period, GERGIN (Grupo Español de Robótica Ginecológica) has served as a collaborative professional network, promoting scientific exchange, training, and multicentre research rather than directing the national implementation of robotic surgery. Despite rapid growth in robotic programmes, systematic evidence on how Spanish gynecologists perceive the clinical benefit, professional implications, and educational consequences of robotic surgery has not previously been collected at a national level.

International evidence is heterogeneous. Minimally invasive approaches have been widely adopted and are associated with reduced surgical morbidity in endometrial cancer [4], with robotic assistance performing at least comparably to conventional laparoscopy in randomised data [6]; conversely, minimally invasive radical hysterectomy for cervical cancer was associated with inferior oncological outcomes [5]. Concerns have also been raised about procedural costs and the potential displacement of trainees from the operative field during robotic procedures. The console architecture inherent to robotic platforms effectively removes the trainee from the operating table during the robotic phase, potentially impairing the apprenticeship-based learning model of surgical residency [7, 8]. At the same time, enhanced visualisation and instrument control may offer unique pedagogical advantages in anatomical education and operative planning.

Understanding how experienced robotic gynecologists in Spain perceive these professional, clinical, and training dimensions is essential for informing workforce planning, designing adapted curricula, and guiding programme expansion decisions within the Spanish National Health System.

We conducted a national survey of GERGIN-affiliated gynecologists with specific objectives of characterising the professional profile of the robotic gynecology community, quantifying perceptions of clinical benefit for patients, evaluating ergonomic impact attitudes, and identifying perceived barriers to effective resident training in the robotic environment.

Materials and Methods

Study design and setting

A cross-sectional, observational, anonymous survey study was conducted in November 2025. GERGIN distributed the questionnaire to all 120 registered members via institutional email on 16 November 2025, with a follow-up reminder on 23 November 2025. The data collection window was two consecutive weeks.

Target population and eligibility criteria

Eligible participants were GERGIN-registered gynecologists actively practising robotic gynecological surgery in Spain. Inclusion criteria: (1) active specialist in gynecology with robotic surgical activity (benign or oncological); (2) users of at least one commercially available robotic platform; (3) practice in a Spanish public, private, or mixed-sector hospital. Exclusion criteria: obstetrics and gynaecology residents without autonomous operative activity, professionals not currently performing surgery, and incomplete questionnaires (> 30% missing items).

Sample size

Using a finite-population formula (Cochran 1977) with $N = 120$, $Z = 1.96$, $p = 0.50$, and $\pm 6\%$ margin of error, the minimum required sample was 83 valid responses [9]; the 82 valid responses obtained correspond to a margin of error of $\pm 6.1\%$.

Survey instrument

Block 1 (items 1–10) collected sociodemographic and professional data (age, gender, region, hospital sector, robotic experience, case volume, accredited surgeons per centre, robotic system, cases per session, primary subspecialty). Block 2 (items 11–22) assessed clinical, educational, and professional impact using 7-point Likert scales (1 = strongly disagree/minimum to 7 = strongly agree/maximum; for item 18, 1 = major impediment to 7 = clear facilitation of competency acquisition), categorical options, and multiple-choice formats.

Survey administration and reporting

Survey design and sampling frame. This was a closed, voluntary, self-administered web survey. The sampling frame was the complete GERGIN membership register ($N = 120$) as of November 2025; the questionnaire link was distributed only to registered members and was never published on a public website. Because every eligible member of the target population was invited, the study constitutes a census of the sampling frame rather than an open convenience sample; participation, however, was self-selected, so the responding sample is non-probabilistic.

Contact mode and advertising. Initial contact with potential participants was made exclusively over the Internet. Invitations were sent by institutional e-mail from the GERGIN secretariat on 16 November 2025 to all 120 registered members, with a single reminder on 23 November 2025 to all members. The survey was not announced or advertised on any website, social-media channel, banner, mailing list other than the GERGIN register, or offline medium. The verbatim text of the invitation and reminder e-mails and the full questionnaire are provided as Appendices S1 and S2.

