Do reusable trocars increase the risk of wound complications in minimally invasive inguinal hernia repair?

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Cleveland Clinic

Disclosures

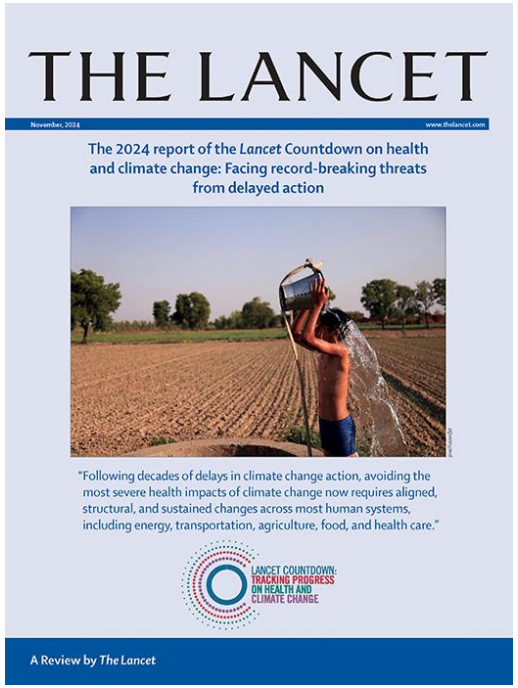
Dr. Petro serves as a consultant for Advanced Medical Solutions, TelaBio, Medtronic, Bard-Davol, and Surgimatix, and has received an institutional research grant from Merck.

Dr. Prabhu is on the advisory board (received consulting fees) for Surgimatix, DistalMotion, and CMR Surgical.

Dr. Miller is a consultant for Boston Scientific, received a research grant from the American Hernia Society and research funding from Integra.

Dr. Rosen serves as the medical director of the ACHQC and receives salary support, received institutional research grants from Telabio and Medtronic.

The remaining authors have no disclosures to report.


THE LANCET
November, 2024
www.thelancet.com
The 2024 report of the *Lancet* Countdown on health and climate change: Facing record-breaking threats from delayed action
"Following decades of delays in climate change action, avoiding the most severe health impacts of climate change now requires aligned, structural, and sustained changes across most human systems, including energy, transportation, agriculture, food, and health care."
LANCET COUNTDOWN: TRACKING PROGRESS ON HEALTH AND CLIMATE CHANGE
A Review by *The Lancet*


1216-M
1217-M
1218-M
1219-M

Climate Change and Surgery

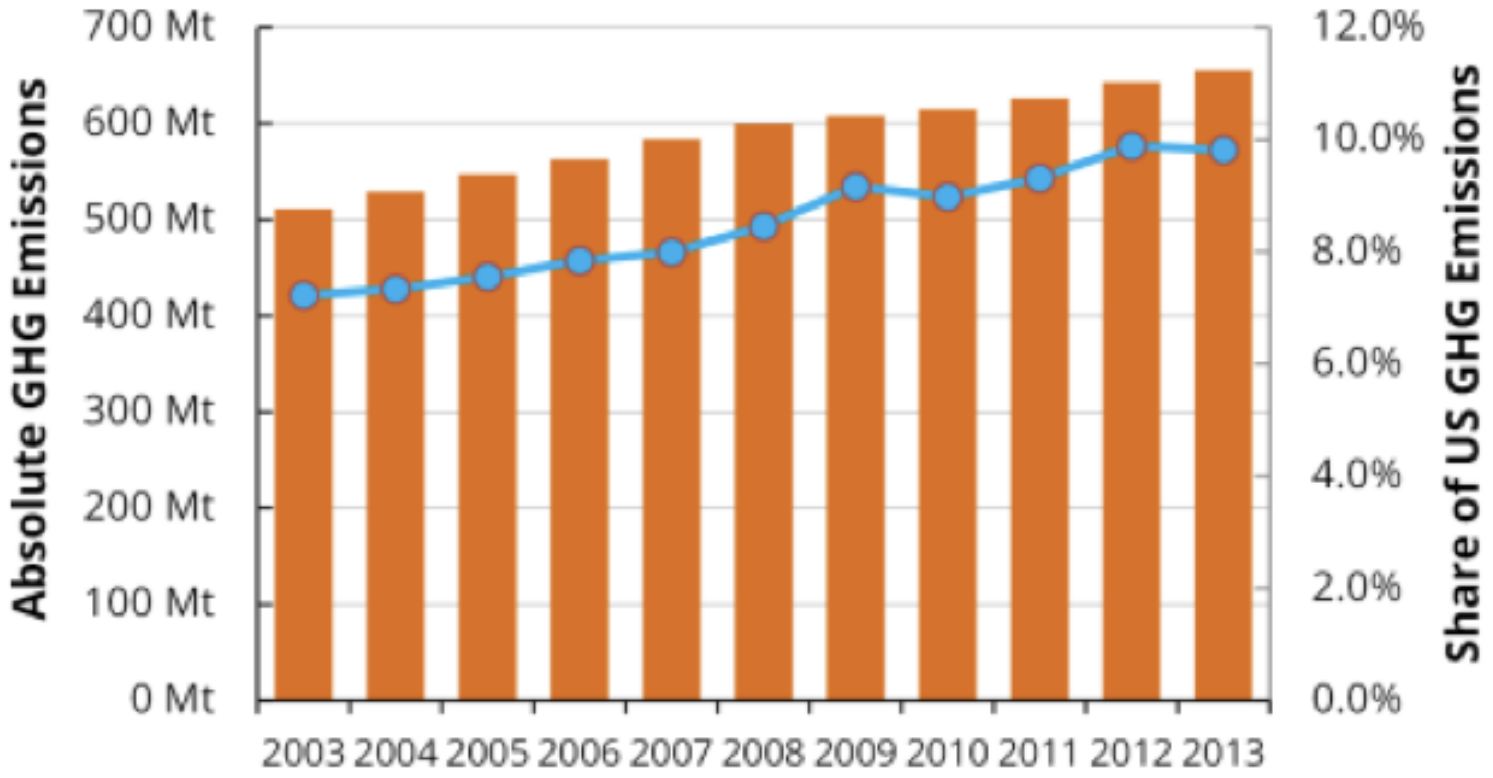
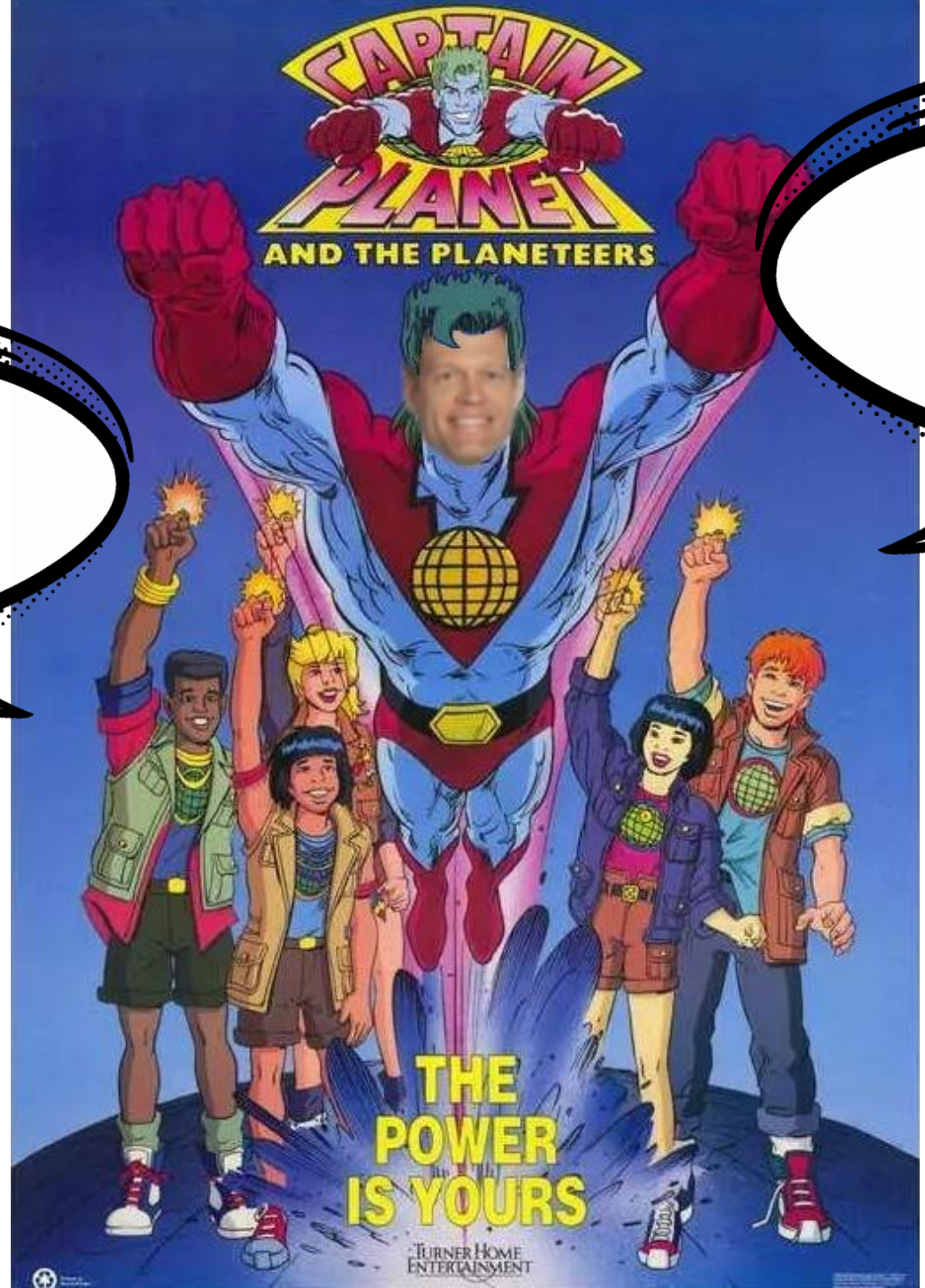


