Erectile dysfunction criteria of 131,350 patients after open, laparoscopic, and robotic radical prostatectomy

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ABSTRACT

Purpose: Comparing post-radical prostatectomy erectile function (EF) rates among different techniques has always been a challenge in urology. This difficulty is due to the heterogeneity of studies, mainly in relation to the type of EF classification criteria used. The aim is to apply a new evidence-gathering methodology, called reverse systematic review (RSR), to compare EF rates among open prostatectomy (RRP), laparoscopic (LRP) and robotic (RARP) prostatectomy, using different classification criteria.

Methods: A search was carried out in 8 databases between 2000 and 2020 through systematic review (SR) studies referring RRP, LRP or RARP (80 SR). All references used in these SR were captured referring to 910 papers in a global database called EVIDENCE. A total of 268 studies related to post-prostatectomy EF rates were selected for the final analysis, totaling 465 cohorts or reports referring to 131,350 patients.

Results: 119 (25.6%) reports for RRP, 143 (30.7%) reports for LRP and 203 (43.7%) reports for RARP were found. Mean overall EF rates, respectively for RRP, LRP, and RARP, were: 16, 12, and 35% at 1 month; 22, 26 and 42% in 3 months; 30, 44 and 54% at 6 months, 41, 55 and 59% at 12 months, and 58, 52 e 67% at more than 18 months. The most used EF criterion was *Erection Sufficient for Intercourse* – ESI (74.1%), followed by *Sexual Health Inventory for Men* – SHIM > 21 (5.5%), *SHIM* > 16 (3.7%). ESI showed the lowest discrepancy in EF rates in each period compared to the global average, for each technique, demonstrating less ability to influence the final results, favoring any of the techniques.

Conclusions: The RSR demonstrated that the RARP showed higher rates of EF recovery at all times analyzed (1 to > 18 months), in relation to the RRP and LRP. The ESI criterion was the most used in the literature and showed the lowest bias capable of influencing the results and favoring any of the techniques and might be the fairest option for future comparisons.

INTRODUCTION

After more than 20 years of coexistence of the three main techniques of radical prostatectomy, open (RRP), laparoscopic (LRP) and robotic (RARP), the urological scientific community finds it difficult to answer the following question: which of the techniques presents the lowest rates of erectile dysfunction after radical prostatectomy?

The European Association of Urology (EAU) guidelines (1), in its most recent version, cites conflicting data when comparing the three techniques (2-5) and blames the great heterogeneity of the methods for assessing ED, as there is a wide variety of Patient-Reported Outcomes Measures (PROMs) described for this purpose (e.g., International Index of Erectile Function - IIEF, IIEF-5, Expanded Prostate Cancer Index Composite with 26 items – EPIC-26, Sexual Health Inventory for Men – SHIM, etc.), also suggested by the American Urological Association (AUA) (6). The EAU panel also establishes the need for new well-designed long-term studies and to re-evaluate the criteria for defining EF using more objective methods and more standardized levels (e.g., normalization of scores or return to baseline erectile function, Erection Sufficient for Intercourse - ESI, etc.) (7).

Evidence-based medicine establishes that the highest levels of evidence come from systematic reviews of homogenized studies, in order to increase the comparable sample and statistical power. However, this homogenization process limits the results to a specific scenario that is often not replicable in practice, reducing external validation. Our study group created a new methodology for capturing evidence, called Reverse Systematic Review (8), which aggregates all studies included in systematic reviews on RP in a large database called EVIDENCE, which is population-based and heterogeneous.

The aim of this study was to assess, using EVIDENCE data, how researchers used different EF assessment criteria, their influence on EF rates over time, in order to compare the three main RP techniques.

MATERIALS AND METHODS

The RSR methodology was previously described and applied in other studies by the authors (8-15). The description of RSR methodology and the study design are available in Appendix A.

In December 2020, a literature search was carried out using 8 databases: PubMed, Web of Science, Cochrane Library, Embase, ProQuest, CINAHL (The Cumulative Index to Nursing and Allied Health Literature), VHL/Bireme and Scopus. We searched for SR articles, with or without meta-analysis, that addressed the technique of RRP, LRP and RARP, with a general strategy based on health descriptors and synonyms referring to the terms: "Laparoscopy", "Open", "Retropubic", "Prostatectomy", "Robotic Surgical Procedures", "Systematic Review" and "Meta-analysis" through the "Title, Abstract and Subject." Afterwards, limiters were used: "humans", gender ("male"), language ("English") and type of studies ("Systematic Review"). The period in the literature was between 01/01/2000 and 12/05/2020. In each database, the necessary adaptation of the search methodology was carried out (Appendix B).

After the reviews were identified by the initial search, two researchers (Moretti TBC, Reis LO) independently selected reviews that included at least one of the three RP techniques. After the initial screening, the full texts were analyzed and any discrepancies were resolved after open discussion between the authors. Reviews without systematization of the search or integrative methodology, conference or congress abstracts and other techniques were excluded.

Due to the difficulty of the databases in standardizing health descriptors (MeSH terms) and classifying a study as SR, studies were included that provided a clear description of the systematization of criteria of search, despite not mentioning in their methodology that respected the PRISMA criteria (16).

Once all the SRs were chosen, the next step was to extract all the articles cited in the bibliographic references that were included in these for analysis. Publications in "Abstracts" and citations in "Report meetings" or "Congress Annals" were excluded. As before, two researchers separately reviewed the studies (Moretti TBC, Reis LO) and discrepancies in selection were resolved with open discussion between them.

After the sample was chosen through the systematization described above, all were analyzed by the main author (Moretti TBC) and the largest amount of available data was captured and tabulated in a dedicated spreadsheet (*Excel, Microsoft Corporation®*).

When a study evaluated more than one cohort, each one was considered an isolated study and was called a *report*, which is the unit of publication used in the study.

The global content of all selected studies, including bibliographic, demographic, and clinical-surgical variables, generated a reference population database for various studies and analyzes, called EVIDENCE Database.

- *Analyzed variables:*

For this study, perioperative variables separated into the three groups (RRP, LRP and RARP) were analyzed, including: age (years), BMI (kg/m^2), initial PSA (mg/dl), clinical Gleason score (cGS - mean and stratified), clinical staging (cT); intraoperative variables: operative time (min), pelvic lymphadenectomy rate (%), nerve sparing rate (unilateral or bilateral), estimated blood loss (ml) blood transfusion rate (%), length of hospital stay (days), time of bladder catheterization (days) and oncological variables: pathological Gleason Score (pGS), pathological staging (pT) and positive surgical margin rate (PSM) (mean and stratified). These variables were studied in order to characterize the profile of patients in each group.