Survey platform and context. The questionnaire was hosted on Google Forms and was completed through a web link embedded in the invitation e-mail; responses were captured automatically in the platform database, with no manual transcription of answers. The GERGIN register comprises gynecologists who have declared active robotic surgical practice; this frame therefore pre-selects surgeons already committed to the technology, which is expected to shift perceptions of clinical benefit and ergonomics in a favourable direction relative to the wider Spanish gynecological community.

Voluntariness, incentives, informed consent and data protection. Participation was entirely voluntary and was not a condition of any GERGIN activity; respondents could abandon the questionnaire at any point without consequence and no individual item had to be answered in order to advance. No monetary or non-monetary incentives (including an offer to share the aggregate results) were offered. The first screen presented an information sheet stating the purpose of the study, the identity of the coordinating investigators and GERGIN's role in distribution, the estimated completion time (8–10 minutes), the anonymous nature of the data, and the fact that responses would be stored on the platform's servers and exported to a password-protected institutional file held by the corresponding author for five years and used solely for aggregated scientific reporting. Continuation past this screen and submission of the questionnaire were taken as implied informed consent; no signature and no directly identifying data were requested. No names, e-mail addresses or IP addresses were stored alongside responses, so individual respondents could not be re-identified, and access to the exported dataset was restricted to SGA and VL. Data were handled in accordance with Regulation (EU) 2016/679 (General Data Protection Regulation) and Spanish Organic Law 3/2018 on the protection of personal data.

Development and testing. Items were drafted by the GERGIN scientific committee, reviewed for content validity and clarity by an expert panel, revised accordingly, and then pilot-tested electronically by 20 robotic gynecologic surgeons who completed the questionnaire on desktop and mobile browsers to verify usability, correct item display and automatic data capture; the estimated completion time in the pilot was 8–10 minutes. Pilot responses were excluded from the analysis dataset. No formal psychometric validation (internal consistency, test–retest reliability or factor analysis) was undertaken; the instrument is descriptive.

Questionnaire structure. The questionnaire comprised 22 items in two blocks (Block 1, items 1–10; Block 2, items 11–22), presented on consecutive screens grouped by block. Items and blocks were presented in a fixed order for all respondents; neither items nor questionnaire versions were randomised or alternated. Adaptive (conditional) questioning was not used: all respondents were shown all 22 items.

Response formats were 7-point Likert scales (items 11, 12, 15–18), single-choice categorical items (13, 14, 19, 20) and multiple-response items (21, 22).

Duplicate prevention. The survey was closed and delivered by personal e-mail. No log-file analysis was performed. No duplicate or inconsistent records were identified and no record was removed as a duplicate.

Response, participation and completion rates. Because the survey was closed and no public landing page existed, unique site visitors cannot be defined and a view rate is not calculable; these metrics are therefore not reported. Of the 120 invited members, 82 submitted a completed questionnaire, giving a response rate of 68.3% (82/120). The platform stored only submitted questionnaires, so participation and completion rates as defined by CHERRIES could not be computed, and the 68.3% figure is a response rate over the complete invited frame. Fifty-one questionnaires were submitted in the first week and 31 after the reminder.

Handling of incomplete questionnaires and atypical timestamps. Questionnaires with more than 30% missing items were pre-specified for exclusion; no submission met this criterion and all 82 returned questionnaires were analysed. Denominators are reported for each item in Table 1, and percentages are calculated over the respondents answering the corresponding item.

Statistical analysis

Likert responses are reported as means and standard deviations (SD). Categorical items are presented as frequencies and proportions. Analyses were performed with SPSS v.28 (IBM Corp.). Formal ethics committee review was not required under applicable Spanish legislation (Ley 14/2007 de Investigación Biomédica) for anonymous voluntary surveys not involving patient data.

Statistical correction. No weighting of items, post-stratification or propensity-score adjustment was applied to compensate for the non-probabilistic sample; the results describe the responding sample only.