Fig 1. Time series of life cycle GHG emissions from US health care activities. Shown for 2003–2013, in absolute terms (orange bars) and as a share of U.S. national emissions (blue line). Mt = million metric tons.

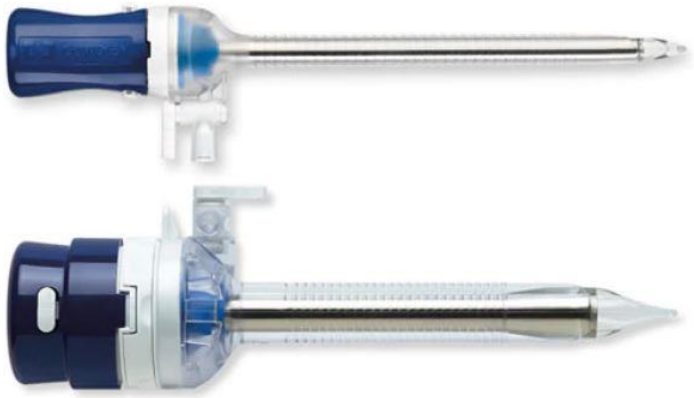
doi:10.1371/journal.pone.0157014.g001



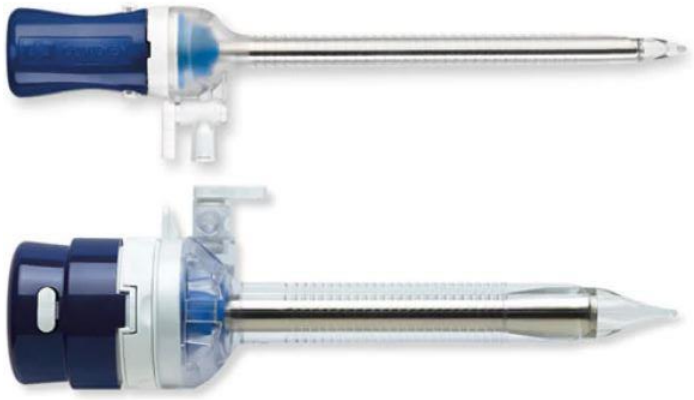
SAVE THE PLANET!

CHOOSE REUSABLE!

MIS trocars



MIS trocars



PLoS One. 2022 Jul 15;17(7):e0271601. doi: 10.1371/journal.pone.0271601. eCollection 2022.

Environmental impact of single-use, reusable, and mixed trocar systems used for laparoscopic cholecystectomies

Linn Boberg [1], Jagdeep Singh [2], Agneta Montgomery [3], Peter Bentzer [1 4]

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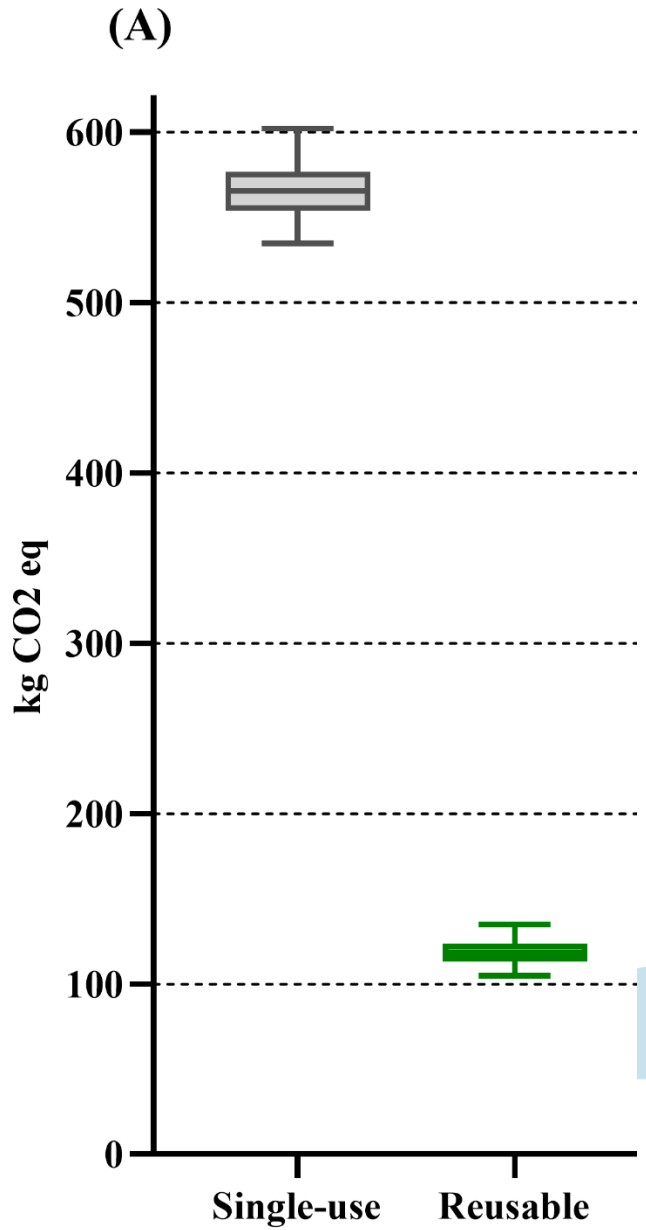