The main variables of analysis were the erectile function (EF) rates recorded at 1, 3, 6, 12, and more than 18 months after surgery. In addition, all criteria for clinical evaluation of ED stratified by surgical technique were analyzed. Subgroup analysis was performed among the most frequent criteria used in the literature.

- *Statistical analysis:*

The measures of central tendency were represented by the mean and dispersion by the standard error of the mean (SE). All descriptive analyzes were weighted by the number of patients, thus, due to the population nature of the samples, any comparison of means generated showed a statistical difference, given the high “N” and narrow “SE”. The difference in EF rates for each criterion with the population mean was calculated, as well as the mean variation in the EF rate over time (1 to more than 18 months), called mean discrepancy. Statistical analyzes were performed using IBM-SPSS® V.24 and graphs using Microsoft Excel®.

RESULTS

In the first stage of the systematic search for SR on radical prostatectomy, 634 studies were identified in 8 databases. After excluding 107 duplications (17%) and 447

studies that did not meet the inclusion criteria, 80 review studies were chosen for the second stage (Appendix C).

In the second stage, all selected SRs were read by the first author (Moretti TBC) and primary studies used were captured, resulting in a total of 2,356 citations. After excluding 1,172 (49.7%) duplications and 274 studies that did not meet the inclusion criteria, 910 studies were selected for the global database (EVIDENCE Database).

After excluding studies on others subjects, 268 papers on EF were selected for final analysis (Appendix D). Due to the existence of more than one cohort in some studies, each cohort was considered separately, resulting in 465 publication units or reports (Nr). Separated by technique, 119 (25.6%) reports for RRP, 143 (30.7%) reports for LRP and 203 (43.7%) reports for RARP were included (Appendix A).

Descriptive statistics among three techniques of clinical, surgical, and pathological variables studied are listed in Supplementary Table.

Regarding the global distribution of the EF classification criteria in the three techniques, twenty-three different criteria were found, and when the study did not specify the classification method, it was called “Not described”. EF rates for each criterion are detailed in supplementary material (Appendix E). Among the most commonly used criteria, we have the ESI, defined as “Erection Sufficient for Intercourse more than 50% of the time, with or without the use of medication”, and the use of the SHIM score (The Sexual Health Inventory for Men) or the same than IIEF-5 (Simplified International Index of Erectile Function – 5 questions).

Among the three most cited criteria, “ESI” was the most frequent: 76% RRP, 81% LRP and 64% RARP. There is a similar distribution pattern between the RRP and LRP. However, there is a greater concentration of studies that used the criteria “SHIM > 21” and “SHIM > 16” in cases submitted to RARP (Supplementary Figure).

Erectile function rates over time (1, 3, 6, 12 and > 18 months), whether global, stratified by surgical techniques and different EF classification criteria, are described in Figure 1. Variance (SE) and sampling values (Np and Nr) are available in Appendix E. RARP gives superior results in all analyses, followed by LRP, except in the 30-day super early EF rates and late recovery (> 18 months), where RRP outperforms LRP (Figure 1b and 1c).

To understand the influence of each criterion on EF rates, Figure 2 describes the distribution of differences between EF rates by the most used criteria with the overall

mean. The smallest discrepancies with the global population average were found in “ESI” criterion (Figure 2a). “SHIM > 21” positively favors RARP and LRP (Figure 2b). Values with the greatest discrepancy occur in “SHIM > 16” and “Others” criteria, with heterogeneous behavior over time (Figure 2c-d).

DISCUSSION

When comparing the EF rates among different RP approaches, one of the main factors of bias is the heterogeneity of the criteria for classifying and grading the EF available in the literature. Although the main scientific urological societies recommend the use of specific PROMs for this purpose (IIEF, EPIC, SHIM, etc.) (17), the difficulty in applying these questionnaires can generate even more biases in the overall analysis.

The heterogeneity of these evaluation methods goes against one of the greatest methodological precepts of systematic reviews with meta-analysis, which is to compare studies with the same methodological approaches, or very similar ones, in order to eliminate or reduce selection biases. However, this process of homogenization of works ends up throwing away a lot of information that is part of a heterogeneous population scenario closer to the “real world”.

This study is the first in the literature that gathers a quantity of 268 papers that were used in 80 systematic reviews along the coexistence among the three main RP techniques. The population and heterogeneous sample, referring to 465 cohorts and 131,350 patients, represents different clinical, demographic and structural scenarios, which reflect different conditions where the patients were submitted. This sample characterized by the RSR allows a different perspective at the results based on heterogeneity, which obviously does not replace the results of the classic SR, as well as RTC's or high-quality uncontrolled prospective ones, but adds to it to be more real-world representative.

Our dataset will be the largest publicly available dataset of this kind for future work to build upon. The power of heterogeneity lies in the ability to externally validate the results, as different scenarios are represented in the included papers. In addition, the population sample generates a narrow standard error of the mean, increasing the precision of the results in relation to the population mean.

One of the first SR carried out by Ficarra et al., in 2012, compared 5 studies that demonstrated superiority in EF rates in 12 months of RARP in relation to RRP (OR: 2.84; 1.48-5.43; p=0.002), and 4 studies which showed no difference between RARP and LRP (OR: 1.89; 0.70-5.05; p=0.21). However, despite the majority using the ESI criterion, two studies with different criteria were included in the meta-analysis, including the use of PROMs, such as SHIM > 17, as well as a subjective criterion such as "presence of erection". In addition, there was no uniformity in the type of neurovascular preservation that was performed, whether total or partial (2).

The RSR allows the entry of all studies that were cited in the SR, regardless of the question, increasing the number of studies and their heterogeneity, making it valid. In our study, RARP showed higher EF rates at all measured times followed by LRP. Only in the super early (1 months) and late (> 18 months) return did the RRP outperform the LRP (Figure 1b).

A multicenter study proposed by Haglind et al. pooled data from 14 centers and compared 12-month return to sexual potency rates of RRP vs. RARP, respectively, using the IIEF-5 > 16 of 81% vs. 78%, and with the IIEF-5 > 21 of 93% vs. 90%, without statistical difference (4). Our study demonstrated greater differences between RRP and RARP at 12 months, respectively, for SHIM > 16 of 48.8% vs. 70.6%, and for SHIM > 21 of 56.5% vs. 70.3%. The reduction in rates in our study is probably due to the effect of the heterogeneity of the included studies. This "reactive worsening" effect of mean results in RSR is due to the large increase in the number of studies, which triggers the central limit theorem, shifting the mean with great precision to the population mean.