Reporting guideline. The study is reported in accordance with the Checklist for Reporting Results of Internet E-Surveys (CHERRIES); the completed checklist is provided as Appendix S3.

Results

Response rate

Of 120 GERGIN members contacted, 82 returned valid questionnaires (response rate 68.3%): 51 in the first week and 31 after the reminder. No submissions were excluded.

Block 1: professional profile and surgical activity

Participant characteristics are illustrated in Figs. 1–2. The cohort had a mean age of 44.7 ± 7.9 years and was exactly gender-balanced (50% female). Respondents were distributed across multiple Spanish autonomous communities, with the highest concentrations in Catalonia (15.9%), Madrid (14.6%), and the Valencian Community (14.6%). Most worked in public hospitals (80.5%), with 15.9% in mixed public–private centres and 3.7% in exclusively private institutions.

Robotic experience was substantial: 44.4% of the 81 respondents answering this item had more than five years of practice (mean 4.8 ± 3.1 years) and 42.7% had performed more than 100 procedures (mean 110 ± 95 cases). Most centres had two to three accredited robotic surgeons (45.1%) or four to six (43.9%), with a mean of 3.2 ± 2.0 per centre. The Da Vinci Xi was the predominant platform (98.8%), with early-stage diversification shown by Hugo RAS (9.8%) and other systems (4.9%), participants could select more than one platform. The modal session (6–8h) volume was two robotic cases (53.7%), with a mean of 2.3 ± 0.9 . Gynecologic oncology was the primary subspecialty for 74.4%.

Block 2: clinical, human, and educational impact

Full results for items 11–22 are presented in Table 1.

Regarding patient-related outcomes, respondents rated improvement in patient recovery from robotic versus laparoscopic surgery at a mean of 5.20/7 (SD 1.69), with 76.8% scoring ≥ 5 (Fig. 3). Patient experience of robotic surgery was rated similarly (mean 5.07/7, SD 1.71; 72.0% scored ≥ 5). In terms of emotional impact on patients, 59.8% of surgeons considered robotic disclosure emotionally neutral, 37.8% believed it reduced anxiety, and only 2.4% perceived increased anxiety. All respondents (100%) reported that their centre does not use any validated objective instrument to assess patient-reported experience with robotic surgery.

The educational domain revealed a clear internal dichotomy (Fig. 4). Robotic surgery was perceived to enrich residents' anatomical and surgical understanding (item 17: mean 5.07/7; 69.5% ≥ 5). In contrast, strong consensus emerged that it reduces residents' intraoperative exposure (item 15: mean 2.66/7; 72.0% ≤ 3) and does not accelerate the surgical learning curve (item 16: mean 2.44/7; 72.8% ≤ 3 ; $n = 81$). The question of whether robotics constitutes an impediment to overall competency acquisition (item 18; 1 = major impediment, 7 = clear facilitation) yielded a mean of 3.29/7, with 58.5% scoring ≤ 3 , i.e. leaning towards perceiving robotics as an impediment.

Regarding surgeon training, of the 81 respondents answering this item, 79.0% had completed a formal programme including proctorship, simulation, and certification (very high level); 13.6% reported high-level training; 6.2% basic training; and 1.2% none. Ergonomic benefit was near-universally endorsed: 98.8% answered "Yes, clearly" to ergonomic improvement versus laparoscopy, with 1.2% indicating "Somewhat" and none reporting no improvement.

The dominant perceived advantages of robotic surgery were precision and maneuverability (93.9%) and surgeon ergonomics (93.9%), followed by improved patient recovery (59.8%) and operative safety

(57.3%). Leading perceived limitations were cost (80.5%) and OR and equipment availability (70.7%), with surgical time (20.7%) and training demands (12.2%) cited less frequently. These distributions are illustrated in Fig. 5.

Table 1

Perceptions of clinical, human, and educational impact (items 11–22; n = 82 unless otherwise indicated).