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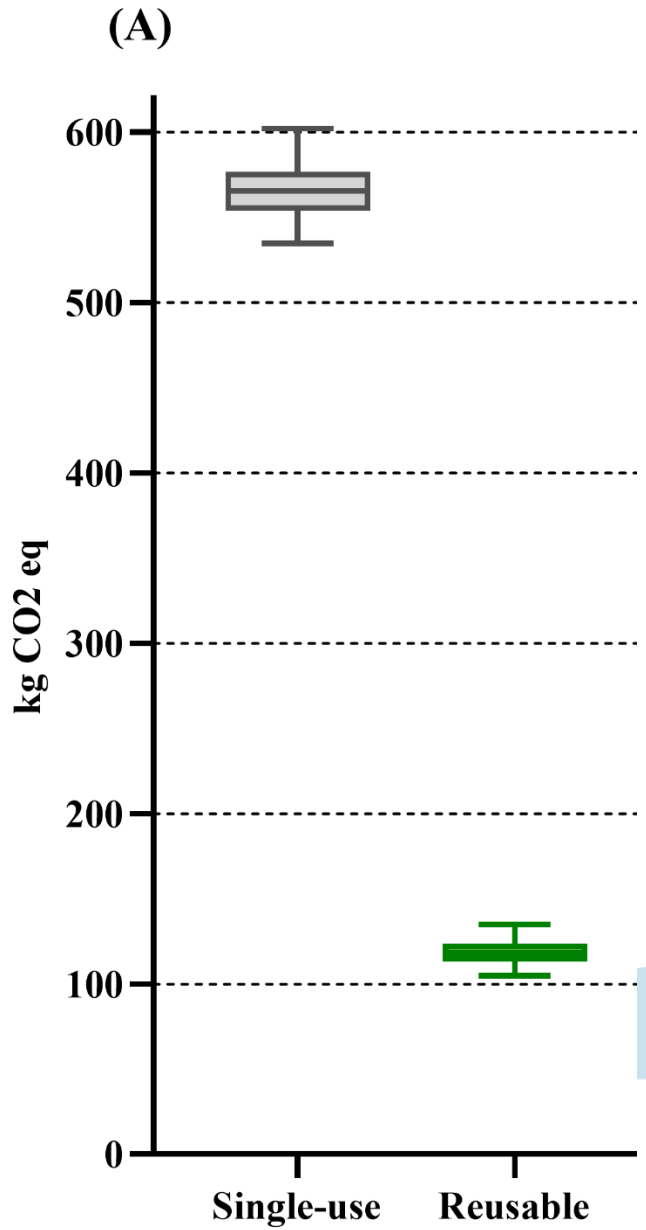
Environmental impact of single-use, reusable, and mixed trocar systems used for laparoscopic cholecystectomies

Linn Boberg [1], Jagdeep Singh [2], Agneta Montgomery [3], Peter Bentzer [1 4]

Scenario	Single-use trocar system	Reusable trocar system
500 procedures (primary analysis)	€ 37 567	€ 17 359
250 procedures	€ 18 783	€ 10 643
750 procedures	€ 56 350	€ 24 076
2-fold allocation, sterilization process	€ 37 567 [a]	€ 19 692
5-fold allocation, sterilization process	€ 37 567 [a]	€ 26 690

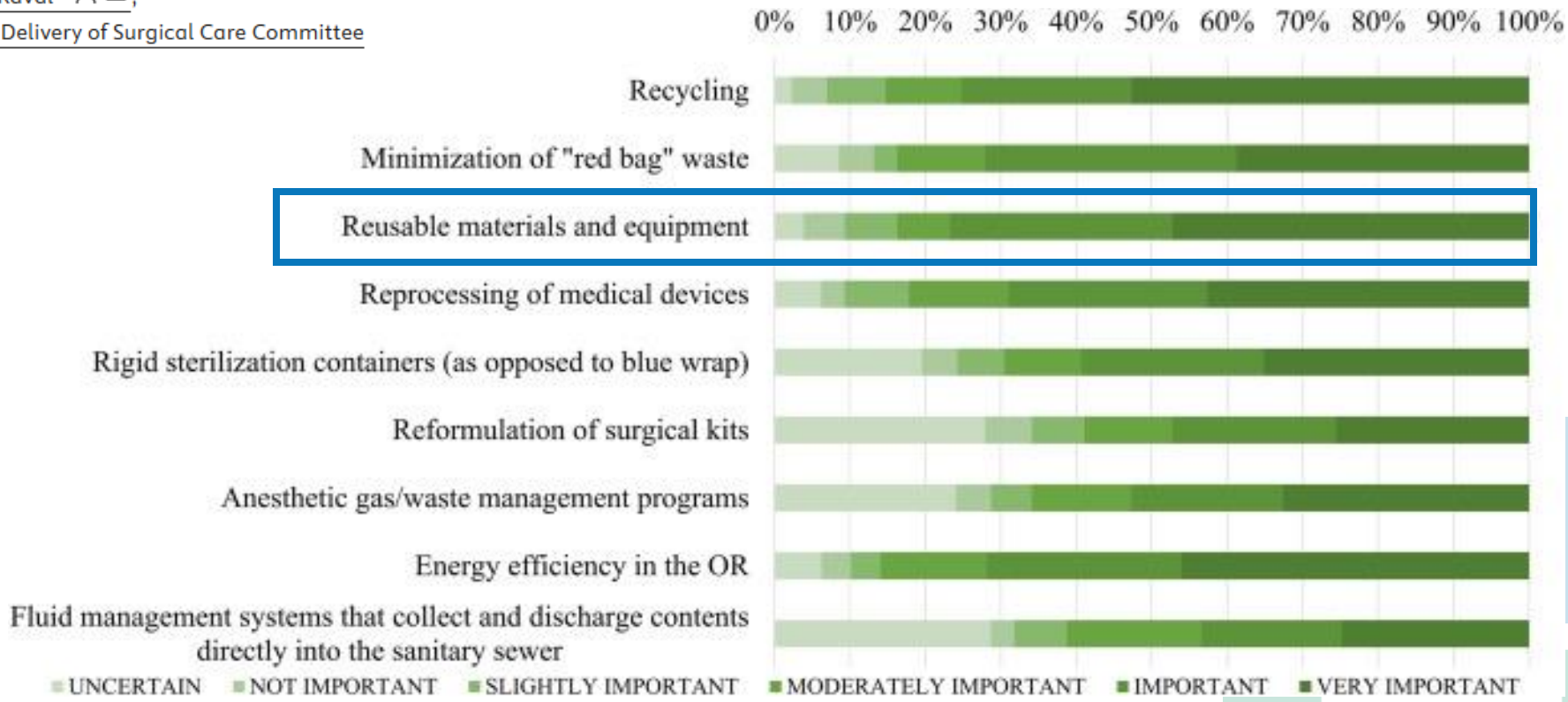


Journal of Pediatric Surgery
Volume 58, Issue 12, December 2023, Pages 2278-2285

Pediatric Surgeon Perceptions on Operating Room Environmental Stewardship and Current Institutional Climate-Smart Actions

