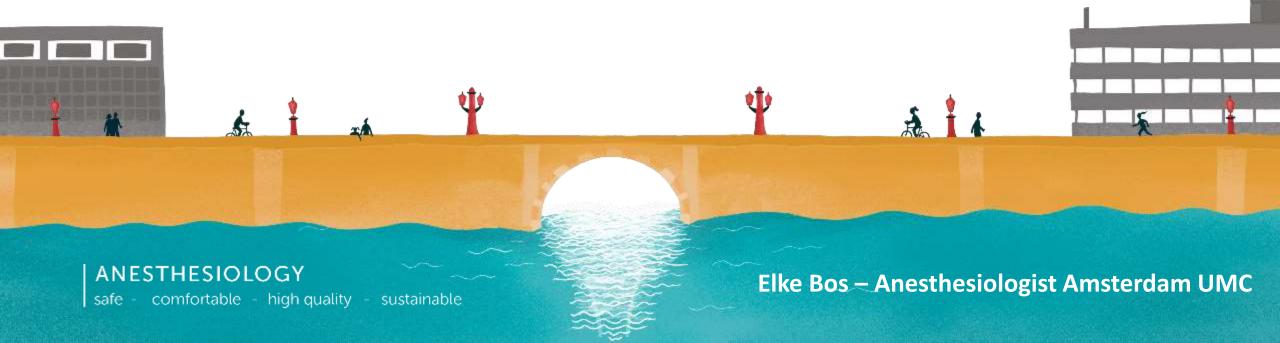


SHARE project

Sustainable Healthcare Resource Allocation in Scarcity via Robotic Surgery Evaluation





Amsterdam Research Centre for Health Economics



Centrum voor Duurzame Zorg Amsterdam UMC

















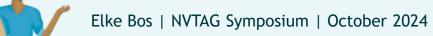




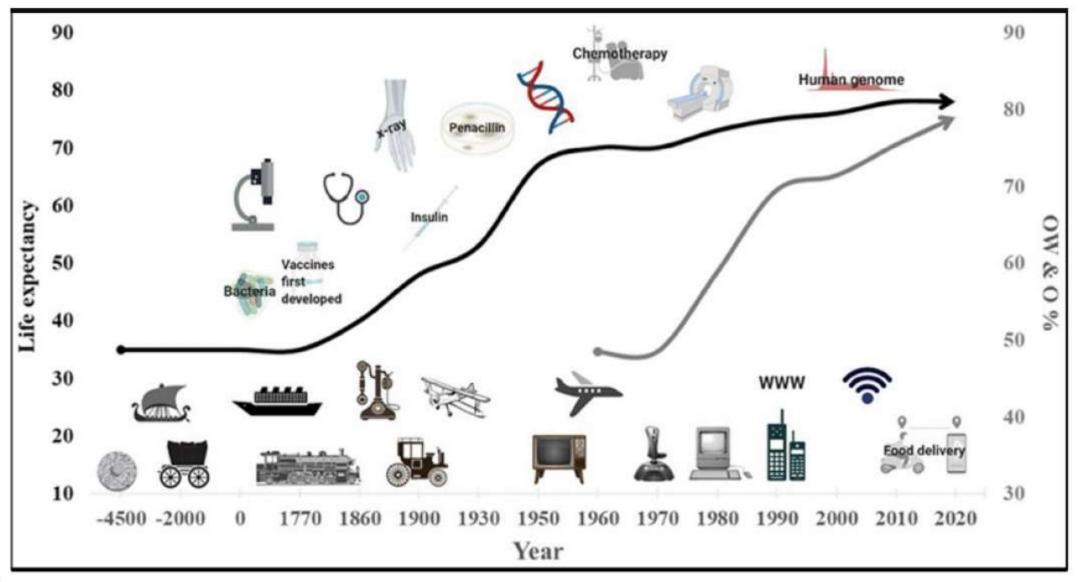




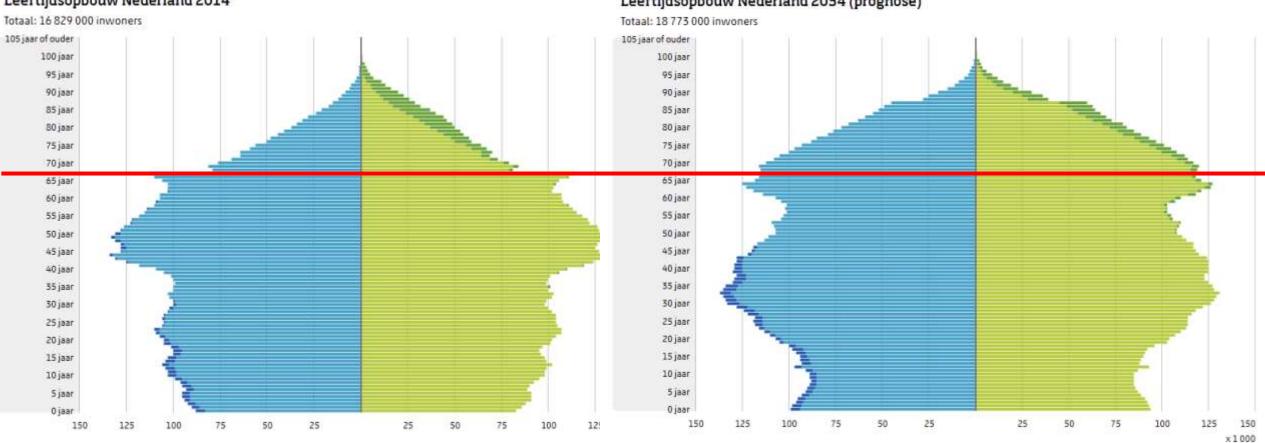












Leeftijdsopbouw Nederland 2014 Totaal: 16 829 000 inwoners

Leeftijdsopbouw Nederland 2034 (prognose)

Elke Bos | NVTAG Symposium | October 2024



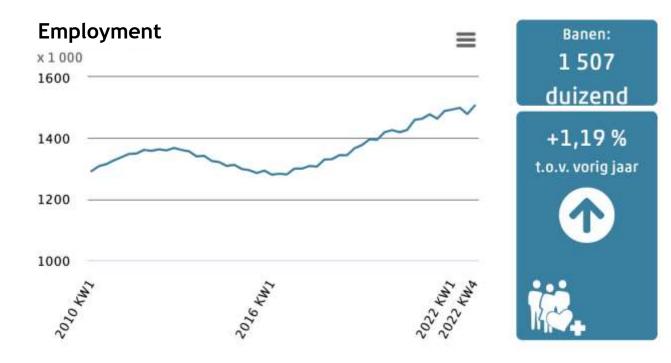


"I'm not going to be a victim of my own success."