#	Item (summary)	Scale	Mean (SD)	Scores 1–3 (%)	Scores 5–7 (%)	Main finding
11	Patient recovery improvement vs. laparoscopy	Likert 1–7	5.20 (1.69)	12.2	76.8	Strong positive perception; most respondents scored ≥ 5
12	Patient's perceived experience of robotic surgery	Likert 1–7	5.07 (1.71)	13.4	72.0	Highly positive patient-experience ratings
13	Emotional impact of robotic disclosure	Categorical	—	—	—	59.8% neutral; 37.8% reduces anxiety; 2.4% increases anxiety
14	Use of validated patient-experience scales	Categorical	—	—	—	100% report no objective scale in use
15	Preservation of residents' operative exposure	Likert 1–7	2.66 (1.55)	72.0	9.8	Broad consensus that robotics reduces resident exposure
16	Acceleration of residents' learning curve	Likert 1–7	2.44 (1.56)	72.8	11.1	Majority perceive no acceleration of learning curve (n = 81)
17	Anatomical–surgical educational contribution	Likert 1–7	5.07 (1.93)	20.7	69.5	Positive didactic value for anatomy and surgical understanding
18	Impediment to competency acquisition (1 = impediment, 7 = facilitation)	Likert 1–7	3.29 (1.64)	58.5	23.2	Leaning towards impediment; concern for traditional skills
19	Level of formal robotic training	Categorical	—	—	—	79.0% very high; 13.6% high; 6.2% basic; 1.2% none (n = 81)
20	Ergonomic improvement vs. laparoscopy	Categorical	—	—	—	98.8% "Yes, clearly"; 1.2% "Somewhat"; 0% "No"
21	Main advantages over laparoscopy (multiple)	Categorical	—	—	—	Precision/maneuverability 93.9%; Ergonomics 93.9%; Patient recovery 59.8%; Safety 57.3%

#	Item (summary)	Scale	Mean (SD)	Scores 1–3 (%)	Scores 5–7 (%)	Main finding
22	Main limitations vs. laparoscopy (multiple)	Categorical	—	—	—	Cost 80.5%; OR availability 70.7%; Surgical time 20.7%; Training/curve 12.2%

Discussion

This national survey represents the first systematic assessment of clinical, educational, and professional perceptions of robotic surgery in Spanish gynecology. The 68.3% response rate substantially exceeds benchmark rates for email surveys in specialist professional groups [10] and reflects genuine engagement with the topic. The cohort is mature and highly experienced: 60.5% had ≥ 3 years of robotic practice, 42.7% had performed > 100 procedures, and 79.0% had completed a full formal training pathway including proctorship and certification. This experiential depth lends credibility to the nuanced, self-critical assessments observed alongside evident professional enthusiasm.

The near-unanimous endorsement of ergonomic improvement (98.8%) is clinically and professionally significant. Work-related musculoskeletal disorders are prevalent among laparoscopic surgeons, with up to 80–90% reporting symptoms in published series, driven by forced prolonged postures, counter-intuitive instrument manipulation, and visual-proprioceptive mismatch [11, 12]. The robotic console fundamentally alters this ergonomic equation by enabling seated operation with neutrally positioned arms and an immersive three-dimensional visual interface. Our data suggest that, from the surgeon's perspective, this benefit is unambiguous and widely experienced. This is a finding with implications for long-term surgical workforce health and sustainability.

The clinical impact perceptions are broadly consistent with published meta-analyses reporting reduced blood loss, shorter hospital stays, and lower wound complication rates with robotic versus open surgery and comparable outcomes versus laparoscopy in endometrial cancer [13], while randomised evidence shows that minimally invasive hysterectomy achieves disease-free survival equivalent to laparotomy in early-stage endometrial cancer [14]. The dominance of precision and maneuverability as perceived advantages (93.9%) aligns with evidence of superior operative field control in complex anatomical spaces such as the deep pelvis and paravesical region. The majority's view that robotic surgery reduces patient anxiety or leaves it unchanged (97.6% combined) may have implications for preoperative counselling, nevertheless this perception is unsupported by objective validated scales.