Gwyneth A. Sullivan [a], Audra J. Reiter [a], Charesa Smith [a], Richard D. Glick [b], David E. Skarda [c d], Hau D. Le [e], Kenneth W. Gow [f], Barrie S. Rich [b], Mehul V. Raval [a] ✉,
the American Academy of Pediatrics Section on Surgery Delivery of Surgical Care Committee

Surgeon Perceptions



Journal of Hospital Infection
Volume 88, Issue 3, November 2014, Pages 127-131

Review

Infections and exposures: reported incidents associated with unsuccessful decontamination of reusable surgical instruments

P.M. Southworth

Databases of medical literature, Medline and Embase, were searched systematically. Articles detailing incidents associated with unsuccessful decontamination of surgical instruments were identified. Twenty-one articles were identified reporting incidents associated with failures in decontamination. A large proportion of incidents involved the attempted disinfection, rather than sterilization, of surgical instruments (43% of articles), counter to a number of national guidelines. Instruments used in eye surgery were most frequently reported to be associated with decontamination failures (29% of articles). Of the few articles detailing potential or confirmed pathogenic transmission, Pseudomonas aeruginosa and Mycobacterium spp. were most represented. One incident of possible variant Creutzfeldt–Jakob disease transmission was also identified. Limitations of

ANZ Journal of Surgery
Royal Australasian College of Surgeons

REVIEW ARTICLE | Full Access

Systematic review of reusable versus disposable laparoscopic instruments: costs and safety

Joey Siu, Andrew G. Hill, Andrew D. MacCormick

First published: 23 November 2016 | https://doi.org/10.1111/ans.13856 | Citations: 59

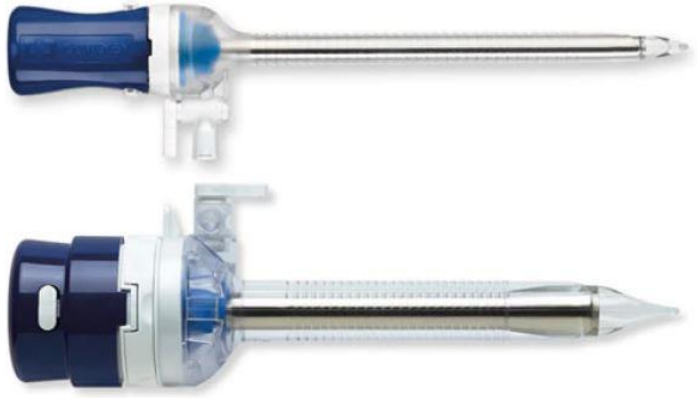
J. Siu MBChB, PGDipSurgSci (Ed); **A. G. Hill** MD, EdD, FRACS, FACS; **A. D. MacCormick** BHB, PhD, FRACS.

as single-use, multi-use, or combined (i.e., hybrid). As their names suggest, single-use instruments are disposed of after having been used only once, while multi-use instruments may be used multiple times provided adequate re-sterilization. One of the major reasons for single-use instrument preference is the perception that they cause less infections and contamination. While plausible in theory, the available evidence does not appear to support this claim.[9, 10] Nevertheless, the popularity and demand of single-use instruments has increased in recent times, raising important questions regarding the potential for an increased healthcare-associated environmental footprint. A survey by the Global Eco-Health

Primary Aim

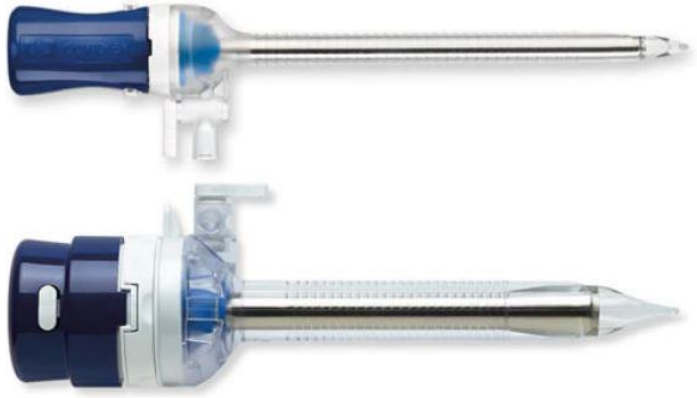
To compare the rates of surgical site infection between patients undergoing minimally invasive inguinal hernia repair with disposable versus reusable trocars.

Practice Pattern



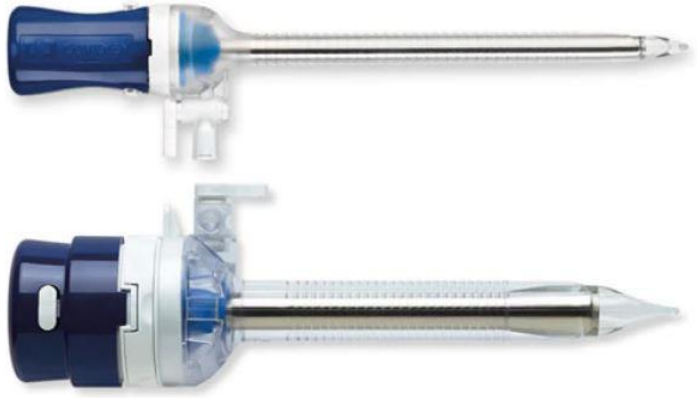
Practice Pattern

Laparoscopic =
Disposable



Practice Pattern

Laparoscopic = Disposable



Robotic = Reusable

Methods

- ACHQC query
  - Laparoscopic or robotic inguinal hernia repair
  - Elective
  - Permanent synthetic mesh
  - CDC clean wound class
  - January 2017 to December 2023
  - 30-day follow-up

Outcomes

- Primary outcome: incidence of surgical site infection (SSI)
- Secondary outcomes:
  - Surgical site occurrence (SSO)
  - SSO or SSI requiring procedural intervention (SSOPI)
  - Reoperation
  - Readmission