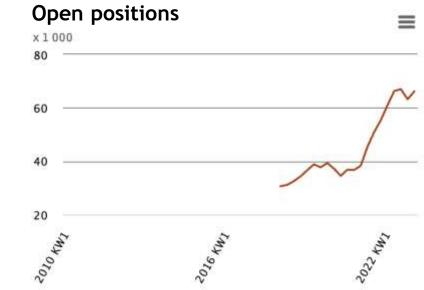
Elke Bos | NVTAG Symposium | October 2024



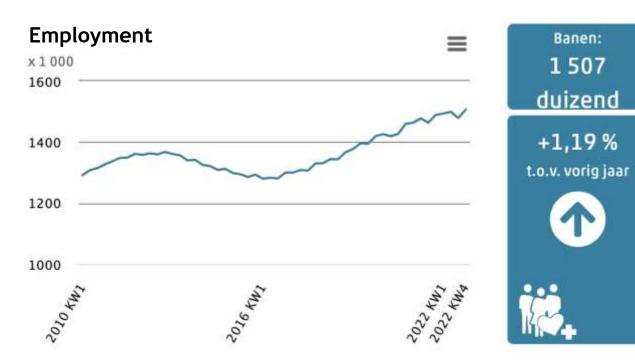




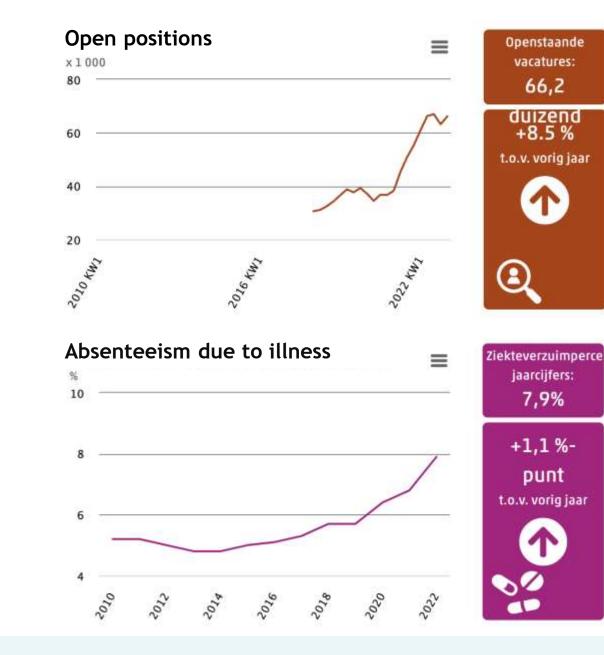


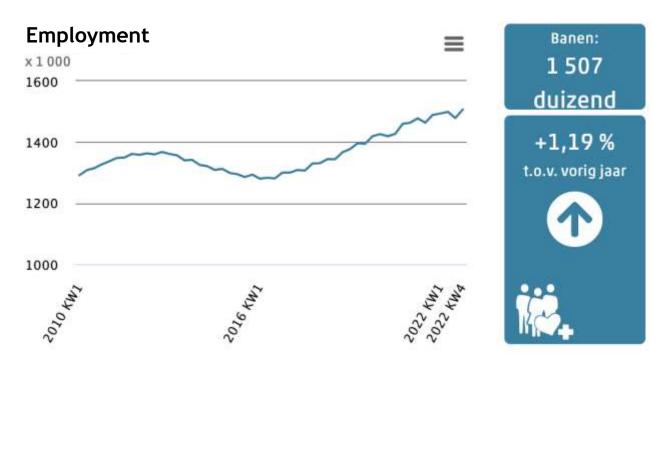
















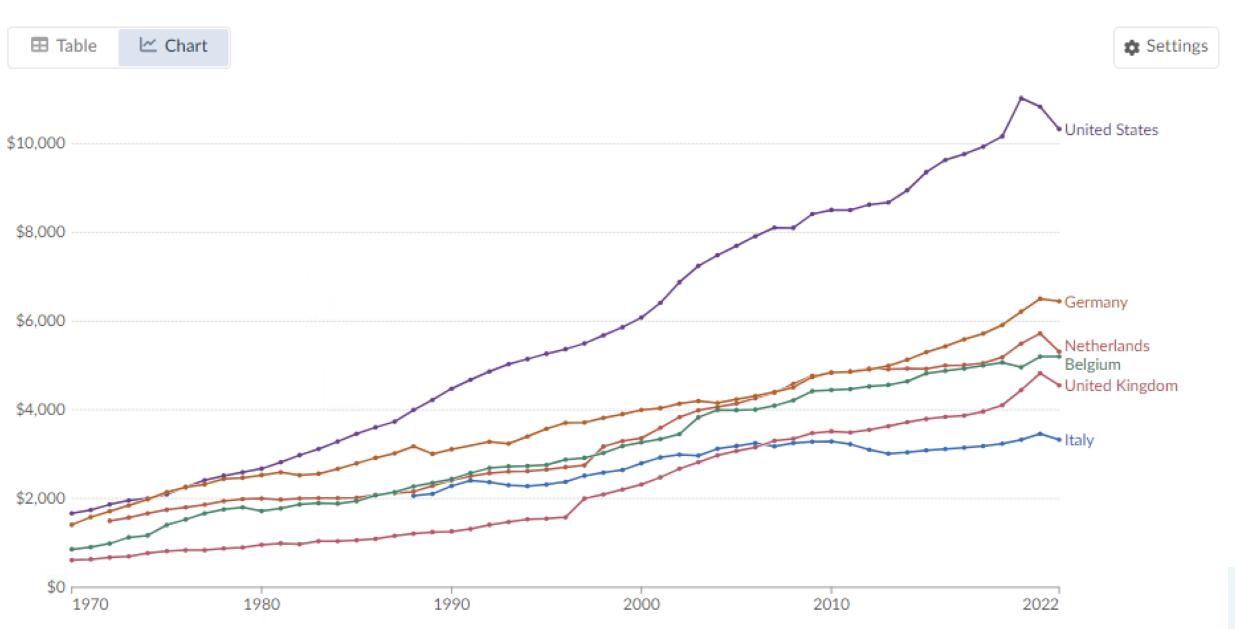




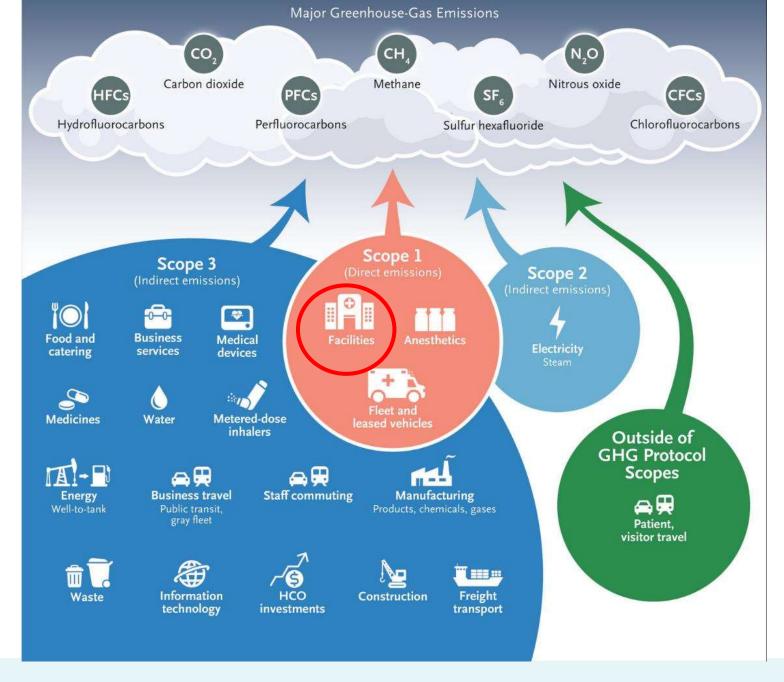


Health expenditure per capita, 1970 to 2022

Health expenditure includes all financing schemes and covers all aspects of healthcare. This data is adjusted for inflation and differences in the cost of living between countries.