Considering the analysis criteria, the ESI was the most used among all the techniques (76% RRP, 81% LRP and 64% RARP). Note that the distribution is more similar between RRP and LRP (Figure 1a and b). In RARP, there is a greater use of criteria such as SHIM > 21. When analyzing the impact of using these criteria on EF rates over time, we found that the ESI has less power to shift the results of each technique from global mean values (Figure 2a). SHIM criteria > 21 and > 16 are more likely to favor RARP at 3 and 6 months, and LRP at > 18 months. On the other hand, Capogrosso et al., in a SR including 280 studies, showed that 70% used the IIEF, 12% the single question, 7% EPIC and 8% others validated tool, however, without any clinical analysis of the results (7). Therefore, even with this bias, when we analyze the results of studies that used the ESI criterion,

which supposedly, based on the analysis of our study, interferes less in the results, RARP presented better rates of return to EF compared to the others, for all times (Figure 2c).

Faced with the reality exposed by our study, the great importance of the ESI criterion in the scientific history of radical prostatectomy is highlighted. Considering its greater neutrality in results, we believe that it is a simple and very useful criterion in clinical practice, which meets the needs proposed by the EAU panel. Obviously, the use of PROMs follows all the precepts of scientific rigor, but in practice this rigor was not respected, since PROMs were not used more frequently and, when they were used, they influenced a specific technique in the detriment of others.

Our study presents a major limitation inherent to the methodology itself, since heterogeneity is not, on purpose, controlled. The lack of control of clinical baseline heterogeneity and statistical heterogeneity, fundamental steps of a classic SR, are not taken into account in the RSR, which generates a lot of discomfort in understanding the power of the heterogeneous scenario and its scientific representativeness. Another limitation involves the fact that weighting by the number of patients generates a narrow standard error of the mean. This makes any comparison of means statistically significant, generating only descriptive data. New studies in the EVIDENCE database promise specific subgroup analyzes with dedicated tests.

CONCLUSION

The RSR identified a preference of the scientific community in using the ESI criterion to classify patients with post-radical prostatectomy erectile dysfunction. In addition, the ESI criterion showed less ability to favor one operative technique over another. RARP presented higher EF rates than RRP and LRP in the global analysis and among the most used criteria (ESI, SHIM > 21 and SHIM > 16) over time (1 to more than 18 months). The heterogeneous data generated by this methodology should be viewed with caution since the rates of erectile dysfunction are dependent on several factors related to the patient and the associated pathology. Future analyzes with factor stratification must be performed on the database in order to control such influence.

Author Contributions:

TBCM, LAM: data collection, analysis, statistics, and manuscript writing

LOR: supervision, data analysis, manuscript editing.

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Declaration of Interest:

The authors report no conflicts of interest.

Financial Disclosure:

The authors declare that they have no relevant financial interests.

Data Availability Statement:

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Compliance with Ethical Standards:

Research involving Human Participants: The authors certify that the study was performed under the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

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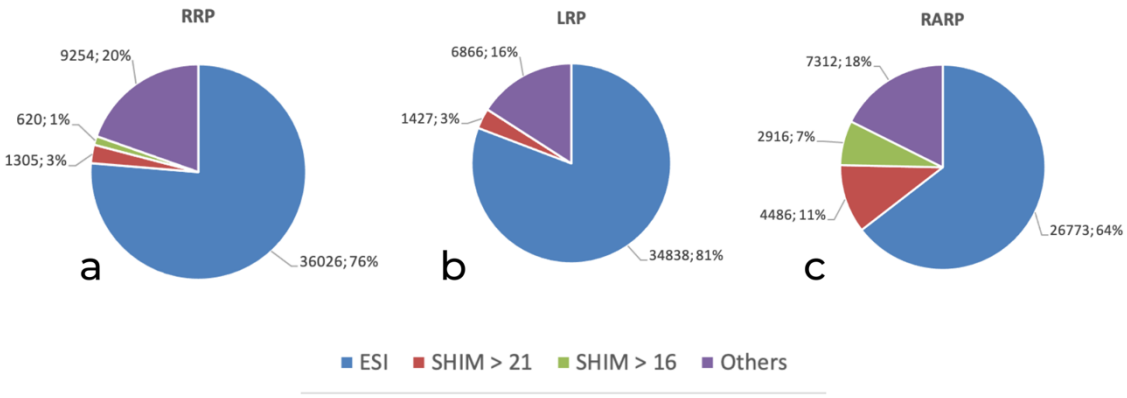
Table 1: Clinical, surgical, and pathological characteristics stratified by different techniques (RRP, LRP and RARP).

	RRP				LRP				RARP			
	Nr	Np	Mean	SE	Nr	Np	Mean	SE	Nr	Np	Mean	SE
Age (years)	105	39,169	**61.54**	.01	135	41,740	**62.70**	.01	183	36,420	**60.76**	.01
BMI (Kg/m2)	33	7,100	**26.55**	.01	59	13,374	**26.33**	.02	133	29,111	**27.10**	.01
Initial PSA (mg/dl)	78	27,592	**7.61**	.02	130	34,602	**8.61**	.01	175	31,519	**6.70**	.01
cGS (mean)	20	1,553	**5.92**	.01	54	11,730	**6.10**	.00	46	4,430	**6.24**	.00
cGS < 7 (%)	36	20,694	**70.68**	.11	54	12,750	**60.69**	.13	88	21,184	**58.09**	.11
cGS = 7 (%)	34	19,084	**23.78**	.08	50	12,309	**33.08**	.11	84	20,619	**32.46**	.07
cGS > 7 (%)	39	21,882	**4.28**	.03	43	11,363	**6.18**	.04	83	24,101	**8.44**	.07
cT1 (%)	62	34,281	**61.03**	.09	84	20,249	**57.86**	.14	103	26,938	**73.99**	.08
cT2 (%)	60	31,659	**35.27**	.09	79	16,916	**39.88**	.14	97	24,139	**26.27**	.08
cT3 (%)	30	15,921	**3.14**	.02	31	7,594	**8.95**	.14	38	13,500	**2.86**	.04
cT4 (%)	1	110	**1.80**	.00	1	144	**0**	.00	2	371	**0.56**	.03
Operative Time (min)	43	12,706	**157.91**	.42	119	37,582	**180.09**	.19	128	26,487	**174.72**	.29
Pelvic Lymphadenectomy rate (%)	18	9,197	**91.12**	.25	51	22,263	**49.52**	.13	49	8,904	**40.29**	.33
NS rate (%)	43	19,127	**79.61**	.18	81	25,007	**58.33**	.15	80	19,097	**88.20**	.08
Unilateral NS rate (%)	39	16,222	**16.12**	.15	78	22,435	**16.73**	.08	74	18,341	**20.35**	.06
Bilateral NS rate (%)	51	29,895	**81.85**	.10	92	24,477	**45.40**	.18	99	21,695	**72.62**	.10
EBL (mL)	40	12,344	**867.53**	3.90	99	25,094	**374.49**	1.34	131	26,378	**196.41**	.65
Blood Transfusion rate (%)	33	7,101	**12.96**	.19	83	25,837	**2.48**	.02	87	18,884	**1.71**	.02
LOS (days)	31	7,286	**6.44**	.05	89	24,902	**5.36**	.02	102	21,954	**2.30**	.01
Catheter time (days)	26	3,897	**9.44**	.05	88	25,958	**7.93**	.02	78	16,683	**7.36**	.02
pGS (mean)	15	1,809	**6.69**	.01	41	5,829	**6.46**	.01	20	1,947	**6.85**	.01
pGS < 7 (%)	32	13,570	**51.61**	.11	54	16,253	**38.90**	.17	98	22,752	**41.04**	.09
pGS = 7 (%)	28	10,310	**43.51**	.12	47	14,146	**56.62**	.16	100	22,765	**50.82**	.08
pGS > 7 (%)	31	13,104	**9.23**	.05	41	13,235	**12.59**	.08	101	26,573	**8.17**	.03
pT2 (%)	68	33,433	**70.01**	.05	115	36,215	**68.12**	.07	151	31,777	**76.35**	.06
pT3 (%)	58	19,649	**31.27**	.08	106	35,076	**30.32**	.06	138	30,647	**23.41**	.06
pT4 (%)	16	4,052	**2.94**	.04	26	15,343	**1.49**	.01	32	14,942	**0.80**	.01
PSM rate (%)	65	28,865	**21.61**	.05	126	39,468	**19.36**	.03	170	34,805	**16.84**	.04
PSM - pT2 (%)	31	10,968	**18.41**	.11	76	32,346	**12.33**	.03	91	19,399	**11.68**	.04
PSM - pT3 (%)	20	5,262	**45.72**	.19	69	30,584	**37.44**	.04	72	16,202	**38.77**	.09
PSM - pT4 (%)	2	125	**100.00**	.00	12	3,205	**91.23**	.23	10	1,977	**83.33**	.50