Propensity Score Matching

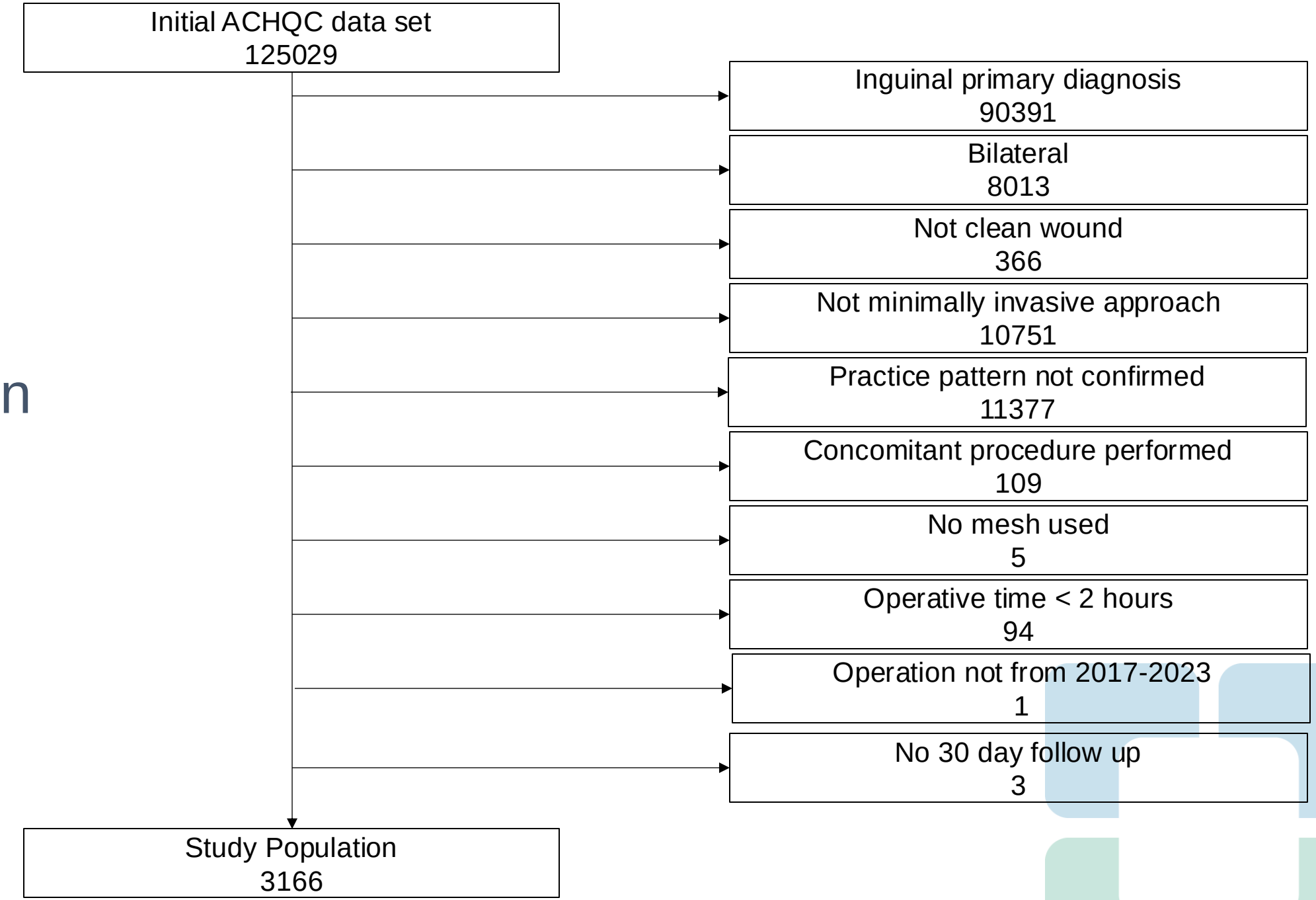
- 1:1 with nearest neighbor caliper width of 0.2
- Variables:
  - Gender
  - Age
  - BMI
  - Current smoker
  - Diabetes mellitus
  - COPD
  - Immunosuppression
  - ASA class
  - Recurrent hernia as indication for repair
  - Year of operation

Multi-Cohort Analysis

Multi-Cohort Analysis

Practice Followers

Study Population



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Baseline Characteristics

	Unmatched Cohort			1:1 Propensity Score Matched Cohort		
	Disposable *N=1424*	Reusable *N=1742*	P-value	Disposable *N=1191*	Reusable *N=1191*	P-value
Age capped at 90	64 [53,72]	64 [50,72]	0.5	54 [50,72]	63 [51,72]	0.6
Gender			**0.002**			0.8
Male	93% (1323)	90% (1563)		92% (1097)	92% (2197)	
Female	7% (101)	10% (179)		8% (94)	8% (185)	
Race			0.7			0.4
White	88% (1258)	89% (1547)		88% (1051)	88% (2088)	
Non-white	12% (166)	11% (195)		12% (140)	12% (294)	
BMI Capped 15-60	26 [24,28]	26 [24,29]	**<0.001**	26 [24,28]	26 [24,29]	0.6
Hypertension	35% (502)	39% (685)	**0.02**	39% (462)	37% (878)	**0.05**
Diabetes Mellitus	6% (83)	7% (124)	0.1	6% (75)	6% (152)	0.9
COPD	2% (30)	1% (23)	0.09	2% (20)	2% (46)	0.4
Anti-coagulation medications	3% (47)	3% (44)	0.2	2% (29)	3% (67)	0.3
Immunosuppressants	1% (17)	1% (25)	0.6	1% (11)	1% (25)	0.5
Current Smoker	9% (130)	11% (185)	0.2	9% (112)	10% (231)	0.6

Baseline Characteristics

	Unmatched Cohort			1:1 Propensity Score Matched Cohort		
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Operative Details

	Unmatched Cohort			1:1 Propensity Score Matched Cohort		
	Disposable *N=1424*	Reusable *N=1742*	P-value	Disposable *N=1191*	Reusable *N=1191*	P-value
Year of Operation			**<0.001**			**0.05**
2017	16% (222)	6% (98)		12% (140)	8% (98)	
2018	17% (240)	8% (147)		14% (166)	12% (144)	
2019	17% (248)	11% (198)		15% (183)	16% (191)	
2020	14% (204)	14% (245)		16% (193)	18% (211)	
2021	12% (175)	17% (302)		15% (174)	17% (206)	
2022	12% (165)	23% (407)		14% (165)	14% (168)	
2023	12% (170)	20% (345)		14% (170)	15% (173)	
ASA Class			**<0.001**			0.1
1	17% (241)	12% (205)		16% (195)	13% (155)	
2	65% (928)	70% (1221)		65% (770)	68% (806)	
3	17% (248)	18% (309)		18% (219)	19% (224)	
4	0% (7)	0% (7)		1% (7)	1% (6)	
5	0% (0)	0% (0)		0% (0)	0% (0)	
Operative time, minutes			**<0.001**			**<0.001**
0 - 59	79% (1119)	69% (1201)		78% (933)	68% (807)	
60 - 119	21% (305)	31% (541)		22% (258)	32% (384)	
>120	0% (0)	0% (0)		0% (0)	0% (0)	
Indications for Hernia Repair - Recurrent Hernia	10% (140)	13% (227)	**0.005**	10% (122)	11% (126)	0.8
Indications for Hernia Repair - Bowel Obstruction	0% (6)	0% (8)	0.9	1% (6)	1% (6)	1