Our World in Data





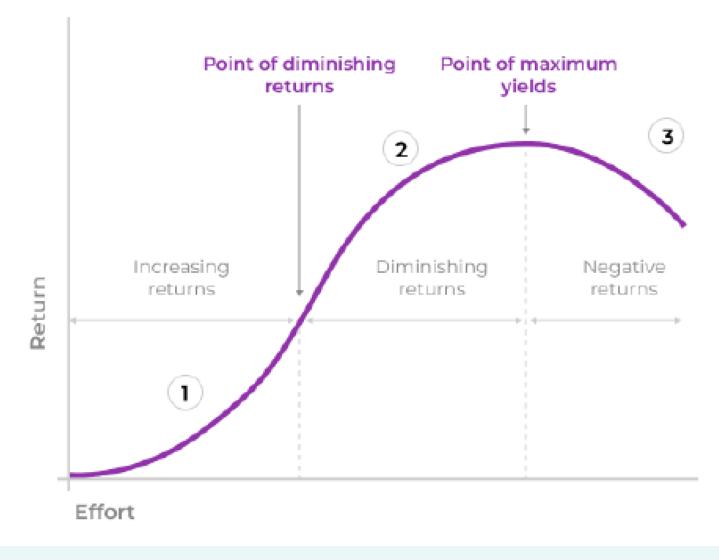














Gupta. Voorkom de volgende golf. 2021















A biased selection

Review > Cancers (Basel). 2024 Apr 22;16(8):1596. doi: 10.3390/cancers16081596.

Robotic versus Laparoscopic Liver Resections for Colorectal Metastases: A Systematic Review and Meta-Analysis

Kamil Safiejko ¹, Michal Pedziwiatr ², Michal Pruc ^{3 4}, Radoslaw Tarkowski ⁵, Marcin Juchimiuk ¹, Marian Domurat ¹, Jacek Smereka ⁶, Khikmat Anvarov ⁷, Przemyslaw Sielicki ³, Krzysztof Kurek ³, Lukasz Szarpak ^{1 3 8 9}

Affiliations + expand PMID: 38672678 PMCID: PMC11048946 DOI: 10.3390/cancers16081596

= 0.78). Laparoscopic or robotic approaches for colorectal liver metastases are comparable in terms of safety and effectiveness. There are significant advantages to robotic surgery, although there is still no



Robotic versus Laparoscopic Liver Resections for Colorectal Metastases: A Systematic Review and Meta-Analysis

Kamil Safiejko ¹¹, Michal Pedziwiatt ²², Michal Pruc ³¹ ⁴², Radoslaw Tarkowski ⁵, Marcin Juchimiuk ¹¹, Marian Domurat ¹⁷, Jacek Smereka ⁶, Khikmat Anvarov ⁷⁷, Przemysław Sielicki ³³, Krzysztof Kurek ³, Lukasz Szarpak ¹¹ ³ ¹⁸ ⁶

PMID: 38672678 PMCID: PMC11048946 DOI: 10.3390/cancers16081596



= 0.78). Laparoscopic or robotic approaches for colorectal liver metastases are comparable in terms of safety and effectiveness. There are significant advantages to robotic surgery, although there is still no

Review > Int J Gynaecol Obstet. 2024 Sep:166(3):994-1005. doi: 10.1002/ijgo.15485. Epub 2024 Apr 8.

Robotic-assisted laparoscopic versus abdominal and laparoscopic myomectomy: A systematic review and meta-analysis

Weiqi Chen ¹¹ ², Jun Ma ¹¹, Zhao Yang ² ², Xiao Han ⁴, Chenyang Hu ¹¹, Huai Wang ¹¹, Ying Peng ⁵, Lei Zhang ¹³, Bin Jiang ¹¹ ²

Conclusions: The safety and effectiveness of RLM are superior to those of AM but inferior to those of

LM.



Robotic versus Laparoscopic Liver Resections for Colorectal Metastases: A Systematic Review and Meta-Analysis

Kamil Safiejko ¹, Michal Pedziwiatr ², Michal Pruc ³ ⁴, Radosław Tarkowski ⁵, Marcin Juchimiuk ¹, Marian Domurat ¹, Jacek Smereka ⁶, Khikmat Anvarov ⁷, Przemysław Sielicki ³, Krzysztof Kurek ³, Lukasz Szarpak ¹ ³ ⁸ ⁹

Affiliations + expand PMID: 38672678 PMCID: PMC11048946 DOI: 10.3390/cancers16081596



= 0.78). Laparoscopic or robotic approaches for colorectal liver metastases are comparable in terms of safety and effectiveness. There are significant advantages to robotic surgery, although there is still no

Review > Int J Gymaecol Obstet. 2024 Sep:166(3):994-1005. doi: 10.1002/§go:15485. Epub 2024 Apr 8.

Robotic-assisted laparoscopic versus abdominal and laparoscopic myomectomy: A systematic review and meta-analysis

Weiqi Chen 8 2 , Jun Ma 3 , Zhao Yang 2 3 , Xiao Han 4 , Chenyang Hu 3 , Huai Wang 3 , Ying Peng 5 , Lei Zhang 3 , Bin Jiang 3 2

Conclusions: The safety and effectiveness of RLM are superior to those of AM but inferior to those of

LM.

Meta-Analysis > Surg Endosc. 2024 Sep:38(9):4846-4857. doi: 10.1007/s00464-024-11162-6. Epub 2024 Aug 15.

Robotic, laparoscopic and open surgery for gallbladder cancer: a systematic review and network meta-analysis

```
Madeline Yen Min Chee <sup>3</sup> <sup>2</sup>, Andrew Guan Ru Wu <sup>2</sup>, Khi-Yung Fong <sup>2</sup>, Ashley Yew <sup>3</sup>, 
Ye Xin Koh <sup>3</sup> <sup>3</sup>, Brian K P Goh <sup>4</sup> <sup>5</sup> <sup>6</sup>
```

intraoperative blood loss and post-operative complications compared to OS. There was no obvious benefit of either MIS approach (laparoscopic versus robotic) over the other.



Robotic versus Laparoscopic Liver Resections for Colorectal Metastases: A Systematic Review and Meta-Analysis

Kamil Safelko ³, Michał Pedziwiatr ⁸, Michał Puce³ ⁴, Radoslaw Tarkowski ³, Marcin Juchimiuk ³, Marian Domurski ¹, Jacek Smereka ⁴, Khikmat Anvarov ⁷, Przemysław Sielicki ³, Krzystof Kurek ³, Lukasz Szarpak ¹ ³ ⁸ ⁸ Affiliations + expand PMID: 38672678 PMID: PMC11048946 DOI: 10.3390/cancer:16081596

= 0.78). Laparoscopic or robotic approaches for colorectal liver metastas safety and effectiveness. There are significant advantages to robotic surg

Review → Int J Gynaecol Obstet. 2024 Sep:166(3):994-1005. doi: 10.1002/ijgo.15485. Epub 2024 Apr 8.

