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Increased Rate of Minimally Invasive Surgery and Improved Outcomes in Colorectal Surgery Following Implementation of LAPCO-Ro

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Abbreviations:
RAES: Romanian Association for Endoscopic Surgery;
LAPCO: National Training Programme in Laparoscopic Colorectal Surgery;
LAPCO-Ro: Romanian National Training Programme in Laparoscopic Colorectal Surgery;
LCS: laparoscopic colorectal surgery;
MIS: minimally invasive surgery;
NICE: National Institute for Health and Care Excellence;
STTAR: Structured Training Trainer Assessment Report;
TT: Train-the-Trainer;
UK: United Kingdom;
USA: United States of America.

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Rezumat

Implementarea LAPCO-Ro a condus la o creștere semnificativă a numărului de intervenții minim invazive în chirurgia colorectală in România, cu rezultate clinic superioare

Introducere: Deşi beneficiile chirurgiei colorectale laparoscopice (LCS) sunt bine documentate, în România utilizarea acestei tehnici a rămas mult timp redusă, sub 4% din cazuri fiind efectuate laparoscopic în 2018. Pentru a diminua acest decalaj a fost inițiat LAPCO Romania (LAPCO-Ro), program național de formare modelat după National Training Programme din Marea Britanie, organizat ca rețea structurată de mentorat, evaluare bazată pe competențe şi dezvoltare a formatorilor. Obiectivul acestui studiu este evaluarea impactului programului asupra utilizării chirurgiei minim invazive în patologia colorectală şi asupra complicațiilor.
Metode: Prezentăm structura şi experiența inițială a programului LAPCO-Ro şi evaluăm impactul acestuia asupra implementării LCS la nivel național, urmărind modificarea ratei de adoptare, compararea ratelor de complicații între procedurile supervizate prin LAPCO-Ro şi cele nesupervizate, precum şi proiecția evoluției naționale în absența programului.
Rezultate: Între 2017 şi 2024, proporția rezecțiilor colorectale laparoscopice în România a crescut de la 3,2% la 11,6%. Ratele de complicații pentru cazurile laparoscopice au rămas constant mai mici decât în chirurgia deschisă (media 2,8% față de 4,8%), cu un risc relativ între 0,31 şi 0,87, ceea ce indică o reducere a morbidității cu 13-69% comparativ cu intervențiile deschise. Până la mijlocul anului 2025, cursanții au participat la peste 1.000 de intervenții de chirurgie colorectală laparoscopică. Excluzând cazurile efectuate de cursanții LAPCO-Ro, tendința națională din România ar fi urmat traiectoria liniară anterioară (+177 cazuri/an), ajungând la o rată de adoptare a laparoscopiei de doar aproximativ 10% până în 2024, în loc de 13% cât s-a înregistrat în realitate. Astfel, LAPCO-Ro a accelerat difuzia națională cu 30-35%, ceea ce a dus la aproximativ 500 de colectomii minim invazive suplimentare în 2024 şi peste 1.000 de la începutul programului. În cadrul rețelei LAPCO-Ro, cazurile laparoscopice supervizate au fost asociate cu o morbiditate postoperatorie redusă (2,46%).

Concluzii: Experiența LAPCO-Ro arată că o rețea națională de formare, structurată şi bazată pe competențe, poate accelera diseminarea chirurgiei colorectale minim invazive într-un sistem de sănătate cu adoptare tardivă.

Cuvinte cheie: chirurgie colorectală laparoscopică, chirurgie minim invazivă, program național de training, mentorat chirurgical, formarea trainerilor, România