Operative Details

	Unmatched Cohort			1:1 Propensity Score Matched Cohort		
	Disposable *N=1424*	Reusable *N=1742*	P-value	Disposable *N=1191*	Reusable *N=1191*	P-value
Year of Operation			**<0.001**			**0.05**
2017	16% (222)	6% (98)		12% (140)	8% (98)	
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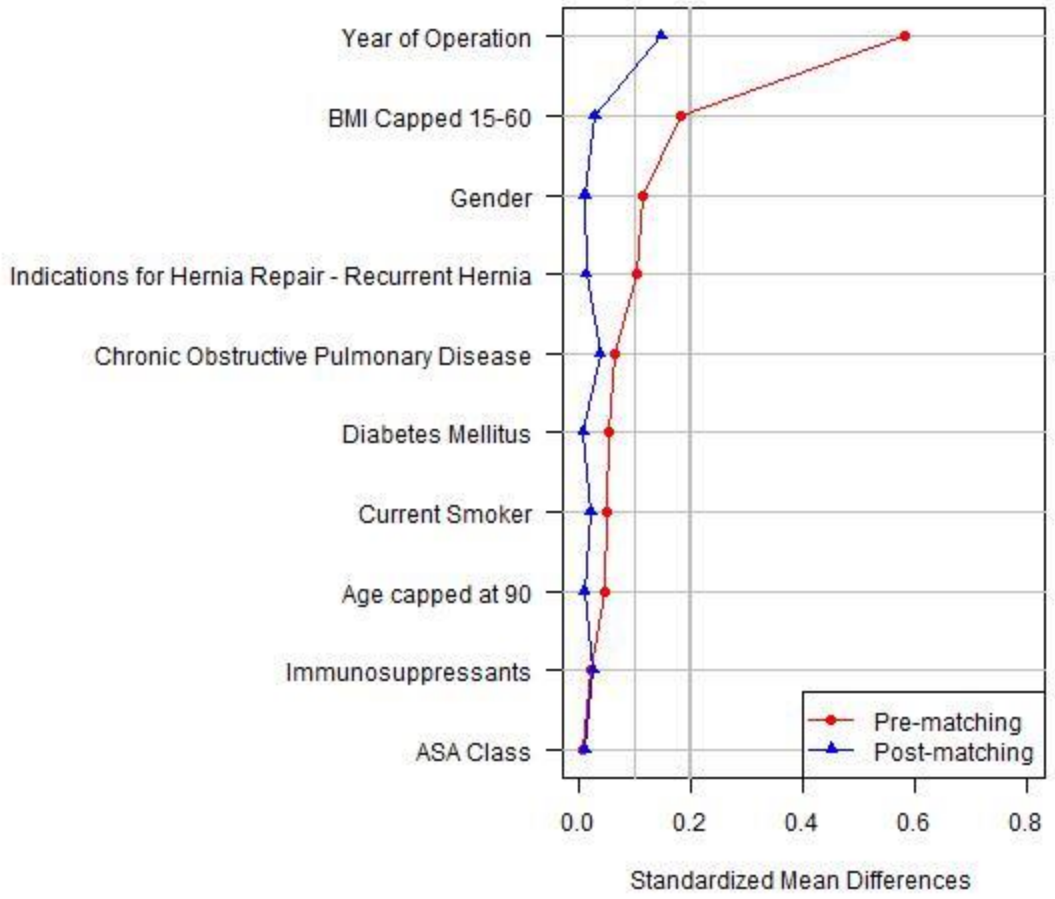
Propensity Matching Characteristics



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30-day Outcomes

	Disposable *N=1191*	Reusable *N=1191*	P-value
SSI			0.6
Yes	0% (2)	0% (1)	
No	100% (1189)	100% (1190)	
SSO			**0.003**
Yes	5% (56)	2% (29)	
No	95% (1135)	98% (1162)	
SSOPI			1
Yes	0% (3)	0% (3)	
No	100% (1188)	100% (1188)	
Reoperation			0.4
Yes	1% (8)	0% (5)	
No	99% (1183)	100% (1186)	
Readmission			0.6
Yes	0% (1)	0% (2)	
No	100% (1190)	100% (1189)	

SSO Events

	Disposable *N=1191*	Reusable *N=1191*	P-value
SSI			0.6
Yes	0% (2)	0% (1)	
No	100% (1189)	100% (1190)	
SSO			**0.003**
Yes	5% (56)	2% (29)	
No	95% (1135)	98% (1162)	
SSOPI			1
Yes	0% (3)	0% (3)	
No	100% (1188)	100% (1188)	
Reoperation			0.4
Yes	1% (8)	0% (5)	
No	99% (1183)	100% (1186)	
Readmission			0.6
Yes	0% (1)	0% (2)	
No	100% (1190)	100% (1189)	

SSO Events

	Disposable *N=1191*	Reusable *N=1191*	P-value
Wound cellulitis			0.2
Yes	5% (3)	0% (0)	
No	95% (53)	100% (29)	
Wound serous drainage			0.3
Yes	4% (2)	0% (0)	
No	96% (54)	100% (29)	
Wound purulent drainage			0.5
Yes	2% (1)	0% (0)	
No	98% (55)	100% (29)	
Seroma			**0.04**
Yes	82% (46)	62% (18)	
No	18% (10)	38% (11)	
Hematoma			**0.007**
Yes	12% (7)	38% (11)	
No	88% (49)	62% (18)	