Robotic-assisted laparoscopic versus abdominal and laparoscopic myomectomy: A systematic review and meta-analysis

Weigi Chen ¹¹ 2, Jun Ma ¹¹, Zhao Yang ² ², Xiao Han ⁴, Chenyang Hu ¹¹, Huai Wang ¹¹, Ying Peng ⁵, Lei Zhang ³, Bin Jiang ¹¹ 2

Conclusions: The safety and effectiveness of RLM are superior to those of AN LM.

Meta-Analysis > Surg Endosc. 2024 Sep:38(9):4846-4857. doi: 10.1007/s00464-024-11162-6. Epub 2024 Aug 15.

Robotic, laparoscopic and open surgery for gallbladder cancer: a systematic review and network meta-analysis

Madeline Yen Min Chee $^{\pm}$ 2, Andrew Guan Ru Wu 2, Khi-Yung Fong 2, Ashley Yew 3, Ye Xin Koh $^{\pm}$ 3, Brian K P Goh $^{\pm}$ 5 6

intraoperative blood loss and post-operative complications compared to OS. There was no obvious benefit of either MIS approach (laparoscopic versus robotic) over the other.



Review > Surg Endosc. 2024 Jan;38(1):56-65. doi: 10.1007/s00464-023-10561-5. Epub 2023 Nov 28.

Robotic versus laparoscopic liver resection for liver malignancy: a systematic review and meta-analysis of propensity score-matched studies

Zhang-Tao Long ^{# 1}, Hua-Jian Li ^{# 1}, Hao Liang ^{# 1}, Ya-Chen Wu ¹, Sajid Ameer ¹, Xi-Lin Qu ¹, Zhi-Qiang Xiang ¹, Qian Wang ², Xiao-Ming Dai ³, Zhu Zhu ^{4 5}

Conclusion: Surgical and oncological outcomes are comparable between RLR and LLR on patients with liver malignancies. Therefore, the benefits of applying RLR in patients with liver malignancies need to be further explored.



:ancers16081596. esections for

Review and

Robotic versus Laparoscopic Liver Resections for Colorectal Metastases: A Systematic Review and Meta-Analysis

Kamil Safiejko¹, Michal Pedziwiatr², Michal Pruc³⁴, Radoslaw Tarkowski⁵, Marcin Juchimiuk¹ Marian Domurat ¹, Jacek Smereka ⁶, Khikmat Anvarov ⁷, Przemysław Sielicki ³, Krzysztof Kurek ³, Lukasz Szarpak ¹¹ 3 8 9

Affiliations + expand PMID: 38672678 PMCID: PMC11048946 DOI: 10.3390/cancers16081596

cowski 5, Marcin Juchimiuk 1, v Sielicki³, Krzysztof Kurek³,

Lukasz Szarpak 1 3 8 9

Affiliations + expand PMID: 38672678 PMCID: PMC11048946 DOI: 10.3390/cancers16081596

= 0.78). Laparoscopic or robotic approaches for colorectal liver metastases are comparable in terms of stases are comparable in terms of safety and effectiveness. There are significant advantages to robotic surgery, although there is still no satety and effectiveness. There are significant advantages to robotic surgery, although there is still no

Review > Int. J Gynaecol Obstet. 2024 Sep:166(3):994-1005. doi: 10.1002/ligo.15485. Epub 2024 Apr 8.	1.1002/ijgo.15485.
Robotic-assisted laparoscopic versus abdominal and laparoscopic myomectomy: A systematic review and meta-analysis	abdominal and
Weigi Chen 8 2, Jun Ma 3 , Zhao Yang 2 3, Xiao Han 4 , Chenyang Hu 3 , Huai Wang 3 , Ying Peng 5 , Lei Zhang 3 , Bin Jiang 1 2	atic review and

ıd

Review > Surg Endosc. 2024 Jan;38(1):56-65. doi: 10.1007/s00464-023-10561-5. Epub 2023 Nov 28. Robotic versus laparoscopic liver resection for liver

malignancy: a systematic review and meta-analysis of propensity score-matched studies

Zhang-Tao Long * 1, Hua-Jian Li * 1, Hao Liang * 1, Ya-Chen Wu 1, Sajid Ameer 1, Xi-Lin Qu 1 Zhi-Qiang Xiang ¹, Qian Wang ², Xiao-Ming Dai ³, Zhu Zhu ⁴ ⁵

Weigi Chen 3 2, Jun Ma 3, Zhao Yang 2 3, Xiao Han 4, Chenyang Hu 1, Huai Wang 3, Ying Peng 5,

Conclusions: The safety and effectiveness of RLM are superior to those of AM but inferior to those of

LM. LIVI.

metu unuryoro

need to be jurther explo

Meta-Analysis > Surg Endosc. 2024 Sep:38(9):4846-4857. doi: 10.1007/s00464-024-11162-6. Epub 2024 Aug 15.

Robotic, laparoscopic and open surgery for gallbladder cancer: a systematic review and network meta-analysis

Madeline Yen Min Chee ³ ², Andrew Guan Ru Wu ², Khi-Yung Fong ², Ashley Yew ², Ye Xin Koh ³ ³, Brian K P Goh ⁴ ⁵ ⁶

intraoperative blood loss and post-operative complications compared to OS. There was no obvious benefit of either MIS approach (laparoscopic versus robotic) over the other.

Robotic versus laparoscopic general surgery in the emergency setting: a systematic review

ew > J Robot Surg. 2024 Jul 5;18(1):281. doi: 10.1007/s11701-024-02016-3.

```
Theophilus T K Anyomih <sup>1</sup><sup>2</sup>, Alok Mehta <sup>3</sup>, Dorcas Sackey <sup>4</sup>, Caroline A Woo <sup>5</sup>,
Emmanuel Y Gyabaah<sup>6</sup>, Marigold Jabulo<sup>2</sup>, Alan Askari<sup>7</sup>
```

Perioperative outcomes for emergency robotic surgery in selected general surgery conditions are comparable to laparoscopic surgery. However, recommending robotic surgery in the acute setting necessitates a well-powered large population study for stronger evidence.



Elke Bos | NVTAG Symposium | October 2024



Robotic versus Laparoscopic Liver Resections for Colorectal Metastases: A Systematic Review and Meta-Analysis

Kamil Safiejko ¹¹, Michal Pedziviatr ², Michal Pruc ³ ⁴, Radoslaw Tarkowski ⁵, Marcin Juchimiuk ¹¹, Marian Domura ¹¹, Jacek Smereka ⁶, Khikmat Anvarov ⁷, Przemysław Sielicki ³, Krzysztof Kurek ³, Lukasz Szarpak ¹¹ ^{3 8 g}

PMID: 38672678 PMCID: PMC11048946 DOI: 10.3390/cancers16081596

cancers16081596

Affiliations + expand PMID: 38672678 PMCID: PMC11048946 DOI: 10.3390/cancers16081596

= 0.78). Laparoscopic or robotic approaches for colorectal liver metastases are comparable in terms of safety and effectiveness. There are significant advantages to robotic surgery, although there is still no

for

nd

uchimiuk¹

tof Kurek 3



Review > J Robot Surg. 2024 May 16;18(1):212. doi: 10.1007/s11701-024-01954-2.

