Robotic surgery in oncology
Results from a multidimensional assessment in Italy

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Rationale of the study

- **The evolution of general surgery in recent years has been extraordinary**: from open surgery, it has advanced to the use of minimally invasive techniques, initially with laparoscopy and more recently with the introduction of robotic systems in surgery
- **Robotic surgery allows the surgeon to perform procedures with extreme precision**, facilitating a wide variety of interventions in different surgical settings (Yu et al., 2013), **thus also offering advantages for patients** such as shorter hospital stays, reduced postoperative pain, lower risk of infections, less intraoperative bleeding, reduced need for transfusions, quicker return to all daily activities, and better aesthetic outcomes (Roh *et al.*, 2018; Flynn *et al.*, 2021; Chan *et al.*, 2021)
- **Despite the undeniable advantages of robotic surgery, its use is not standardized in clinical practice, likely due to the high cost of the technology itself**

Objective

To define the incremental benefits concerning a higher implementation of robotic surgery with respect to laparoscopy, assuming the hospital perspective, within the colorectal, gastric, esophageal, and pancreatic surgical settings, assuming the hospital perspective

Methods

A Health Technology Assessment, grounded on the **AdHopHTA framework**, was conducted in 2023/2024

Different data sources were utilized:

- **Literature evidence**, to define efficacy and safety comparative indicators considering both surgical approaches
- **Real-world data**, derived from Niguarda Hospital in Milan, a large-size Italian hospital, collecting anonymous hospital data flows to economically valorize the surgical pathways
- **Healthcare professionals' perceptions**, defining the perceived added value of robotic versus laparoscopic surgery, based on an evaluation scale ranging from -3 to +3

Results

From the economic evaluation of the single procedure, to the demonstration of the financial sustainability

From an economic perspective, an advantage is reported, except for gastric surgeries, leading to a general modification of costs per patient ranging from +7% to -9%

	Colorectal surgical setting	Esophageal surgical setting	Gastric surgical setting	Pancreatic surgical setting
Laparoscopic surgery	9,625.12 €	10,002.95 €	10,187.33 €	13,878.03 €
Robotic surgery	8,853.09 €	9,130.54 €	10,897.16 €	13,470.66 €
Difference (€)	**-772.03 €**	**-872.41 €**	**709.83 €**	**-407.37 €**
Difference (%)	**-8.02%**	**-8.72%**	**6.97%**	**-2.94%**

Over a 6-month time horizon, in the conduction of 131 surgical procedures, a higher use of robotic surgery would lead to a general hospital economic saving equal to 3% (-39,677 €)

	SCENARIO AS IS*	SCENARIO TO BE**
Laparoscopic surgery	1,410,670 €	316,047 €
Robotic surgery	0 €	1,054,946 €
Total costs	**1,410,670 €**	**1,370,993 €**
Difference (Euro)	**-39,677 €**	
Difference (%)	**-2.81%**	

* Scenario AS IS: no surgical procedures performed with robotic surgery

** Scenario TO BE: robotic surgery performed 61% and 64% colorectal and gastric interventions respectively, and to all the esophageal and pancreatic surgical procedures

Literature declared a superimposable safety profile, despite a higher efficacy (% patients requiring a conversion to open surgery) emerged in most surgical settings

Literature

Literature review for the definition of efficacy and safety data

Health Economics tools

Quantitative approaches, useful for the economic evaluation of the surgical pathways, comparing laparoscopic procedures and robotic implementation, and for the definition of the organizational and social quantitative impacts

Qualitative approaches

Administration of qualitative questionnaires filled in by 21 healthcare professionals involved, to validate the advantages obtained

From the organisational sustainabilty to the assessment of the social benefits

A higher use of robotic surgery would generate significant organizational savings, in terms of reduction in the hospitalization days (-22%; -516 days)

	SCENARIO AS IS*	SCENARIO TO BE**
Laparoscopic surgery	2,342	408
Robotic surgery	0	1,418
Total hospitalization days	**2,342**	**1,826**
Difference (hospitalization days)	**516**	
Difference (%)	**-22%**	

* Scenario AS IS: no surgical procedures performed with robotic surgery

** Scenario TO BE: robotic surgery performed 61% and 64% colorectal and gastric interventions respectively, and to all the esophageal and pancreatic surgical procedures

This feature would decrease the overall patients' productivity loss by on average 26%

	Colorectal surgical setting	Esophageal surgical setting	Gastric surgical setting	Pancreatic surgical setting
Laparoscopic surgery	717€	2,054 €	1,213 €	1,696 €
Robotic surgery	525€	1,234 €	1,120 €	1,194 €
Difference (€)	**-191€**	**-820€**	**-93€**	**-501€**
Difference (%)	**-27%**	**-40%**	**-8%**	**-29%**

Healthcare professionals' perceptions confirmed the superiority of robotic surgery, declaring a better occupational safety (0.60 vs -0.04, p-value=0.031) and effectiveness profile (1.62 vs -1.00, p-value=0.048). They also confirmed the potentialities of robotic surgery to improve patients' satisfaction (2.33 vs 1.67, p-value=0.022), and to optimize both the patients' post-operative pain (2.11 vs 1.33, p-value=0.033)

	AS IS Scenario	TO BE Scenario	P-value
Effectiveness	1.00	1.62	0.048
Safety	0.32	0.64	0.156
Equity Impact	0.30	0.07	0.490
Social and Ethical Impact	1.33	1.54	0.471
Legal Impact	1.33	1.47	0.873
Organizational Impact - 12 months	0.15	0.31	0.098
Organizational Impact - 36 months	0.22	0.46	0.344

Conclusions

Results showed the strategic relevance related to robotic surgery routinely implementation in the surgical practice, demonstrating their hospital economic and organizational sustainability, with important advantages for patients

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