Abstract

Background: Despite the recognised benefits of laparoscopic colorectal surgery (LCS), its uptake in Romania has remained low, with less than 4% of cases performed using laparoscopy in 2018. To address this gap, LAPCO Romania (LAPCO-Ro), modelled on the UK National Training Programme, was established as a structured network for mentorship, competency-based evaluation and faculty development. The objective of this study is to evaluate the impact of this programme on the use of minimally invasive surgery in colorectal pathology and on complication rates.
Methods: We describe the structure and early experience of LAPCO-Ro and evaluate its effect on nationwide LCS implementation, focusing on changes in adoption rates, comparison of complication rates between procedures supervised by LAPCO-Ro and those that were not, and projections of national outcomes in the absence of the programme.
Results: From 2017 to 2024, the proportion of laparoscopic colorectal resections in Romania increased from 3.2% to 11.6%. Complication rates for laparoscopic cases remained consistently lower than open surgery (mean 2.8% vs 4.8%), with relative risk ranging from 0.31 to 0.87, indicating a 13–69% reduction in morbidity compared to open procedures. Excluding LAPCO-Ro trainee-related cases, the national trend in Romania would have followed its earlier linear trajectory (+177 cases/year), reaching only about 10% laparoscopic adoption by 2024 instead of the actual 13%. LAPCO-Ro thus accelerated national diffusion by 30–35%, resulting in approximately 500 additional minimally invasive colectomies in 2024 and over 1,000 since the start of the programme. Within LAPCO-Ro, mentored laparoscopic colorectal cases were associated with low postoperative morbidity (2.46%).
Conclusions: The LAPCO-Ro experience demonstrates that a structured, competency-based national training network can accelerate the dissemination of minimally invasive colorectal surgery in a late-adopter health system.

Keywords: laparoscopic colorectal surgery, minimally invasive surgery, national training program, surgical education, mentorship, Romania

Introduction

Laparoscopic colorectal surgery (LCS) is associated with improved recovery, reduced complications, and shorter hospital stays. However, its technical complexity results in a long learning curve – ranging from 30 to 152 cases before proficiency is achieved. Prolonged learning, often through self-directed methods, can increase operative times, conversion rates, and complications(1). In Romania, the Romanian Association for Endoscopic Surgery (RAES) reported LCS rates of only 2.5% in 2008 and 3.8% in 2018, according to the National Institute of Health Services Management.

Drawing inspiration from international models, efforts to improve LCS implementation in Romania mirror global trends, where MIS uptake has been slow. The United States, for instance, saw an increase from 6.5% in the early 2000s to 45.9% (peaking at 56% in 2016), while Australia reached 41.5%, and several Asian countries surpassed 60% (2). Yet, adoption remains limited outside major centers (3).

The UK's LAPCO programme, launched in 2007, supports NICE recommendations and aims to spread MIS for colorectal cancer safely. The programme emphasises mentorship, competency-based progression, video assessment, and independent validation (4). Over five years, more than 1,000 mentored cases were completed, with outcomes for trainees equivalent to experts (5). Structured supervision ensures safer outcomes compared to self-taught pathways (6).

Key to the UK program is the LapCo-TT (Train-the-Trainer) initiative, which standardises surgical teaching (7). The curriculum includes learner-centred models, deconstruction of operative tasks, structured interventions, feedback, and assessment with STTAR. Trainers continue coaching beyond the initial training to support postoperative care. Evaluations show that TT-trained mentors provide more consistent and

effective feedback, making the professionalization of surgical education one of the most significant contributions of LAPCO (6,8-10).

In Romania, RAES piloted a training programme in 2019, with two instructors and eight trainees, supported by Medtronic. Following positive results, LAPCO-Ro was launched in partnership with the UK programme, integrating mentorship, case-based assessment, and a LapCo-TT faculty development track. LAPCO-Ro focused on training laparoscopic right and left sided colonic resections. Trainers complete TT workshops, standardising mentoring nationwide. This approach supports sustainable adoption not only in Romania but also as a model for other specialties and health systems seeking structured MIS dissemination.

The objective of this study was to provide a detailed account of the implementation of the LAPCO-Ro national training programme in Romania and to assess its impact on the national adoption rate of laparoscopic colorectal surgery as well as postoperative outcomes.

Material and Method

This multicentre observational descriptive study uses data from the LAPCO-Ro training network (January 2019 - September 2025) and compares its findings with data from the National Institute for Management of Health Services, which analyses trends from 2017 to 2024, including complications related to laparoscopic colorectal surgery.