Robotic assisted versus laparoscopic surgery for deep endometriosis: a meta-analysis of current evidence

Matteo Pavone ¹ ² ³, Alessandro Baroni ⁴, Federica Campolo ⁵, Marta Goglia ⁶, Diego Raimondo ⁷, Antonella Carcagnì ⁸, Cherif Akladios ⁹, Jacques Marescaux ¹⁰, Francesco Fanfani ⁵ ¹¹, Giovanni Scambia ⁵ ¹¹, Manuel Maria Ianieri ⁵ ¹²

group. Robotic surgery is not inferior to laparoscopy in patients with endometriosis in terms of surgical outcomes; however, RAS requires longer operative times and longer hospital stay. The

Review > Surg Endosc. 2024 Jan;38(1):56-65. doi: 10.1007/s00464-023-10561-5. Epub 2023 Nov 28 Review > Int J Gynaecol Obstet. 2024 Sep:166(3):994-1005. doi: 10.1002/ligo.15485. Epub 2024 Apr 8. Robotic versus laparoscopic liver resection for liver Robotic-assisted laparoscopic versus abdominal and malignancy: a systematic review and meta-analysis liver laparoscopic myomectomy: A systematic review and 1al and of propensity score-matched studies alysis meta-analysis ew and Zhang-Tao Long # 1, Hua-Jian Li # 1, Hao Liang # 1, Ya-Chen Wu 1, Sajid Ameer 1, Xi-Lin Qu 1, Zhi-Qiang Xiang ¹, Qian Wang ², Xiao-Ming Dai ³, Zhu Zhu ⁴ ⁵ Weigi Chen 3 2, Jun Ma 3, Zhao Yang 2 3, Xiao Han 4, Chenyang Hu 1, Huai Wang 1, Ying Peng 5, Lei Zhang ³, Bin Jiang ¹ 2 Zhang-Tao Long * '', Hua-Jian Li * '', Hao Liang * '', Ya-Chen Wu '', Sajid Ameer '', Xi-Lin Qu 1, 7hi-Oiang Xiang 1 Oian Wang 2 Xiao-Ming Dai 3 7hu 7hu 4 5 Conclusions: The safety and effectiveness of RLM are superior Conclusion: Surgical and oncological outcomes are comparable between RLR and LLR on patients with liver malignancies. Therefore, the benefits of applying RLR in patients with liver malignancies LM. LIVI. Review > J Robot Surg. 2024 Jul 5;18(1):281. doi: 10.1007/s11701-024-02016-3. Robotic versus laparoscopic general surgery in the Meta-Analysis > Surg Endosc. 2024 Sep:38(9):4846-4857. doi: 10.1007/s00464-024-11162-6. 1162-6. Epub 2024 Aug 15. 1 the emergency setting: a systematic review Robotic, laparoscopic and open surgery for Theophilus T K Anyomih ¹ ², Alok Mehta ³, Dorcas Sackey ⁴, Caroline A Woo ⁵, gallbladder cancer: a systematic review and network Emmanuel Y Gyabaah ⁶, Marigold Jabulo ², Alan Askari ⁷ meta-analysis twork Theophilus T K Anyomin - , Alok Menta -, Dorcas Sackey -, Caroline A Woo -, Madeline Yen Min Chee 3 2, Andrew Guan Ru Wu 2, Khi-Yung Fong 2, Ashley Yew 2, Emmanuel Y Gyabaah ⁶, Marigold Jabulo², Alan Askari⁷ Ye Xin Koh ^{1, 3} Brian K P Goh ⁴ 5 € Madeline Yen Min Chee ³ ², Andrew Guan Ru Wu ², Khi-Yung Fong ², Ashley Yew ², Perioperative outcomes for emergency robotic surgery in selected general surgery conditions are Ye Xin Koh ¹ ³, Brian K P Goh ⁴ ⁵ € ditions are comparable to laparoscopic surgery. However, recommending robotic surgery in the acute setting cute setting necessitates a well-powered large population study for stronger evidence. intraoperative blood loss and post-operative complications compared to OS. The wered large population study for stronger evidence.

benefit of either MIS approach (laparoscopic versus robotic) over the other. benefit of either MIS approach (laparoscopic versus robotic) over the other.



Robotic versus Laparoscopic Liver Resections for Colorectal Metastases: A Systematic Review and Meta-Analysis

Kamil Safiejko ¹, Michal Pedziwiatr ², Michal Pruc ³, ⁴, Radoslaw Tarkowski ⁵, Marcin Juchimiuk ¹, Marian Domurat ¹, Jacek Smereka ⁶, Khikmat Anvarov ⁷, Przemysław Sielicki ³, Krzysztof Kurek ³, Lukasz Szarpak ¹ ³ ⁸ ⁹

Affiliations + expand PMID: 38672678 PMCID: PMC11048946 DOI: 10.3390/cancers16081596

= 0.78). Laparoscopic or robotic approaches for colorectal liver metastases are comparable in terms of safety and effectiveness. There are significant advantages to robotic surgery, although there is still no



Review > J Robot Surg. 2024 May 16;18(1):212. doi: 10.1007/s11701-024-01954-2.

Robotic assisted versus laparoscopic surgery for deep endometriosis: a meta-analysis of current evidence

Matteo Pavone ¹ ² ³, Alessandro Baroni ⁴, Federica Campolo ⁵, Marta Goglia ⁶, Diego Raimondo ⁷, Antonella Carcagni ⁸, Cherif Akladios ⁹, Jacques Marescaux ¹⁰, Francesco Fanfani ⁵ ¹¹, Giovanni Scambia ⁵ ¹¹, Manuel Maria Ianieri ⁵ ¹²

group. Robotic surgery is not inferior to laparoscopy in patients with endometriosis in terms of surgical outcomes; however, RAS requires longer operative times and longer hospital stay. The

Review > Int J Gynaecol Obstet, 2024 Sep:166(3):994-1005. doi: 10.1002/§go.15485. Epub 2024 Apr 8.

Robotic-assisted laparoscopic versus abdominal and laparoscopic myomectomy: A systematic review and meta-analysis

Weiqi Chen ³ ² , Jun Ma ³ , Zhao Yang ² ³ , Xiao Han ⁴ , Chenyang Hu ¹ , Huai Wang ³ , Ying Peng ⁵ , Lei Zhang ³ , Bin Jiang ¹ ²

Conclusions: The safety and effectiveness of RLM are superior to those of A LM.

Review > Surg Endosc. 2024 Jan;38(1):56-65. doi: 10.1007/s00464-023-10561-5. Epub 2023 Nov 28.

Robotic versus laparoscopic liver resection for liver malignancy: a systematic review and meta-analysis of propensity score-matched studies

Zhang-Tao Long [#] 1, Hua-Jian Li [#] 1, Hao Liang [#] 1, Ya-Chen Wu ¹, Sajid Ameer ¹, Xi-Lin Qu ¹, Zhi-Qiang Xiang ¹, Qian Wang ², Xiao-Ming Dai ³, Zhu Zhu ⁴ 5

Conclusion: Surgical and oncological outcomes are comparability with liver malignancies. Therefore, the benefits of applying RLF need to be further explored.

Review > J Robot Surg. 2024 Jul 5;18(1):281. doi: 10.1007/s11701-024-02016-3.