FIGURE LEGENDS



Supplementary Figure: Graphic percentage distribution of the main EF criteria stratified by surgical technique (RRP, LRP and RARP).

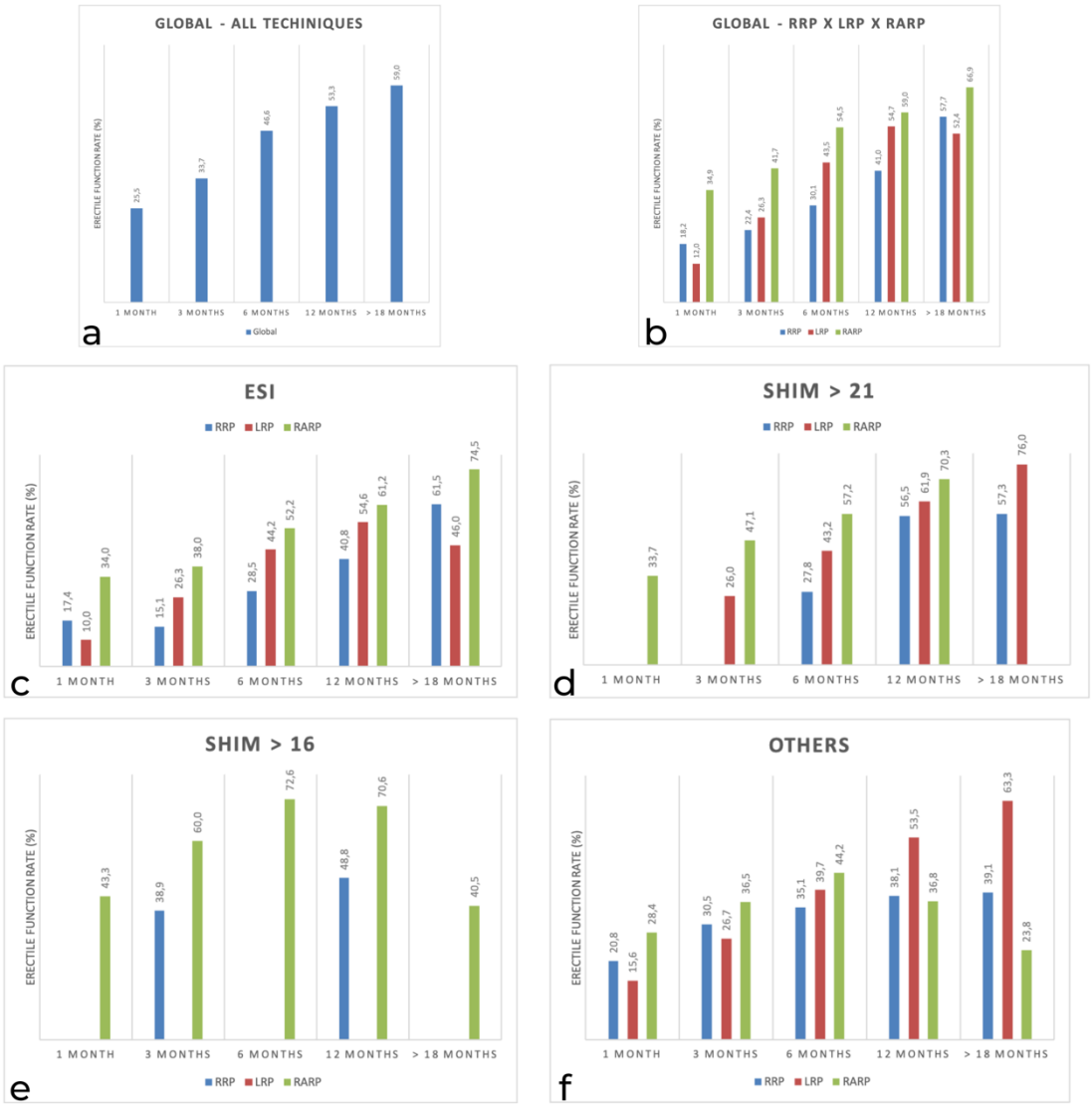


Figure 1: Graphic distribution of post-prostatectomy erectile function (EF) rates at 1, 3, 6, 12 and more than 18 months. (**a**) global distribution (all techniques); (**b**) global distribution stratified by surgical techniques (RRP, LRP and RARP). (**c - f**) stratified by more used criteria.

Figure 2: Graphical distribution of the difference in the mean post-prostatectomy erectile function (EF) at 1, 3, 6 and 12 months with the overall mean rate (mean discrepancy) stratified by different techniques (RRP, LRP and RARP) and by different EF criteria (a-d).