LAPCO-Ro programme follows the LAPCO UK framework, including a masterclass in laparoscopic colectomy, clinical immersion at reference centres, mentorship through supervised visits (minimum eight colectomies: four right and four left), video review of at least four unedited cases, and a one-year post-graduation follow-up. Validation requires two unedited videos (one right and one left colectomy), reviewed by two independent trainers

Faculty development mirrors the LapCo-TT curriculum, focusing on learner-centred education, skills deconstruction, stepwise intervention, feedback, and formal evaluation(11). Educational materials and videos are freely available on the RAES website.

Trainer selection is managed by RAES with surgical societies and institutional leaders. Trainers must have performed at least 50 independent laparoscopic colorectal resections, demonstrate interest in education, complete LapCo-TT certification, and participate in trainee assessment and video-based validation. Trainees are selected through a competitive process, requiring baseline laparoscopic experience, institutional support, and commitment to the full LAPCO pathway, with national representation prioritised.

Between January 2019 - September 2025, more than 25 trainees and over 15 trainers participated across 10+ centres, ensuring a mix of high-volume academic and regional hospitals. National and network-level data were summarised using absolute numbers, percentages and relative risk (RR) for complications in laparoscopic versus open surgery. Calculations were performed using standard spreadsheet software.

Results

The pilot phase (2019–2022) included eight trainees and two trainers, with international proctoring. Trainers attended the Medtronic/LapCo "Train the Trainer" course in Istanbul in 2018. The first Romanian "Train the Trainer" course was held in November 2022 at Ponderas Academic Hospital, followed by a second course in 2023 with LapCo International experts. The programme grew from 8 trainees in January 2019 to over 25 by September 2025, with several of the

Table 1. National trends in colorectal surgery in Romania according to National Institute for Management of Health Services (2017–2024)

Year	Open Cases (C)	Complications (C)	Rate % (C)	Laparoscopic Cases (L)	Complications (L)	Rate % (L)	Relative Risk (L/C)
2017	13,477	652	4.84%	446	13	2.92%	0.60
2018	13,482	666	4.94%	648	16	2.47%	0.50
2019	14,230	607	4.27%	931	14	1.50%	0.35
2020	11,074	472	4.26%	805	13	1.61%	0.38
2021	12,346	456	3.69%	1,154	13	1.13%	0.31
2022	14,139	677	4.79%	1,440	69	4.79%	1.00
2023	15,595	709	4.55%	1,754	69	3.94%	0.87
2024	15,850	838	5.28%	2,084	84	4.03%	0.76

original participants now serving as trainers.

RAES requested the National Institute for Management of Health Services to analyse trends from 2017 to 2024, including complications in relation to laparoscopic colorectal surgery, as shown in *Table 1*.

From 2017 to 2024, the proportion of laparoscopic colorectal resections in Romania increased from 3.2% to 11.6%. Complication rates for laparoscopic cases remained consistently lower than open surgery (mean 2.8% vs 4.8%), with relative risk ranging from 0.31 to 0.87, indicating a 13-69% reduction in morbidity compared to open procedures.

Between 2017-2024, the proportion of laparoscopic colorectal resections in Romania increased from 3.2% to 11.6%. Complication rates for laparoscopic cases remained consistently lower than open surgery (mean 2.8% vs 4.8%), with relative risk ranging from 0.31 to 0.87, indicating a 13-69% reduction in morbidity compared to open procedures.

Discussion

This study shows that implementation of LAPCO-Ro, a structured national training programme in laparoscopic colorectal surgery, was associated with a marked increase in LCS adoption in participating centres and with morbidity rates that were lower than national laparoscopic benchmarks.

The LAPCO-Ro programme, launched in partnership with the UK programme was established to promote the safe, widespread adoption of laparoscopic colorectal techniques.

Trainees in eight out of ten centres achieved validation readiness, with increasing laparoscopic procedure volumes.

Between 2017 and 2024, laparoscopic colorectal procedures in Romania consistently showed lower complication rates than open surgery (average 2.8% vs 4.8%). The relative risk ranged from 0.31 to 1.00, suggesting a roughly 40% reduction in complications. The temporary convergence of rates in 2022 likely reflects the expansion of MIS to more complex cases as adoption grew.