Robotic versus laparoscopic general surgery emergency setting: a systematic review

Theophilus T K Anyomih ¹¹ ², Alok Mehta ³, Dorcas Sackey ⁴, Caroline A Woo ⁵, Emmanuel Y Gyabaah ⁶, Marigold Jabulo ², Alan Askari ⁷

Perioperative outcomes for emergency robotic surgery in selected general surg comparable to laparoscopic surgery. However, recommending robotic surgery necessitates a well-powered large population study for stronger evidence. Review > Minim Invasive Ther Allied Technol. 2024 May 31:1-9. doi: 10.1080/13645706.2024.2359705. Online ahead of print.

Robotic versus laparoscopic surgery for colorectal cancer in older patients: a systematic review and meta-analysis

Xinyu Wang ¹, Rui Ma ¹, Tiewei Hou ¹, Hao Xu ¹, Cheng Zhang ¹, Chun Ye ¹

Conclusion: This first meta-analysis comparing outcomes of robotic and laparoscopic surgery in older colorectal cancer patients shows that both approaches result in no difference in operating time, complication rates, conversion to open surgery, reoperation rates, and LOS. Scarce data shows that



Robotic, laparoscopic and open surgery for gallbladder cancer: a systematic review and network meta-analysis

Madeline Yen Min Chee $^{3/2}$, Andrew Guan Ru Wu 2 , Khi-Yung Fong 2 , Ashley Yew 2 , Ye Xin Koh $^{3/3}$, Brian K P Goh $^{4/5}$ 6

intraoperative blood loss and post-operative complications compared to OS. There was no obvious benefit of either MIS approach (laparoscopic versus robotic) over the other.

Elke Bos | NVTAG Symposium | October 2024









> Ann Surg Open. 2023 Apr 28;4(2):e284. doi: 10.1097/AS9.000000000000284.

Surgical stress: the muscle and cognitive demands of robotic and laparoscopic surgery

Abdul Shugaba ¹², Daren A Subar ³², Kate Slade ⁴, Mark Willett ³, Mohammed Abdel-Aty ³, Iain Campbell ³, Nick Heywood ³, Louis Vitone ³, Adnan Sheikh ³, Mike Gill ³, Bachar Zelhof ⁵, Helen E Nuttall ⁴, Theodoros M Bampouras ⁶, Christopher J Gaffney ¹

Conclusion: These data suggest greater muscle demands in laparoscopic surgery, but greater cognitive demands in robotic surgery.









> Surg Endosc. 2022 Nov;36(11):8397-8402. doi: 10.1007/s00464-022-09105-0. Epub 2022 Feb 19.

A comparison of laparoscopic and robotic ergonomic risk

> Ann Surg Open. 2023 Apr 28;4(2):e284. doi: 10.1097/AS9.000000000284.
Sara Monfared ¹, Dimitrios I Athanasiadis ¹, Luke Umana ¹, Edward Hernandez ¹, Hamed Asadi ², Cameron L Colgate ¹, Denny Yu ², Dimitrios Stefanidis ³

robotic and laparoscopic surgery

Abdul Shugaba¹², Daren A Subar³², Kate Slade⁴, Mark Willett³, Mohammed Abde Lain Campbell³, Nick Heywood³, Louis Vitone³, Adnan Sheikh³, Mike Gill³, Bachar Zelhof³, Helen E Nuttall⁴, Theodoros M Bampouras⁶, Christopher J Gaffney¹

Conclusion: These data suggest greater muscle demands in laparoscopic surgery, but greater

cognitive demands in robotic surgery.















- Evaluate innovations with minimal patient benefits in relation to their overall resource and environmental costs
- Evaluate the health benefits lost due to resource allocation to accommodate new technologies (health opportunity costs)





- Evaluate innovations with minimal patient benefits in relation to their overall resource and environmental costs
- Evaluate the health benefits lost due to resource allocation to accommodate new technologies (health opportunity costs)
- → Care that is NOT provided to other patients with expected higher quality-adjusted life year (QALY) gain





SHARE - AIMS

Health Technology Assessment and Life Cycle Assessment

→ to analyze the ecological and environmental impacts of robotic surgery compared to traditional laparoscopy





SHARE - AIMS

Health Technology Assessment and Life Cycle Assessment

- → to analyze the ecological and environmental impacts of robotic surgery compared to traditional laparoscopy
- → guiding resource allocation and indication assessment for robotic surgery, to prioritize public health over minimal patient benefits





SHARE - AIMS

Health Technology Assessment and Life Cycle Assessment

- → to analyze the ecological and environmental impacts of robotic surgery compared to traditional laparoscopy
- → guiding resource allocation and indication assessment for robotic surgery, to prioritize public health over minimal patient benefits
- → develop a novel metric to assess overall resource efficiency (e.g. time, money, personnel, space, equipment, maintenance) enabling quantification of care withheld from other patients when opting for new medical interventions





The next generation of surgical robotics is poised to transform healthcare systems around the world.

- A robot that can "feel" whether tissue is healthy or diseased
- Implement AI

Whether this will result in substantial patient and societal benefit depends critically on whether innovation is guided by appropriate evaluation.











Elke Bos e.m.bos@amsterdamumc.nl

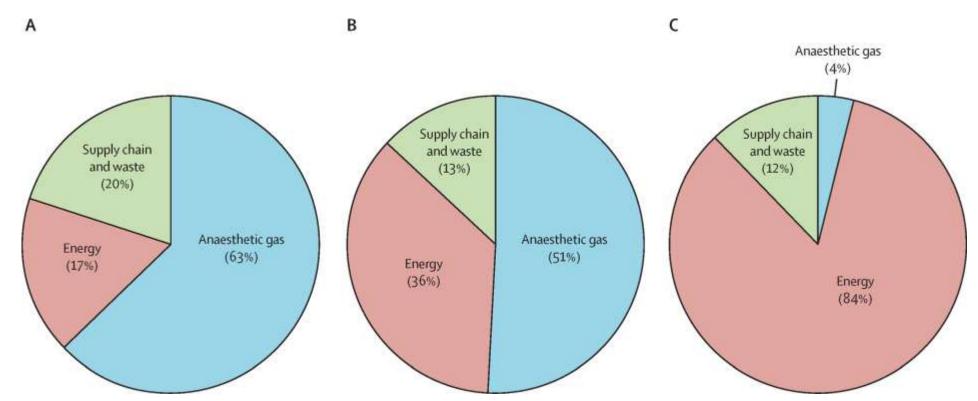






Ŭ

OK uitstoot: aandeel anesthesiegassen

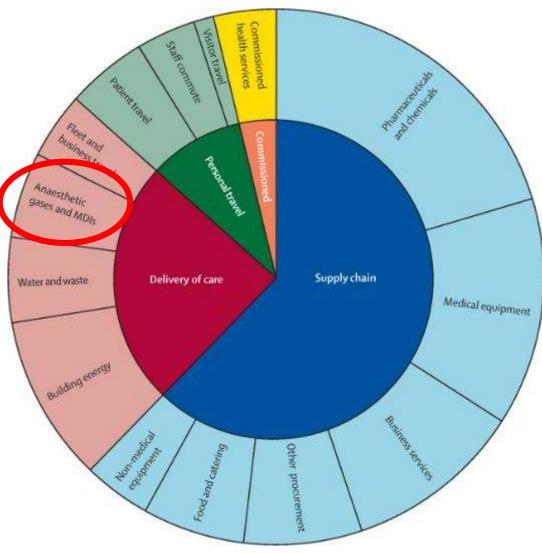






Aandeel damp in CO₂-eq

3% van totale uitstoot van de zorg door inhalatieanesthetica







Feng Q, et al. Robotic versus laparoscopic surgery for middle and low rectal cancer (REAL): short-term outcomes of a multicentre randomised controlled trial. Lancet Gastroenterol Hepatol. 2022 Nov;7(11):991-1004.