APPENDIX A – METHODOLOGY AND STUDY DESIGN

Description of the methodology

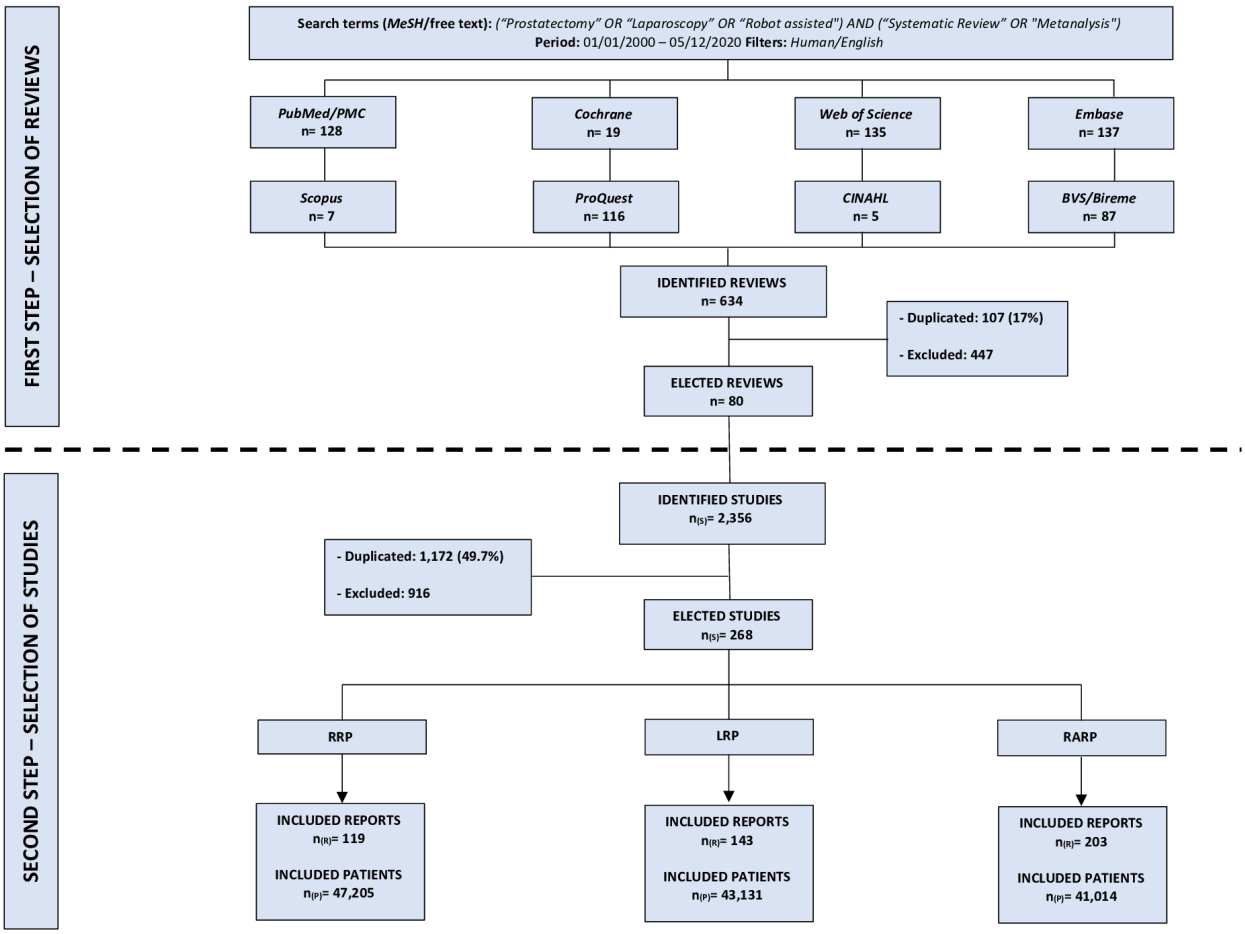
In classic SR, a systematic search in databases is performed to locate original clinical studies that answered a specific question. After this search, studies that are homogeneous and comparable are elected for inclusion and can be merged into the same statistical analysis, the meta-analysis.

In the case of RSR, we followed the opposite path. The literature search is carried out with the objective of identifying all SRs in the history of the technique under study,

regardless of the question of interest, and gathering as many of them as possible, generating a heterogeneous scenario that encompasses complete information about the outcomes that most interested the research scientific environment in that area. At this stage, when gathering all the SRs, the main focus is to capture all the studies included in these reviews that were used to answer the scientists' questions.

Description of the methodology

Flowchart of the study selection process for the composition of the EVIDENCE database and specific eligibility of studies related to post-prostatectomy sexual function.



APPENDIX B – SEARCH STRATEGY

Search strategy was systematized in 8 databases described below and were done using health descriptors specific to each base. It was complemented

with use of synonyms in open search in title, abstract and subject through Boolean indicators.

1) Health Science Descriptors

Search Base	Vocabulary of subjects	Health Science Descriptors		
		1	2	3
PUBMED	MeSh	*Prostatectomy*	*Laparoscopy*	*Robotic Surgical Procedures*
BVS/BIREME	DeCS	*Prostatectomy*	*Laparoscopy*	*Robotic Surgical Procedures*
SCOPUS	--	*Prostatectomy*	*Laparoscopy*	*Robotic Surgical Procedures*
WEB OF SCIENCE	--	*Prostatectomy*	*Laparoscopic*	*Robotic Surgical Procedures*
EMBASE	Emtree	*Prostatectomy*	*Laparoscopy*	*Robotic Surgical Procedures Use preferred term: Robotic Surgical Procedure*
COCHRANE LIBRARY	MeSh	*Prostatectomy*	*Laparoscopy*	*Robotic Surgical Procedures*
PROQUEST	MeSh	*Prostatectomy*	*Laparoscopy*	*Robotic Surgical Procedures*
CINAHL	MH	*Prostatectomy*	*Laparoscopy*	*Robotic Surgical Procedures*

2) Key-words (synonymous):

- *Prostatectomy*: Prostatectomy OR Prostatectomies OR "Prostatectomy, Suprapubic" OR "Prostatectomies, Suprapubic" OR "Suprapubic Prostatectomies" OR "Suprapubic Prostatectomy" OR "Prostatectomy, Retropubic" OR "Prostatectomies, Retropubic" OR "Retropubic Prostatectomies" OR "Retropubic Prostatectomy".

- *Laparoscopy:* Laparoscopy OR Laparoscopies OR Celioscopy OR Celioscopies OR Peritoneoscopy OR Peritoneoscopies OR "Surgical Procedures, Laparoscopic" OR "Laparoscopic Surgical Procedure" OR "Procedure, Laparoscopic Surgical" OR "Procedures, Laparoscopic Surgical" OR "Surgery, Laparoscopic" OR "Laparoscopic Surgical Procedures" OR "Laparoscopic Surgery" OR "Laparoscopic Surgeries" OR "Surgeries, Laparoscopic" OR "Laparoscopic Assisted Surgery" OR "Laparoscopic Assisted Surgeries" OR "Surgeries, Laparoscopic Assisted" OR "Surgery, Laparoscopic Assisted" OR "Surgical Procedure, Laparoscopic".