SSO Events

	Disposable *N=1191*	Reusable *N=1191*	P-value
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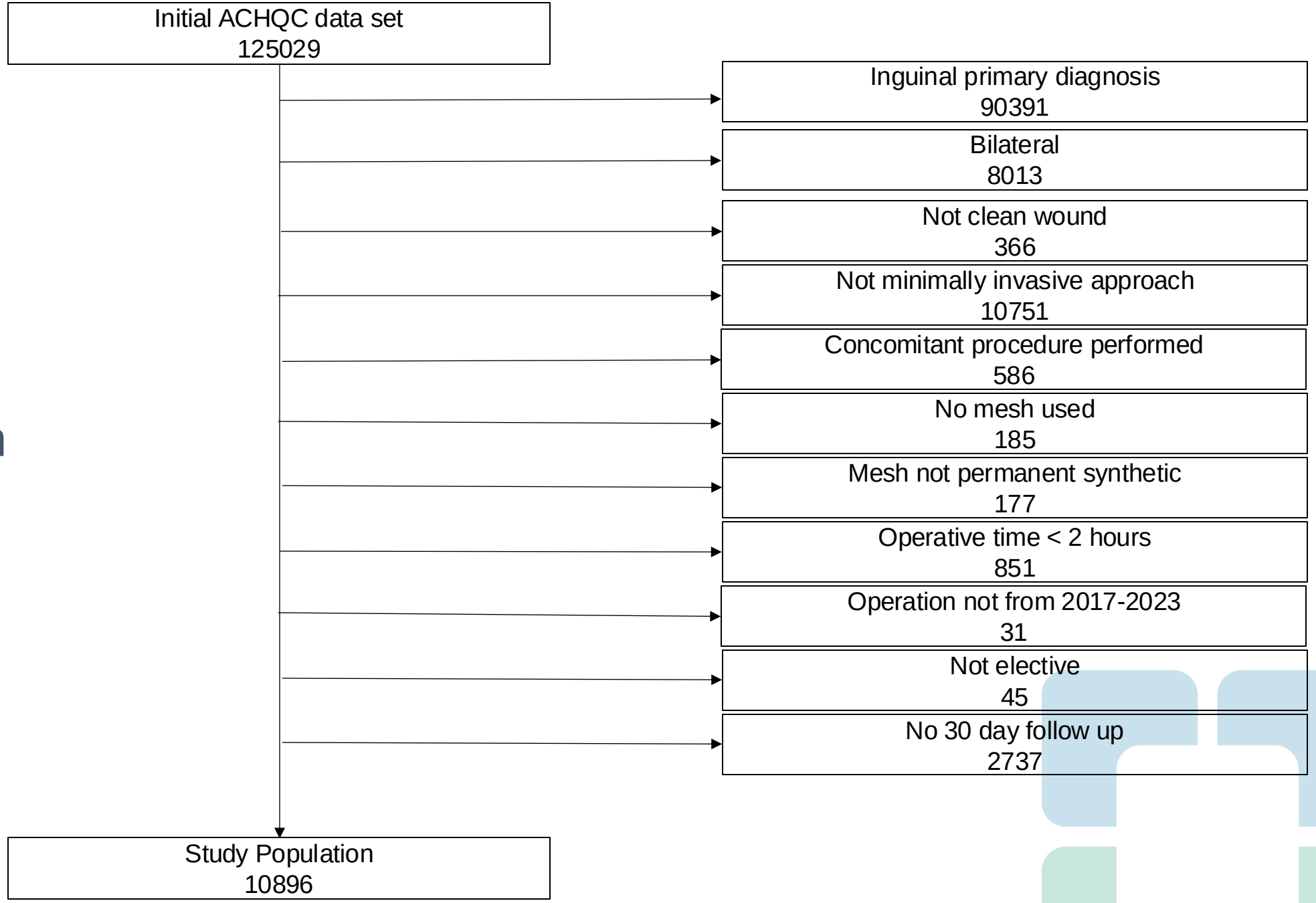
No	88% (49)	62% (18)	

All ACHQC Surgeons

Study Population



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Baseline Characteristics

	Unmatched Cohort			1:1 Propensity Score Matched Cohort		
	Disposable *N=5786*	Reusable *N=5110*	P-value	Disposable *N=4650*	Reusable *N=4650*	P-value
Age capped at 90	61 [48,70]	60 [47,70]	0.31	61 [48,70]	60 [47,70]	0.41
Gender			**<0.001**			**0.042**
Male	92% (5323)	89% (4572)		92% (4255)	90% (4199)	
Female	8% (463)	11% (538)		8% (395)	10% (451)	
Race			**0.009**			0.12
White	85% (4917)	83% (4249)		84% (3928)	83% (3875)	
Non-white	15% (869)	17% (861)		16% (722)	17% (775)	
BMI Capped 15-60	26 [24,28]	26 [24,29]	**<0.001**	26 [24,29]	26 [24,29]	**0.002**
Hypertension	34% (1966)	35% (1795)	0.2	34% (1591)	35% (1626)	0.4
Diabetes Mellitus	6% (373)	8% (399)	**0.006**	7% (327)	8% (356)	0.2
COPD	2% (141)	2% (101)	0.1	2% (102)	2% (96)	0.7
Anti-coagulation medications	4% (206)	4% (198)	0.4	3% (162)	4% (180)	0.3
Immunosuppressants	1% (77)	1% (61)	0.5	1% (57)	1% (56)	0.9
Current Smoker	10% (572)	12% (613)	**<0.001**	11% (494)	12% (555)	**0.05**

Baseline Characteristics

	Unmatched Cohort			1:1 Propensity Score Matched Cohort		
	Disposable *N=5786*	Reusable *N=5110*	P-value	Disposable *N=4650*	Reusable *N=4650*	P-value
Age capped at 90	61 [48,70]	60 [47,70]	0.31	61 [48,70]	60 [47,70]	0.41
Gender			**<0.001**			**0.042**
Male	92% (5323)	89% (4572)		92% (4255)	90% (4199)	
Female	8% (463)	11% (538)		8% (395)	10% (451)	
Race			**0.009**			0.12
White	85% (4917)	83% (4249)		84% (3928)	83% (3875)	
Non-white	15% (869)	17% (861)		16% (722)	17% (775)	
BMI Capped 15-60	26 [24,28]	26 [24,29]	**<0.001**	26 [24,29]	26 [24,29]	**0.002**
Hypertension	34% (1966)	35% (1795)	0.2	34% (1591)	35% (1626)	0.4
Diabetes Mellitus	6% (373)	8% (399)	**0.006**	7% (327)	8% (356)	0.2
COPD	2% (141)	2% (101)	0.1	2% (102)	2% (96)	0.7
Anti-coagulation medications	4% (206)	4% (198)	0.4	3% (162)	4% (180)	0.3
Immunosuppressants	1% (77)	1% (61)	0.5	1% (57)	1% (56)	0.9
Current Smoker	10% (572)	12% (613)	**<0.001**	11% (494)	12% (555)	**0.05**

Operative Details

	Unmatched Cohort			1:1 Propensity Score Matched Cohort		
	Disposable *N=5786*	Reusable *N=5110*	P-value	Disposable *N=4650*	Reusable *N=4650*	P-value
Year of Operation			**<0.001**			**<0.001**
2017	16% (898)	7% (342)		8% (351)	7% (341)	
2018	16% (949)	9% (485)		11% (496)	10% (483)	
2019	17% (961)	14% (720)		18% (850)	15% (715)	
2020	15% (847)	16% (818)		18% (842)	17% (777)	
2021	15% (888)	17% (877)		19% (871)	17% (804)	
2022	12% (683)	19% (961)		15% (681)	17% (778)	
2023	10% (560)	18% (907)		12% (559)	16% (752)	
ASA Class			**<0.001**			**<0.001**
1	21% (1196)	15% (752)		19% (896)	15% (695)	
2	58% (3343)	62% (3172)		58% (2717)	62% (2903)	
3	21% (1200)	22% (1132)		22% (1003)	22% (1011)	
4	1% (43)	1% (40)		1% (34)	1% (36)	
5	0% (0)	0% (0)		0% (0)	0% (0)	
Operative time, minutes			**<0.001**			**<0.001**
0 - 59	65% (3771)	57% (2930)		65% (3038)	57% (2664)	
60 - 119	35% (2015)	43% (2179)		35% (1612)	43% (1985)	
>120	0% (0)	0% (0)		0% (0)	0% (0)	
Indications for Hernia Repair - Recurrent Hernia	8% (470)	9% (437)	0.41	8% (382)	9% (409)	0.31
Indications for Hernia Repair - Bowel Obstruction	0% (24)	1% (34)	0.071	0% (22)	1% (32)	0.21