- multicentre, randomised, controlled, superiority trial, 2016
 2020, middle and low rectal cancer.
- Primary end-point: The 3-year locoregional recurrence rate
- Secondary end-points: circumferential resection margin positivity and 30-day postoperative complications (Clavien-Dindo classification grade II or higher)
- Power calculation: The 3-year locoregional recurrence rate was estimated to be 7% in the laparoscopic group. The hazard ratio of the robotic group was estimated to be 0.5 based on previous reports. With the power (1-β) at 0.9 and significance level (α) at 0.05, 522 cases for each group were required to achieve statistical significance.

Secondary short-term outcomes suggest that for middle and low rectal cancer, robotic surgery resulted in better oncological quality of resection than conventional laparoscopic surgery, with less surgical trauma, and better postoperative recovery

Accession to the backward manife in the 2014/08/2017:04 1011-0-1016-0-00 inter-Mahmmalui anatomida Maaling 80.4% 1213 244 -071-020-040 10.061 Manufactured 18.0.04 11200 471754-15 * 3.44 1.000 1111-011 10110-0012 1100 10.752 111/1994 411014-05 4-121 United Interface or following Second Address 411154416 -------2010/01/01 1944 ACCUSED AND ADDRESS Desg. out-throughout 821495 misiano. -8122-2406-846 11424 Control we can a sufficient of the loss 10.2% 51100 8111111111 4761 Palencing's federates 400.764 711246 -2010 States 470 4164 And shall and be addressed £1(14%) 80.3% #1111944731 10.00 10,164 1013.044 -----6.611 Chevron Unider graph of provingen street Adda and 25122 244 MAY CORPORE to children . 1000070-000 1014101 \$8-CLPN2 103,043 ***** 10000 170.046 411594-415 100.000 100.04 distantia in the 101010-000 Classics Mitche grade of phantamental Indiago transmi i a the 2014014-04 ----traffic to be a 12944012940 101404-00 station on page 3446.011 451124-64 and the triang in 2% 441124-06 the and 3113445 -0.5104-0.042 8.625 Requisitor within \$7-mail after specifice 14(5.4%) TRAMO. 17139040 to negati Change How Tony thing for any definition in the BRADE-WAS 1011(10-04) A & D - 40 (A + 20 () -10.0007 within one year offer printers between surgers Torip to first flation, it \$F4.0174-840 Address (1997) in the Rev H 411039-012 11105 Mining Aste 11.0 844 1015-016 Time to first that day, it 4540218462730 401021-0-076-0 10110-0010-001 11276 Mining-Solar 31.01 (14) 10123-044 Town to first same Road shet, sheen 12054-000 71579728 1.67 5-5-1-8-1 to -8-452 manage data 19.07% 1113-645 Transite Anto Andreasting. 2010/02/03 40:00 Rownsk plantelijk -11.8111/14-4-0 -010882 minary little 28.02 (%) 80.5% Taxa Michael Andrea M-10710 to Gard main the loss reputi ふまいん ひかわれる 616 Mining Sets and had 17111-044 Restoration being had done done 700100110 810741443340 1.000 and an in the second by present makes any considered a completance. We can be a present to being advected \$2.00 minute proop our patient \$2.00 minute insig of the draming terms for more of another more descent in the Ingenerator price, one patient dial (access of practices). Sub-age and series relations, the particulor dell anti-collecter diratog Par chandring chemic barging of diabeters in address in

Administration (in 1981)

10.241

44,004,040

International Advantations:

seringing prote with a 30 days after operation

Rationic with complications of Casimo Streik-goals I

Language and a state of the sta

Add and the lot of the

441444-32

Assessory.

in malain

1000

sinder b

Falls 3. Protogenetics multiplity and recovery following relative or laperenoistic magne-

Û

Feng Q, et al. Robotic versus laparoscopic abdominoperineal resections for low rectal cancer: A single-center randomized controlled trial. J Surg Oncol. 2022 Dec;126(8):1481-1493.

- RCT, single center, double blinded, 2013 2016, robotic and laparoscopic abdominoperineal resections (APRs)
- 174 robotic vs 173 laparoscopic
- Primary end-point: 30-day postoperative complication rate (Clavien-Dindo grade II orhigher) of the intent-to-treat population
- Secondary end-points: secondary outcomes ERAS protocol compliance, surgical quality, pathological outcomes, postoperative short-term recovery, urinary and sexual function, and long-term oncological outcomes.
- Power calculation: The estimated sample size was 342 patients (171 in each group). Thissize provided 80% power at the 5% (two-sided) level of significance to detect a reduction in the postoperative complication rate from25% in the laparoscopic group (according to previously reports 20) to12% (according to the unpublished data of our center) in the robotic group using Fisher's exact test, allowing for 10% attrition.
 10% attrition.

Postoperative complications (%)	Robolic n=174	Laparoscopic n=173	Difference - % (95% CI)	value									
Total	23/174(13.2)	41 / 173 (23.7)	-10.5(-18.6 = -2.3)	0.013			-	+	-1				
Sex			Interaction analysis,	P=0.602	£1.			1					
Main	15 (108 (13.9)	30/113 (26.5)	-12.7 (-22.9 to -2.0)	0.019			-		-				
Famalo	8/66(12.1)	11/00(18.3)	-6.2 (-19.2 to 6.5)	0.300			-	+	+	-			
Age - year			interaction analysis.	P=0.202	r -								
< 60	10/87 (14.9)	14/73 (19.2)	4.2 (-16.3 to 7.4)	6.476				+	•	-			
≥ 60	10/107 (11.5)	27 / 100 (27.0)	-15.5 (-26.2 to -4.1)	0.008		12	-	-	-				
ASA classification			Interaction analysis,	P+0.965	61								
1	18/124(12.9)	27/116(23:3)	-10.4 (-20.1 to +0.8)	0.036			-	+	-				
15 - 111	7750(14.0)	14/57(24.6)	-10.6 (-25.0 to 4.8)	0.170			_	+	+	÷			
Body mass index - kg/m ²			Interaction analysis,	P+0.254	10								
\$ 23.8	33(111(11.7)	31/116118.1)	-6.4 (-15.7 to 3.0)	0.177			- 24	+•	+				
2 24	10/63(15,9)	20/57 (36.1)	-19.2 (-34.0 to -3.0)	0.015		_		+	- 1				
rior abdominal surgery		1	Interaction analysis.	P=0.708	0			1					
No	16/131(12.2)	31/133(23.0)	-11.1 (-20.2 in -1.8)	0.018			-	+	-				
Yes	7/43(16.3)	10/40 (25.0)	-8.7 (-26.0 to 8.7)	0.325		1		-	+	_			
reoperative chemoradiotherapy		- company	Interaction analysis,	P=0.674	0			1					
No	18 / 137 (13.1)	31 (138 (22.5)	-0.3 (-18.3 to -0.2)	0.043				-	-				
Yes	5/37(13.5)	10/35(28.6)	-13.5 (-33.2 to 3.9)	0.110		_		+-	+				
lumor size - cm			Interaction analysis,	P+0.238	÷								
<4	10/91(11)0)	13.130 (14.4)	-3.9 (-13.5 to 6.5)	0.485				+	•	-			
2.4	13/83(157)	28183(33.7)	-18.1 (-30.5 m -5.0)	0.007		_	-	-	- 1				
Pathological T stage			Interaction analysis.	P=0,789	61			1					
1-2	9/72(12.5)	15176(21.1)	-8.6 (-20.5 to 3.7)	0.165			_		+				
3-4	14/102(13.7)	25/97(25.8)	-12.1 (-23.8 in -1.0)	0.032			-	+	-				
Pathological N stage			Interaction analysis.	P=0.378	0								
11	15/107(14.0)	257 110 (21.0)	-7.5 (-17.4 to 2.7)	0.343					+				
1-2	8/67(11.9)	16/57(28.1)	-18.1 (-30.1 to -2.1)	0.023		-	-	+	-				
					40	-30	-20	-10	0	10	20	30	4
					-					-			+