- *Robotic Surgical Procedures*: "Robotic Surgical Procedures" OR "Procedure, Robotic Surgical" OR "Procedures, Robotic Surgical" OR "Robotic Surgical Procedure" OR "Surgical Procedure, Robotic" OR "Surgical Procedures, Robotic".

- *Cystectomy*: Cystectomy OR Cystectomies.

3) Free Terms (not descriptors)

- All the search bases: "laparoscopic radical prostatectomy (LRP)" OR LRP OR "laparoscopic assisted radical prostatectomy" OR "Robot-assisted laparoscopic radical prostatectomy (RALRP)" OR "Robot assisted laparoscopic radical prostatectomy (RALRP)" OR RALRP OR "Robotic assisted laparoscopic prostatectomy (RALP)" OR "robot-assisted radical prostatectomy (RARP)" OR "robot assisted radical prostatectomy (RARP)" OR RARP OR "Endoscopic extraperitoneal radical prostatectomy (EERP)" OR EERP OR "Endoscopic extraperitoneal radical prostatectomy (EERPE)" OR EERPE OR "Robot-assisted" OR "Robot assisted" OR "robotic prostatectomy" OR "radical

prostatectomy (RP)" OR "radical prostatectomy" OR RP OR RRP OR "retropubic radical prostatectomy" OR "open prostatectomy" OR "laparoscopic radical prostatectomy" OR "robot-assisted prostatectomy" OR "Robot-assisted laparoscopic radical prostatectomy (RALRP)" OR "Robot assisted laparoscopic radical prostatectomy (RALRP)" OR "Robot assisted laparoscopic radical prostatectomy" OR "Robot-assisted laparoscopic radical prostatectomy" OR RALRP OR "Robotic assisted laparoscopic prostatectomy (RALP)" OR "Robot-assisted laparoscopic prostatectomy (RALP)" OR "Robot assisted laparoscopic prostatectomy" OR "Robot-assisted laparoscopic prostatectomy" OR RALP OR "Robot-assisted radical prostatectomy (RARP)" OR "Robot assisted radical prostatectomy (RARP)" OR "Robot-assisted radical prostatectomy" OR "Robot assisted radical prostatectomy" OR RARP OR **"**Robotic prostatectomy".

- Embase: "robot-assisted prostatectomy" OR "robot-assisted prostatectomy" OR "laparoscopic radical prostatectomy" OR **"**Robotic radical prostatectomy" OR "Robotic-assisted radical prostatectomy" OR "Robotic assisted radical prostatectomy".

4) *Systematic Review* Filter

- PubMed: (systematic review [ti] OR meta-analysis [pt] OR meta-analysis [ti] OR systematic literature review [ti] OR this systematic review [tw] OR pooling project [tw] OR (systematic review [tiab] AND review [pt]) OR meta synthesis [ti] OR

meta-analy*[ti] OR integrative review [tw] OR integrative research review [tw] OR rapid review [tw] OR umbrella review [tw] OR consensus development conference [pt] OR practice guideline [pt] OR drug class reviews [ti] OR cochrane database syst rev [ta] OR acp journal club [ta] OR health technol assess [ta] OR evid rep technol assess summ [ta] OR jbi database system rev implement rep [ta]) OR (clinical guideline [tw] AND management [tw]) OR ((evidence based[ti] OR evidence-based medicine [mh] OR best practice* [ti] OR evidence synthesis [tiab]) AND (review [pt] OR diseases category[mh] OR behavior and behavior mechanisms [mh] OR therapeutics [mh] OR evaluation studies[pt] OR validation studies[pt] OR guideline [pt] OR pmcbook)) OR ((systematic [tw] OR systematically [tw] OR critical [tiab] OR (study selection [tw]) OR (predetermined [tw] OR inclusion [tw] AND criteri* [tw]) OR exclusion criteri* [tw] OR main outcome measures [tw] OR standard of care [tw] OR standards of care [tw]) AND (survey [tiab] OR surveys [tiab] OR overview* [tw] OR review [tiab] OR reviews [tiab] OR search* [tw] OR handsearch [tw] OR analysis [ti] OR critique [tiab] OR appraisal [tw] OR (reduction [tw]AND (risk [mh] OR risk [tw]) AND (death OR recurrence))) AND (literature [tiab] OR articles [tiab] OR publications [tiab] OR publication [tiab] OR bibliography [tiab] OR bibliographies [tiab] OR published [tiab] OR pooled data [tw] OR unpublished [tw] OR citation [tw] OR citations [tw] OR database [tiab] OR internet [tiab] OR textbooks [tiab] OR references [tw] OR scales [tw] OR papers [tw] OR datasets [tw] OR trials [tiab] OR meta-analy* [tw] OR (clinical [tiab] AND studies [tiab]) OR treatment outcome [mh] OR treatment outcome [tw] OR pmcbook)) NOT (letter [pt] OR newspaper article [pt]).

Available in:

(https://www.nlm.nih.gov/bsd/pubmed_subsets/sysreviews_strategy.html)

5) Filters

- Search period: from January 1, 2000 to December 5, 2020.

- Language: English

- Type of study: Systematic Review and Meta-analysis

- Species: Human

6) Search Strategy

Each specific search strategy for each database is described below, with the date of the search and the number of articles found:

1 – PUBMED/PMC (MEDLINE)

- **Search Date:** December 5, 2020.
- **Number of articles found: 128**
- **Search Strategy:** (((((((Robotics[MeSH Terms]) OR Robotics[Title/Abstract])) OR (((((((Robotic Surgical Procedures[MeSH Terms]) OR "Robotic Surgical Procedures "[Title/Abstract]) OR "Procedure, Robotic Surgical"[Title/Abstract]) OR "Procedures, Robotic Surgical"[Title/Abstract]) OR "Robotic Surgical Procedure"[Title/Abstract]) OR "Surgical Procedure, Robotic"[Title/Abstract]) OR "Surgical Procedures, Robotic"[Title/Abstract])) OR ((((((((((("Robot-assisted laparoscopic radical prostatectomy (RALRP)") OR "Robot assisted laparoscopic radical prostatectomy (RALRP)") OR "Robot assisted laparoscopic radical prostatectomy") OR "Robot-assisted laparoscopic radical prostatectomy") OR RALRP)) OR (((((("Robot-assisted radical prostatectomy (RARP)") OR "Robot