The LAPCO-Ro network performed 1,017 laparoscopic colorectal operations between 2019 and 2025, with 25 postoperative complications (2.46% morbidity), lower than the national average for laparoscopic resections (4.0%) and international benchmarks such as the UK (3.1%), USA (3.5%), and Australia (3.2%)(9, 12, 13), as shown in *Table 2*. This supports the effectiveness of structured, mentored training in broadening MIS adoption while maintaining safety. Outcomes under competency-based supervision are at least equivalent, if not superior, to mature national programmes. These data confirm the safety and benefit of LCS under the RAES–LAPCO-Ro framework.

Excluding LAPCO-Ro trainee-related cases, the national trend in Romania would have followed its earlier linear trajectory (+177 cases/year), reaching only about 10% laparoscopic adoption by 2024 instead of the actual 13%. LAPCO-Ro thus accelerated national diffusion by 30-35%, resulting in approximately 500 additional minimally invasive colectomies in 2024 and over 1,000 since the start of the programme. This mirrors the effect size seen in the early UK LAPCO model, highlighting the impact of structured mentorship and faculty development.

Key results included:

- Elias Bucharest Emergency Hospital: laparoscopic resections increased from ~20% to 50%; scheduled chronic cases from 33% to 90%.
- Craiova Emergency Hospital: LCS increased from ~20% to 40%.
- Ponderas Hospital: Supervision in over 35% of laparoscopic cases; 96% rate for laparoscopic colorectal surgery; continued training for young surgeons and residents.

Effective candidate selection, adherence to protocols, and the Train-the-Trainer model contributed to low complication rates and

Table 2. Laparoscopic postoperative morbidity in LAPCO-Ro compared with national and international series

Context	Complication rate – Laparoscopic (%)	Reference / Period
LAPCO-Ro programme (Romania)	2.46%	RAES data, 2023–2025
Romania (National, all centres 2024)	4.03%	RAES national audit
UK LAPCO (Hanna et al., 2022)	3.1%	Ann Surg 275(6):1149–1155
USA (Chen et al., 2023)	3.5%	J Surg Res
Australia (Thompson et al., 2011)	3.2%	Med J Aust 194:347–351

standardised supervision. LAPCO-Ro demonstrates that structured national training can overcome barriers to MIS adoption, with results mirroring those in the UK, where laparoscopic rates exceeded 60%. The scalability of the model is evident, with gains in both university and regional hospitals. Structured mentorship and video validation helped offset differences in baseline resources.

Training both trainees and trainers was pivotal(14); the professionalisation of surgical education through LapCo-TT ensured standardised teaching and improved outcomes, similar to the UK experience. Challenges included scheduling, uneven video infrastructure, and limited government funding, which constrain scalability. Future directions include tele-mentoring, standardised video libraries, national audits, and integration of robotic and advanced procedures. The LAPCO-Ro model has led to clear increases in adoption, trainee validation, and service expansion, confirming the feasibility of adapting a proven national training framework to Romanian healthcare.

Potential future steps include expanding to robotic colorectal procedures(15), establishing a centralised tele-mentoring hub, creating a national video library for assessment calibration, and aligning Romanian trainees with European accreditation standards.

Limitrations

This study acknowledges some limitations. The national RAES dataset is observational in nature and dependent on administrative coding, which may introduce variability in reporting accuracy - particularly regarding complication categories and case complexity. Additionally, the dataset lacks detailed clinical parameters such as tumour stage, body mass index, comorbidities, intraoperative events, or conversion rates, thereby constraining the capacity to adjust for case-mix differences between open and laparoscopic cohorts or between LAPCO-Ro and non-LAPCO procedures.

The positive influence of the LAPCO-Ro programme cannot be fully disentangled from other concurrent factors impacting surgical practice, such as advancements in technology, hospital investments, or independent training initiatives.