Û

Luo C, et al. Efficacy and safety outcomes of robotic radical hysterectomy in Chinese older women with cervical cancer compared with laparoscopic radical hysterectomy. BMC Womens Health. 2018 May 1;18(1):61.

- RCT, double blinded, 2014 2015
- 30 robotic radical hysterectomy (RRH)
 vs 30 laparoscopic radical hysterectomy (LRH)
- Primary end-point: Numbers of recurrence and death.
- Secondary end-points: postoperative complications and length of postoperative hospital stay
- Power calculation??

Characteristics	RRH group	LRH group	P value 0.037	
Total number of Postoperative complications, n (%)	4(6.7)	11(18.3)		
Febrile morbidity, n (%)	2(6.7)	5(16.7)	0.421	
Port site cellulitis/hernia/dehiscence, n (%)	1(3.3)	3(10.0)	0.605	
Urinary tract infection, n (%)	1(3.3)	2(6.7)	1.000	
Ureteral injury, n (%)	O(O)	1 (3.3)	1.000	
Indwelling bladder catheter time ^a , d	6(5-11)	7(6-11)	0.043	
Indwelling drain catheter time ^a , d	29(23-36)	32(28-38)	0.038	
Length of postoperative hospital stay ^a , d	13(10-15)	15(11-17)	0.042	
Recurrence, n (%)	2(6.7)	3(10.0)	1.000	
Death, n (%)	1(3.3)	2(6.7)	1.000	

Notes: "median (interquartile range). Abbreviations: RRH robotic radical hysterectomy, LRH laparoscopic radical hysterectomy



Û

Lu J, et al. Assessment of Robotic Versus Laparoscopic Distal Gastrectomy for Gastric Cancer: A Randomized Controlled Trial. Ann Surg. 2021 May 1;273(5):858-867.

- Open-label, non-inferiority RCT, non-blinded, 2017
 2020
- 141 robotic distal gastrectomy (RDG) vs 142 laparoscopic distal gastrectomy (LDG)
- Primary end-point: 3-year disease free survival
- Secondary end-points: ?
- Power calculation Power calculation: projected 3year disease-free survival rate for the LDG group was 82.3%. Based on an alpha of 0.025, a power of 90%, and a margin delta of 16% → 120 pt per group (expected dropout rate of 20%, total of 300 pts)

	RDG (n = 141) LDG (n = 142)		
e	Mean ± SD / N (%)	Mean + SD / N (%)	P valu
Postoperative recovery			
Time to ambulation (d)	2.0 ± 0.7	25±18	0.005
Time to first flatus (d)	3.2 ± 0.6	3.5 ± 0.9	<0:00
Time to first liquid intake (d)	3.5 ± 0.6	3.9 ± 1.3	0.001
Time to first liquid intake (d) Drainage tabe removed time (d) Postoperative hospital stay (d) Postoperative transfusion Reoperation	6.5±1.8	7.0 ± 2.5	0.163
Postoperative hospital stay (d)	7.9 ± 3.4	82+25	0.062
Postoperative transfusion	8 (5.7%)	16 (11.3%)	0.091
Reoperation	0(0.0%)	1 (0.7%)	1.000
Overall morbidity	13 (9.29)	25 (17.6%)	0.039
Surgicul morbidity	5 (3.5%)	9 (6.3%)	0.279
Abdominal bleeding	1 (0.7%)	3 (2.1%)	0.622
Anastomotic leakage	0 (0.0%)	1 (0.75)	1,000
Item	1(0.7%)	1 (0.7%)	1.000
Gastroplegia	0 (0.0%)	1 (0.7%)	1.000
Wound infection	1 (0.7%)	1 (0.2%)	1.000
Peritoncal infection	3 (2.1%)	2 (1.4%)	0.684
Medical morbidity	9 (6.4%)	20 (14.1%)	0.033
Preumonia	8 (5.7%)	16(11.3%)	0.091
Cardiovascular system	1 (0.7%)	1 (0.7%)	1.000
Liver system	2 (1.4%)	1 (0.7%)	0.622
Urinary system	1 (0.791)	2 (1.4%)	1.000
Deep van thrombosis	0 (0.0%)	1(0.7%)	1.000
Deptanned readmission	2 (1.4%)	2 (1.4%)	1.000
Peritonnal infection	1 (0.7%)	1 (0.7%)	1.000
Pneumonia	0 (0.0%)	1 (0.7%)	1.000
Clastroplegia	1 #3.7%3	0 (0.9%)	0.400
Clavien-Dindo classification	8 856 7 98 8	0 (0.0 ±)	0.267
A tarvach-conner crassification	0 (0.0%)	0.010763	(0.200)
n	11 (7.8%)	22 (15.5%)	
The	0 (0.0%)	1 (0.7%)	
111a	1 (0.7%)	1 (0.7%)	
IV	1 (0.7%)	1 (0.7%)	
IV V	0 (0.0%)	0 (0.0%)	
In-hospital mortality	0 (0.0%)	0 (0.0%)	-





Kawka M, et al. Laparoscopic versus robotic abdominal and pelvic surgery: a systematic review of randomised controlled trials. Surg Endosc. 2023 Sep;37(9):6672-6681.

- None of the studies found longterm significant differences (mortality/morbidity)
- Short term total complication rate
 - (n=31/35, 88.6%) studies: no signifcant difference
 - (n=4/35, 11.4%) studies: found a lower total complication rate in the robotic group

Conclusion here were no signifcant diferences between robotic surgery and laparoscopic surgery with regards to mortality and morbidity outcomes in the majority of studies. Robotic surgery was frequently associated with longer operative times and higher overall cost. Selected studies found potential benefts in post-operative recovery time, and patient-reported outcomes; however, these were not consistent across procedures and trials, with most studies being underpowered to detect diferences in secondary outcomes. Future research should focus on assessing quality of life, and long-term outcomes to further elucidate where the robotic platform could lead to patient benefts, as the technology evolves.