assisted radical prostatectomy (RARP)") OR "Robot-assisted radical prostatectomy") OR "Robot assisted radical prostatectomy") OR RARP)) OR "Robotic prostatectomy") OR (("Robot-assisted prostatectomy") OR "Robot assisted prostatectomy")) OR "Robotic radical prostatectomy") OR (("Robotic-assisted radical prostatectomy") OR "Robotic assisted radical prostatectomy")) OR (((((((("Robotic assisted laparoscopic prostatectomy (RALP)") OR "Robot-assisted laparoscopic prostatectomy (RALP)") OR "Robot assisted laparoscopic prostatectomy") OR "Robot-assisted laparoscopic prostatectomy") OR RALP)))))) AND ((((((((((Prostatectomy[MeSH Terms]) OR Prostatectomy[Title/Abstract]) OR Prostatectomies[Title/Abstract]) OR "Prostatectomy, Suprapubic"[Title/Abstract]) OR "Prostatectomies, Suprapubic"[Title/Abstract]) OR "Suprapubic Prostatectomies"[Title/Abstract]) OR "Suprapubic Prostatectomy"[Title/Abstract]) OR "Prostatectomy, Retropubic"[Title/Abstract]) OR "Prostatectomies, Retropubic"[Title/Abstract]) OR "Retropubic Prostatectomies"[Title/Abstract]) OR "Retropubic Prostatectomy"[Title/Abstract]))) AND systematic [sb] Filters: Publication date from 2000/01/01 to 2020/12/05; Humans; English.

2 - BVS / BIREME

- **Search Date:** December, 2020
- **Number of articles found:** 87 (MEDLINE, LILACS, IBECS)

- **Search Strategy:** (tw:(prostatectomy OR prostatectomies OR "Prostatectomy, Suprapubic" OR "Prostatectomies, Suprapubic" OR "Suprapubic Prostatectomies" OR "Suprapubic Prostatectomy" OR "Prostatectomy, Retropubic" OR "Prostatectomies, Retropubic" OR "Retropubic Prostatectomies" OR "Retropubic Prostatectomy")) AND (tw:(robotics)) OR (tw:("Robot-assisted laparoscopic radical prostatectomy (RALRP)" OR "Robot assisted laparoscopic radical prostatectomy (RALRP)" OR "Robot assisted laparoscopic radical prostatectomy" OR "Robot-assisted laparoscopic radical prostatectomy" OR ralrp)) OR (tw:("Robotic assisted laparoscopic prostatectomy (RALP)" OR "Robot-assisted laparoscopic prostatectomy (RALP)" OR "Robot assisted laparoscopic prostatectomy" OR "Robot-assisted laparoscopic prostatectomy" OR ralp)) OR (tw:("Robot-assisted radical prostatectomy (RARP)" OR "Robot assisted radical prostatectomy (RARP)" OR "Robot-assisted radical prostatectomy" OR "Robot assisted radical prostatectomy" OR rarp)) OR (tw:("Robotic prostatectomy")) OR (tw:("Robot-assisted prostatectomy"or "Robot assisted prostatectomy")) OR (tw:("Robotic radical prostatectomy")) OR (tw:("Robotic-assisted radical prostatectomy" OR "Robotic assisted radical prostatectomy")) OR (tw:("Robotic Surgical Procedures" OR "Procedure, Robotic Surgical" OR "Procedures, Robotic Surgical" OR "Robotic Surgical Procedure" OR "Surgical Procedure, Robotic" OR "Surgical Procedures, Robotic")) AND (tw:("SYSTEMATIC REVIEWS" OR "SYSTEMATIC REVIEW")) AND (instance:"regional") AND (la:("en"))

3 - CINAHL (The Cumulative Index to Nursing and Allied Health Literature)

- **Search Date:** December 5, 2020
- **Number of articles found:** 05
- **Search Strategy:** (MH "Prostatectomy") OR "Prostatectomy" OR Prostatectomy OR Prostatectomies OR "Prostatectomy, Suprapubic" OR "Prostatectomies, Suprapubic" OR "Suprapubic Prostatectomies" OR "Suprapubic Prostatectomy" OR "Prostatectomy, Retropubic" OR "Prostatectomies, Retropubic" OR "Retropubic Prostatectomies" OR "Retropubic Prostatectomy" AND (MH "Robotics") OR "Robotics" OR ("Robot-assisted laparoscopic radical prostatectomy (RALRP)" OR "Robot assisted laparoscopic radical prostatectomy (RALRP)" OR "Robot assisted laparoscopic radical prostatectomy" OR "Robot-assisted laparoscopic radical prostatectomy" OR RALRP) OR ("Robotic assisted laparoscopic prostatectomy (RALP)" OR "Robot-assisted laparoscopic prostatectomy (RALP)" OR "Robot assisted laparoscopic prostatectomy" OR "Robot-assisted laparoscopic prostatectomy" OR RALP) OR ("Robot-assisted radical prostatectomy (RARP)" OR "Robot assisted radical prostatectomy (RARP)" OR "Robot-assisted radical prostatectomy" OR "Robot assisted radical prostatectomy" OR RARP) OR "Robotic prostatectomy" OR "Robot-assisted prostatectomy" OR "Robot assisted prostatectomy" OR "Robotic radical prostatectomy" OR ("Robotic-assisted radical prostatectomy" OR "Robotic assisted radical prostatectomy") OR (MH "Robotic Surgical Procedures") OR "Robotic Surgical Procedures" OR "Robotic Surgical Procedures" OR "Procedure, Robotic Surgical" OR "Procedures, Robotic Surgical" OR "Robotic Surgical Procedure" OR "Surgical Procedure, Robotic"

OR "Surgical Procedures, Robotic" AND TI "SYSTEMATIC REVIEWS" OR TI "SYSTEMATIC REVIEW"

4 - WEB OF SCIENCE

- **Search Date:** December 5, 2020
- **Number of articles found:** 135
- **Search Strategy:** (("Robot-assisted laparoscopic radical prostatectomy (RALRP)" OR "Robot assisted laparoscopic radical prostatectomy (RALRP)" OR "Robot assisted laparoscopic radical prostatectomy" OR "Robot-assisted laparoscopic radical prostatectomy" OR RALRP) OR ("Robotic assisted laparoscopic prostatectomy (RALP)" OR "Robot-assisted laparoscopic prostatectomy (RALP)" OR "Robot assisted laparoscopic prostatectomy" OR "Robot-assisted laparoscopic prostatectomy" OR RALP) OR ("Robot-assisted radical prostatectomy (RARP)" OR "Robot assisted radical prostatectomy (RARP)" OR "Robot-assisted radical prostatectomy" OR "Robot assisted radical prostatectomy" OR RARP) OR ("Robotic prostatectomy") OR ("Robot-assisted prostatectomy" OR "Robot assisted prostatectomy") OR ("Robotic radical prostatectomy") OR ("Robotic-assisted radical prostatectomy" OR "Robotic assisted radical prostatectomy")) OR (("Robotic Surgical Procedures" OR "Procedure, Robotic Surgical" OR "Procedures, Robotic Surgical" OR "Robotic Surgical Procedure" OR "Surgical Procedure, Robotic" OR "Surgical Procedures, Robotic")) OR (Robotics)) AND (Prostatectomy OR Prostatectomies OR "Prostatectomy, Suprapubic" OR "Prostatectomies, Suprapubic" OR "Suprapubic Prostatectomies" OR "Suprapubic Prostatectomy" OR "Prostatectomy, Retropubic" OR "Prostatectomies,