The training dimension is where our findings are most complex and, arguably, most consequential for policy. The perception that robotic surgery enhances anatomical education while simultaneously reducing operative exposure represents a structural tension inherent to the technology: the console architecture that optimises the senior surgeon's performance also removes the trainee from the sterile field. This is not unique to Spain; analogous concerns have been documented internationally, where robotic bedside assistant roles are often assigned to junior trainees who lack meaningful operative

engagement [7, 8, 15]. The YEARS (Young European Advocates of Robotic Surgery) survey of early-career European gynecologic surgeons corroborates this concern: despite 83.9% of departments performing robotic surgery weekly, only 37.1% of junior surgeons participated with the same frequency, and a mere 17.7% reported satisfaction with their operative exposure; higher self-perceived confidence was independently associated with age > 35 years and access to at least one dedicated robotic operating day per week [16]. Nor is this erosion confined to the robotic platform: a repeated national survey of the Irish higher specialist training programme (2014, 2017 and 2021) found trainees' confidence in performing abdominal hysterectomy falling from 40.9% to 15.2% ($p = 0.03$) and vaginal hysterectomy from 31.8% to 12.1%, mirroring the reduced operative exposure trainees experience today [17]. Robotic surgery therefore inherits this deficit rather than creating it, but concentrating operative decision-making in a single seat risks deepening it. The mean score of 2.44/7 for learning-curve acceleration and 2.66/7 for preserved operative exposure in our survey are consistent with this picture and are noteworthy given that 79.0% of our respondents had themselves completed a full formal robotic training pathway, suggesting that even well-trained surgeons recognise the structural limitation for those who follow them.

The implications for residency programme design are clear. Dual-console systems, which allow a trainee to operate in parallel with a proctor, provide an integrated teaching and supervising environment without compromising operative times or patient outcomes [18]. Validated simulation-based curricula, such as the Fundamental Skills of Robotic Surgery (FSRS) [7], and proficiency-based virtual-reality programmes provide a safe environment for skill acquisition prior to live cases [19, 20]. Our findings constitute professional-level evidence that these measures are urgently needed within Spanish gynecology training programmes and within European robotic surgical education frameworks more broadly.

Several limitations should be considered. First, although all 120 members of the national register were invited, participation was self-selected and non-probabilistic; respondents may over-represent surgeons from well-established, high-volume programmes, and the register itself comprises clinicians who have already adopted robotic surgery, a framing that plausibly biases perceptions of clinical benefit and ergonomics in a favourable direction. Non-response bias could not be quantified because no register-level characteristics of the 38 non-respondents were available, and no weighting or other statistical correction was applied. Second, the cross-sectional design captures perceptions at a single point in time, within a two-week window in November 2025. Third, the perceptions reported here are subjective and were collected with an instrument that was pilot-tested for usability but not formally validated psychometrically. Fourth, the Da Vinci Xi's near-universal dominance (98.8%) reflects current global market penetration but limits generalisability as market diversification progresses. Finally, the complete absence of validated patient-experience scales across all responding centres (item 14) is a notable finding that warrants further investigation.

Conclusions

Spanish gynecologists with robotic surgical experience broadly endorse its clinical and ergonomic benefits, with particularly strong consensus on improved surgeon ergonomics and perceived benefits in

patient recovery. The survey reveals an important educational paradox: robotic surgery enriches anatomical training but substantially reduces residents' intraoperative exposure and does not accelerate the surgical learning curve. These findings underscore an urgent structural deficit in the adaptation of Spanish gynecology residency programmes to the robotic era.

The profession calls for dual-console infrastructure, simulation-integrated curricula, and formal robotic competency frameworks to preserve training quality as robotic surgery expands in gynecologic oncology. Addressing these educational gaps is a prerequisite for the equitable, safe, and sustainable expansion of robotic gynecology in Spain.