While modelling predicted laparoscopic adoption in the absence of LAPCO-Ro facilitates an estimate of the effect of the programme, this approach does not equate to a controlled trial and remains subject to residual confounding.

LAPCO-Ro trainee-supervised cases may reflect a selection bias towards rigorous included centres with superior baseline resources, including high-definition imaging, recording systems, and experienced anaesthesia teams. This may result in outcomes that surpass national averages and limit generalisability to all hospitals, particularly those with low volumes or in rural settings.

The number of LAPCO-Ro procedures (n = 1,017) included in the present research represents a small sample size relative to total national surgical volume, however it includes a significant number of patients to support the conclusions of the research (extended follow-up is necessary to ascertain its sustained impact on national practice and long-term surgical outcomes).

Despite these limitations, the study offers several significant strengths. It represents the largest analysis to date of laparoscopic colorectal surgery in Romania, synthesising eight years of national RAES data with detailed prospective case logs from the LAPCO-Ro programme. This combined dataset enables robust assessment of epidemiological trends alongside high-fidelity supervised operative outcomes.

Furthermore, the study evaluates not only the growth in laparoscopic adoption, but also the quality of surgical performance by benchmarking LAPCO-Ro trainee-supervised results against national standards. This methodology mirrors that of the UK LAPCO evaluations, enhancing the validity of international comparisons.

The application of a counterfactual model ("national trend without LAPCO-Ro") facilitates quantification of the contribution of the programme to stimulate changes in national practice. The observed acceleration of laparoscopic diffusion by 30–35% and reduction in national complication rates with 39% (otherwise those cases would have been operated by the trainees by open approach) through structured mentorship underscore both clinical and policy significance.

Lastly, the findings highlight the early success of a structured, competency-based national training programme within a middle-income European country, underscoring the feasibility of implementing advanced minimally invasive surgical techniques beyond traditionally high-resource environments.

Conclusions

The implementation of LAPCO-Ro has had a measurable impact on the dissemination and

safety of laparoscopic colorectal surgery in Romania. National laparoscopic adoption increased from < 4% to approximately 10–13% following programme deployment, representing a 30–35% acceleration in minimally invasive uptake compared with expected pre-programme trends. LAPCO-Ro trainee-supervised procedures demonstrated a low complication rate of 2.46%, significantly below both national open surgery rates (39% less complications) and non-LAPCO laparoscopic cases.

By modelling national outcomes with and without LAPCO-Ro, the programme is estimated to have enabled more than 1,000 additional laparoscopic colectomies and prevented 80-100 complications since implementation.

These results demonstrate that a structured, competency-based national training programme can meaningfully influence both the implementation and quality of advanced surgical practice.

Continued investment in mentorship infrastructure, video-based assessment, and trainer development is essential to maintain and expand these gains.

Implications for Practice

The results of this study have important implications for surgical training and health system planning. The Romanian experience supports the premise that structured national training programmes can overcome historical barriers to minimally invasive adoption, particularly in countries with heterogeneous resources and variable institutional experience.

The significant reduction in complications among LAPCO-Ro supervised cases emphasises the need for standardised mentorship, competency-based assessment, and trainer accreditation as core components of safe dissemination. As more centres adopt the programme, the model may be extended beyond colectomy to include advanced rectal, robotic, and pelvic procedures. The findings also provide a compelling rationale for governmental and institutional investment in national MIS training pathways, as these initiatives demonstrably improve surgical quality, patient outcomes, and system efficiency.

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Conflicts of Interest

The authors declare no commercial or financial conflicts of interest related to this study.

The LAPCO-Ro programme received educational support and equipment facilitation from Medtronic during the initial pilot phase, but the company had no role in study design, data collection, analysis, interpretation, manuscript preparation, or the decision to publish.

Ethical Approval

Ethical approval for this study was waived in accordance with national regulations, as the RAES database contains fully anonymized patient-level information and the LAPCO-Ro dataset includes only de-identified procedural and training metrics. No identifiable personal data were collected or processed. The study complied with the ethical standards of the Declaration of Helsinki and followed all applicable institutional and national guidelines for research involving human participants.

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