Operative Details

	Unmatched Cohort			1:1 Propensity Score Matched Cohort		
	Disposable *N=5786*	Reusable *N=5110*	P-value	Disposable *N=4650*	Reusable *N=4650*	P-value
Year of Operation			**<0.001**			**<0.001**
2017	16% (898)	7% (342)		8% (351)	7% (341)	
2018	16% (949)	9% (485)		11% (496)	10% (483)	
2019	17% (961)	14% (720)		18% (850)	15% (715)	
2020	15% (847)	16% (818)		18% (842)	17% (777)	
2021	15% (888)	17% (877)		19% (871)	17% (804)	
2022	12% (683)	19% (961)		15% (681)	17% (778)	
2023	10% (560)	18% (907)		12% (559)	16% (752)	
ASA Class			**<0.001**			**<0.001**
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5	0% (0)	0% (0)		0% (0)	0% (0)	
Operative time, minutes			**<0.001**			**<0.001**
0 - 59	65% (3771)	57% (2930)		65% (3038)	57% (2664)	
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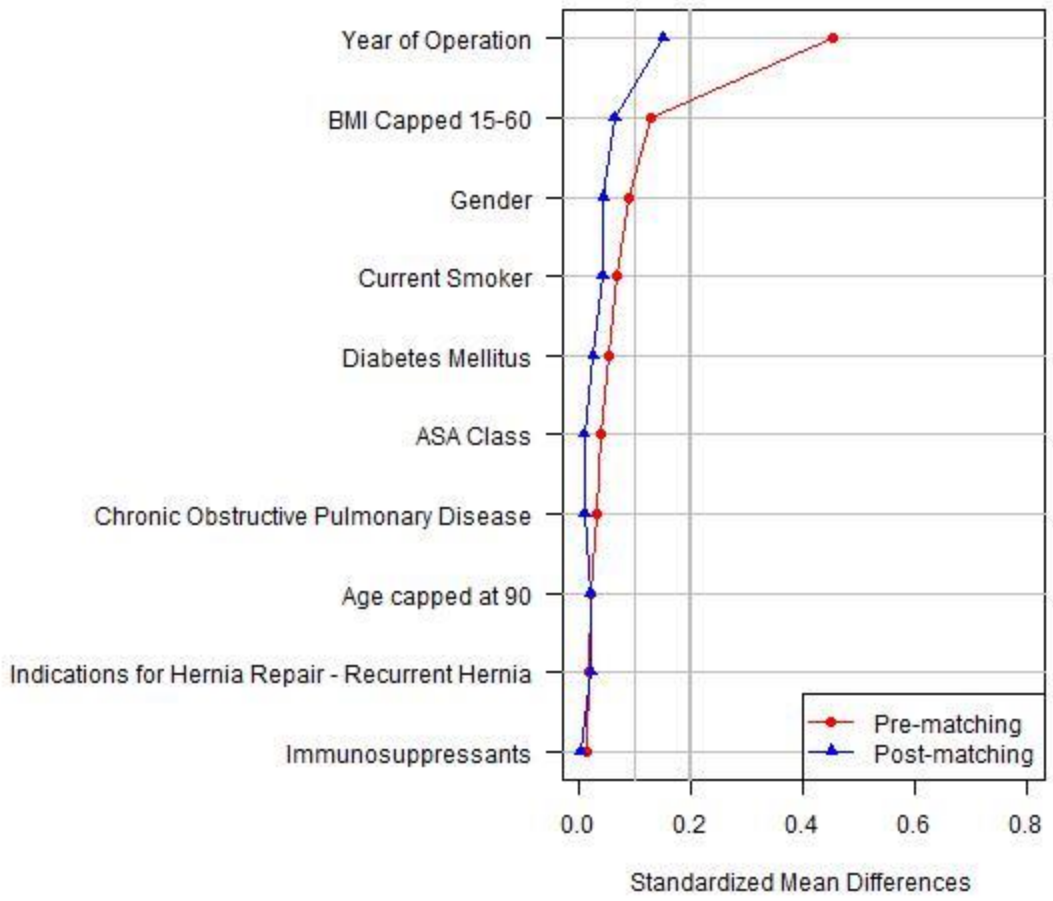
Indications for Hernia Repair - Recurrent Hernia	8% (470)	9% (437)	0.41	8% (382)	9% (409)	0.31
Indications for Hernia Repair - Bowel Obstruction	0% (24)	1% (34)	0.071	0% (22)	1% (32)	0.21

Propensity Matching Characteristics



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30-day Outcomes

	Disposable *N=4650*	Reusable *N=4650*	P-value
SSI			0.5
Yes	0% (3)	0% (5)	
No	100% (4647)	100% (4645)	
SSO			**0.006**
Yes	6% (268)	4% (209)	
No	94% (4382)	96% (4441)	
SSOPI			0.2
Yes	0% (10)	0% (16)	
No	100% (4640)	100% (4634)	
Reoperation			0.22
Yes	0% (8)	0% (14)	
No	100% (4638)	100% (4632)	
Readmission			0.62
Yes	0% (21)	1% (25)	
No	100% (4625)	99% (4621)	

SSO Events

	Disposable *N=4650*	Reusable *N=4650*	P-value
Wound cellulitis			**0.01**
Yes	3% (8)	0% (0)	
No	97% (260)	100% (209)	
Skin or soft tissue necrosis			0.3
Yes	0% (0)	0% (1)	
No	100% (268)	100% (208)	
Wound serous drainage			**0.05**
Yes	3% (8)	0% (1)	
No	97% (260)	100% (208)	
Wound purulent drainage			0.1
Yes	1% (3)	0% (0)	
No	99% (265)	100% (209)	
Localized stab wound infection			0.3
Yes	0% (0)	0% (1)	
No	100% (268)	100% (208)	
Stitch abscess			0.1
Yes	0% (0)	1% (2)	
No	100% (268)	99% (207)	
Seroma			0.6
Yes	81% (218)	83% (174)	
No	19% (50)	17% (35)	
Hematoma			0.7
Yes	13% (36)	15% (31)	
No	87% (232)	85% (178)	

SSO Events

	Disposable *N=4650*	Reusable *N=4650*	P-value
Wound cellulitis			**0.01**
Yes	3% (8)	0% (0)	
No	97% (260)	100% (209)	
Skin or soft tissue necrosis			0.3
Yes	0% (0)	0% (1)	
No	100% (268)	100% (208)	
Wound serous drainage			**0.05**
Yes	3% (8)	0% (1)	
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Localized stab wound infection			0.3
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Seroma			0.6
Yes	81% (218)	83% (174)	
No	19% (50)	17% (35)	
Hematoma			0.7
Yes	13% (36)	15% (31)	
No	87% (232)	85% (178)	

Conclusion

- Consider switching to reusable trocars for laparoscopic inguinal hernia repairs
- Barriers:
  - Supply chain
  - Sterile Processing Department

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Every life deserves world class care.

Overall Complications

Figure 3 displays the forest plot for overall complications. The analysis, which included data from 8375 robot-assisted cases and 55,729 laparoscopic cases, did not reveal a statistically significant difference between the two approaches (OR 1.54, 95% CI (0.83, 2.85)). Individual study findings aligned with the overall pooled estimate, emphasizing the comparable safety profiles of robot-assisted and laparoscopic inguinal hernia repair.