Declarations

Conflict of interest: The authors declare no conflicts of interest.

Funding: No external funding was received for this study.

Ethics approval and consent to participate: The study was conducted in accordance with the Declaration of Helsinki. Formal ethics committee review was not required under Spanish law (Ley 14/2007 de Investigación Biomédica) for an anonymous, voluntary survey of health professionals involving no patient data or biological samples. All participants received written study information on the first screen of the questionnaire, and voluntary completion and submission of the questionnaire were considered to imply informed consent. No personal identifiers were collected, and data were processed in accordance with Regulation (EU) 2016/679 and Spanish Organic Law 3/2018.

Consent for publication: Not applicable.

Availability of data and materials: The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Supplementary material: Appendix S1 – verbatim text of the invitation and reminder e-mails; Appendix S2 – full questionnaire (22 items with response options exactly as displayed); Appendix S3 – completed CHERRIES checklist.

Competing interests: The authors declare no competing interests.

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Authors' contributions: S.G.A. conceived and designed the study, conducted the analysis, and drafted the manuscript. J.P., A.T., L.C., and A.M. contributed to study design, data collection, and critical revision of the manuscript. S.F. contributed to data collection, interpretation of results, and critical revision. S.D. supervised the study, facilitated GERGIN distribution, and contributed to manuscript revision. M.C. contributed to statistical methodology and critical revision. V.L. coordinated GERGIN distribution,

supervised data collection, and finalised the manuscript. All authors approved the final version and agreed to be accountable for all aspects of the work.

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Figures

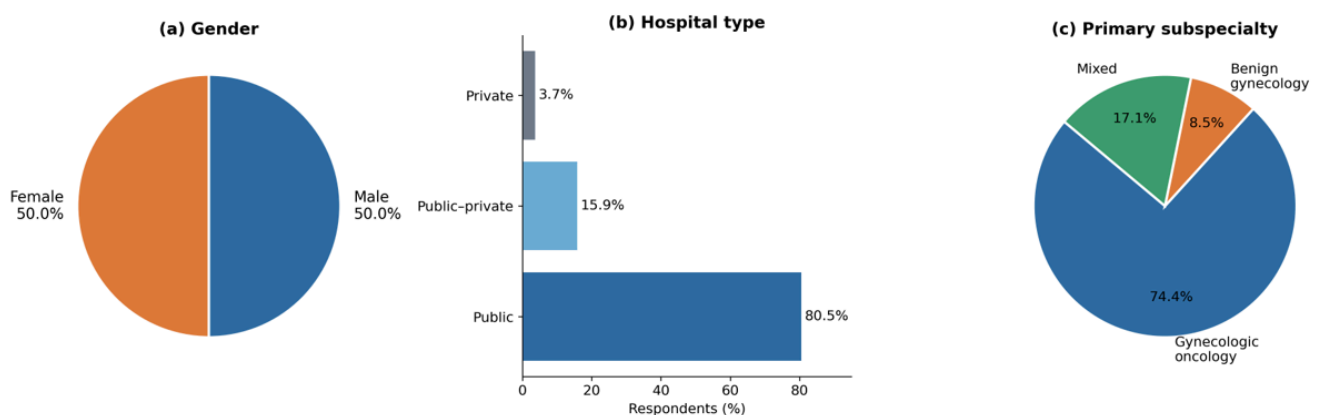


Figure 1

Sociodemographic and professional profile of respondents (n = 82): (a) gender, (b) hospital type, (c) primary subspecialty.

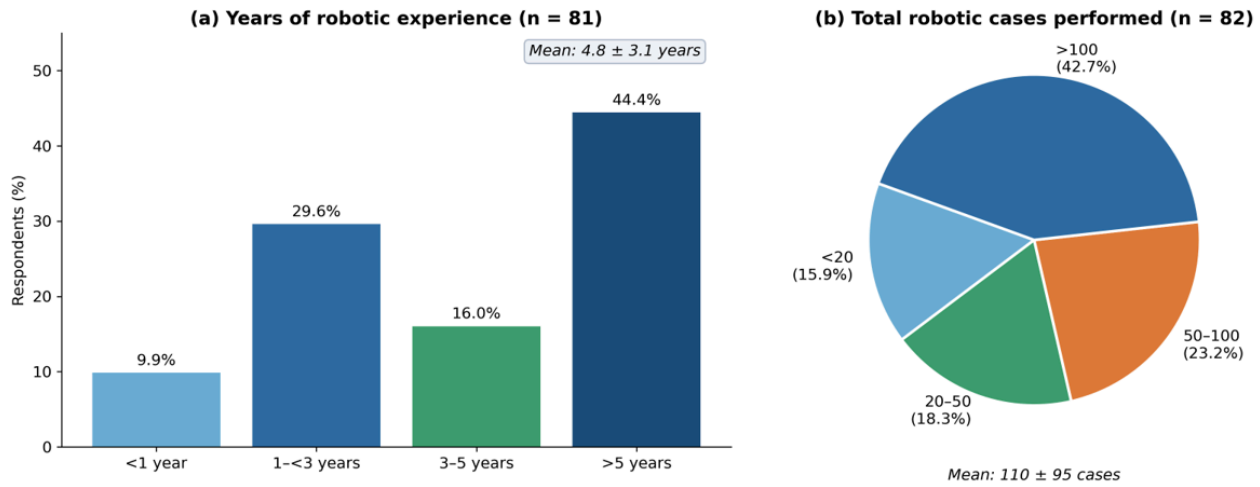


Figure 2

Surgical experience: (a) years of robotic practice (n = 81; mean 4.8 ± 3.1 years) and (b) total robotic cases performed (mean 110 ± 95 cases).

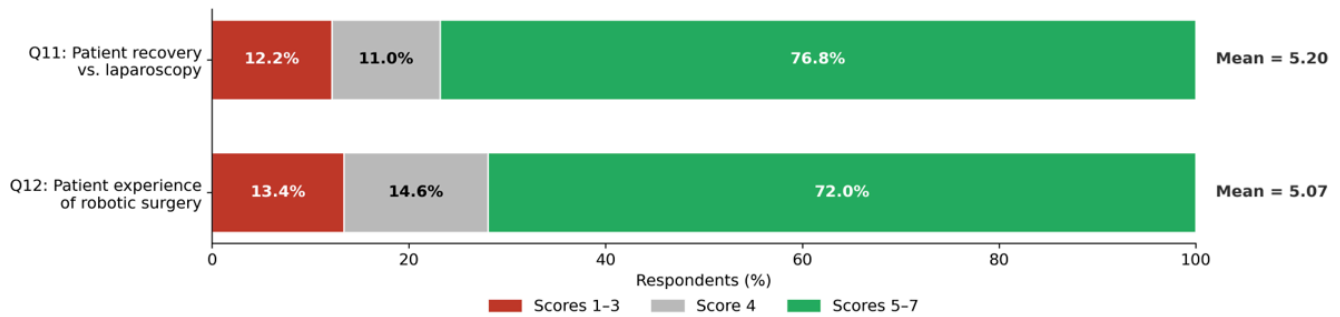


Figure 3

Perceived clinical impact on patients: distribution of responses to items 11 (patient recovery improvement) and 12 (patient experience of robotic surgery). Responses grouped as scores 1-3, 4 and 5-7; means annotated.

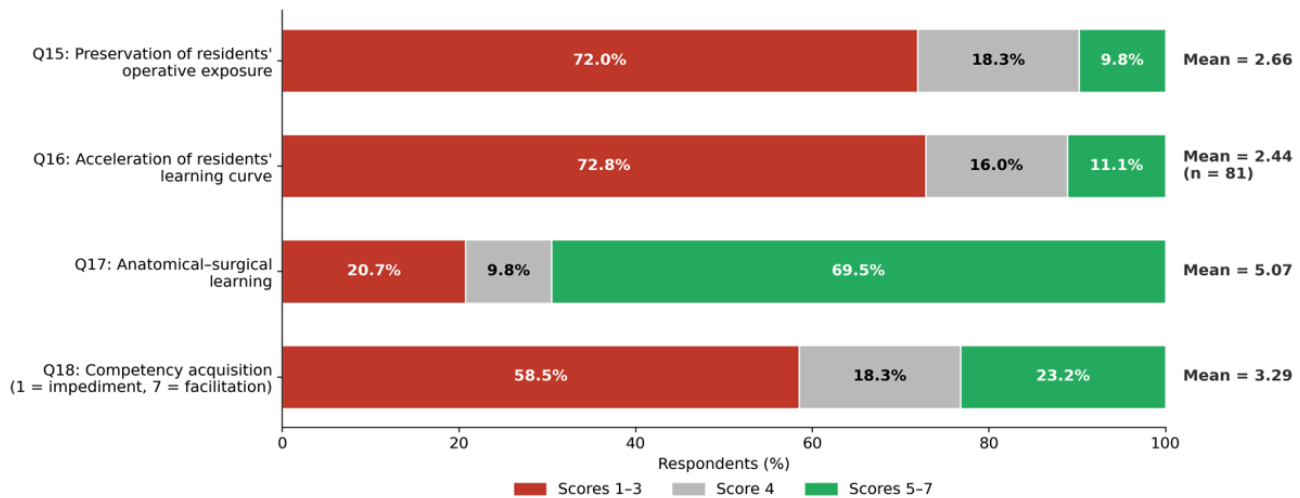


Figure 4

Perceived impact on resident surgical training: distribution of responses to items 15–18, grouped as scores 1–3 (red), 4 (grey) and 5–7 (green); means annotated. Item 18 is scored from 1 = impediment to 7 = facilitation. Note the dichotomy: items 15–16 cluster in the negative zone while item 17 clusters in the positive zone.

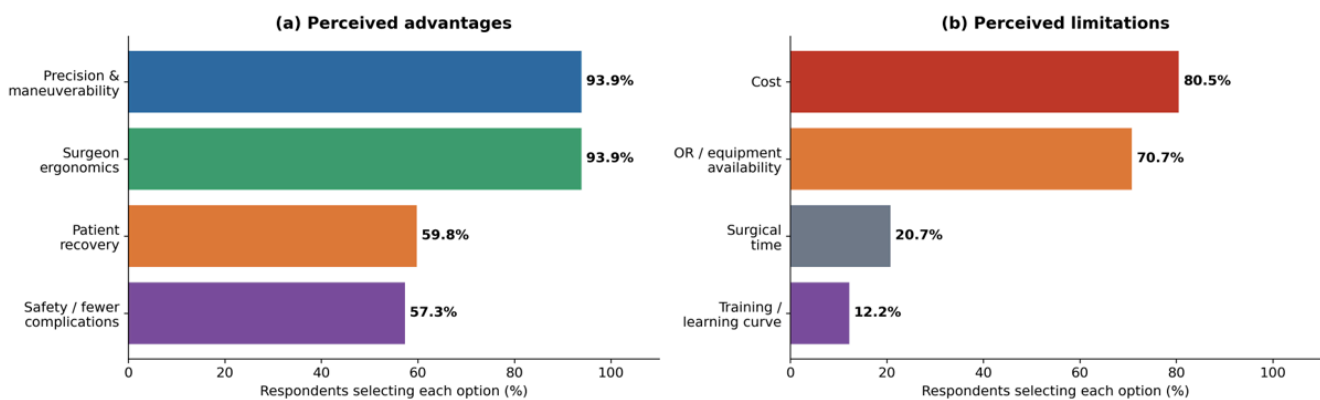


Figure 5

Perceived advantages (a) and limitations (b) of robotic versus laparoscopic surgery (multiple-choice items 21 and 22; multiple responses permitted; percentages over the 82 respondents).