Retropubic" OR "Retropubic Prostatectomies" OR "Retropubic Prostatectomy") AND (2020 OR 2019 OR 2012 OR 2005 OR 2018 OR 2011 OR 2004 OR 2017 OR 2010 OR 2003 OR 2016 OR 2009 OR 2002 OR 2015 OR 2008 OR 2001 OR 2014 OR 2007 OR 2000 OR 2013 OR 2006) AND ("SYSTEMATIC REVIEWS" OR "SYSTEMATIC REVIEW")

5 – EMBASE

- **Search Date:** December 5, 2020
- **Number of articles found:** 137
- **Search Strategy:** ('prostatectomy'/exp OR 'prostatectomy'/syn) AND ('systematic reviews':ab,ti OR 'systematic review':ab,ti) AND ('robotics'/exp OR 'robotic assisted laparoscopic prostatectomy'/exp OR 'robotic assisted laparoscopic prostatectomy (ralp)' OR 'robot-assisted laparoscopic prostatectomy (ralp)' OR 'robot assisted laparoscopic prostatectomy'/exp OR 'robot assisted laparoscopic prostatectomy' OR 'robot-assisted laparoscopic prostatectomy'/exp OR 'robot-assisted laparoscopic prostatectomy' OR ralp OR 'robot-assisted prostatectomy'/exp OR 'robot-assisted prostatectomy'/syn OR 'robot-assisted laparoscopic radical prostatectomy (ralrp)' OR 'robot assisted laparoscopic radical prostatectomy (ralrp)' OR 'robot assisted laparoscopic radical prostatectomy'/exp OR 'robot assisted laparoscopic radical prostatectomy' OR 'robot-assisted laparoscopic radical prostatectomy'/exp OR 'robot-assisted laparoscopic radical prostatectomy' OR ralrp OR 'robot-assisted radical prostatectomy (rarp)' OR 'robot assisted radical prostatectomy (rarp)' OR 'robot-assisted radical prostatectomy'/exp OR 'robot-assisted radical prostatectomy' OR 'robot assisted radical

prostatectomy'/exp OR 'robot assisted radical prostatectomy' OR rarp OR 'robotic prostatectomy'/exp OR 'robotic prostatectomy' OR 'robotic radical prostatectomy'/exp OR 'robotic radical prostatectomy' OR 'robotic-assisted radical prostatectomy'/exp OR 'robotic-assisted radical prostatectomy' OR 'robotic assisted radical prostatectomy'/exp OR 'robotic assisted radical prostatectomy' OR 'robotic surgical procedure'/exp OR 'robotic surgical procedure'/syn) AND [english]/lim AND (2000:py OR 2001:py OR 2002:py OR 2003:py OR 2006:py OR 2007:py OR 2008:py OR 2009:py OR 2010:py OR 2011:py OR 2012:py OR 2013:py OR 2014:py OR 2015:py OR 2016:py OR 2017:py OR 2018:py OR 2019:py OR 2020:py)

6 - COCHRANE LIBRARY

- **Search date:** December 5, 2020
- **Number of articles found:**19
- **Search Strategy:**

  MeSH descriptor: [Prostatectomy] explode all trees OR (Prostatectomy OR Prostatectomies OR "Prostatectomy, Suprapubic" OR "Prostatectomies, Suprapubic" OR "Suprapubic Prostatectomies" OR "Suprapubic Prostatectomy" OR "Prostatectomy, Retropubic" OR "Prostatectomies, Retropubic" OR "Retropubic Prostatectomies" OR "Retropubic Prostatectomy"):ti,ab,kw AND MeSH descriptor: [Robotics] explode all trees OR (Robotics):ti,ab,kw OR ("Robot-assisted laparoscopic radical prostatectomy (RALRP)" OR "Robot assisted laparoscopic radical prostatectomy (RALRP)" OR "Robot assisted laparoscopic radical

prostatectomy" OR "Robot-assisted laparoscopic radical prostatectomy" OR RALRP) OR ("Robotic assisted laparoscopic prostatectomy (RALP)" OR "Robot-assisted laparoscopic prostatectomy (RALP)" OR "Robot assisted laparoscopic prostatectomy" OR "Robot-assisted laparoscopic prostatectomy" OR RALP) OR ("Robot-assisted radical prostatectomy (RARP)" OR "Robot assisted radical prostatectomy (RARP)" OR "Robot-assisted radical prostatectomy" OR "Robot assisted radical prostatectomy" OR RARP) OR ("Robotic prostatectomy") OR ("Robot-assisted prostatectomy"OR "Robot assisted prostatectomy") OR ("Robotic radical prostatectomy") OR ("Robotic-assisted radical prostatectomy" OR "Robotic assisted radical prostatectomy") OR MeSH descriptor: [Robotic Surgical Procedures] explode all trees OR ("Robotic Surgical Procedures" OR "Procedure, Robotic Surgical" OR "Procedures, Robotic Surgical" OR "Robotic Surgical Procedure" OR "Surgical Procedure, Robotic" OR "Surgical Procedures, Robotic"):ti,ab,kw AND ("SYSTEMATIC REVIEWS"):ti,ab,kw OR ("SYSTEMATIC REVIEW"):ti,ab,kw

7 – PROQUEST CENTRAL

- **Search Date:** December 5, 2020
- **Number of articles found:** 116
- **Search Strategy:** ((MJMESH.EXACT.EXPLODE("Prostatectomy") OR (Prostatectomy OR Prostatectomies OR "Prostatectomy, Suprapubic" OR "Prostatectomies, Suprapubic" OR "Suprapubic Prostatectomies" OR "Suprapubic Prostatectomy" OR "Prostatectomy, Retropubic" OR "Prostatectomies, Retropubic" OR "Retropubic Prostatectomies" OR

"Retropubic Prostatectomy")) AND ((MESH.EXACT("Robotics") OR Robotics) OR (("Robot-assisted laparoscopic radical prostatectomy (RALRP)" OR "Robot assisted laparoscopic radical prostatectomy (RALRP)" OR "Robot assisted laparoscopic radical prostatectomy" OR "Robot-assisted laparoscopic radical prostatectomy" OR RALRP) OR ("Robotic assisted laparoscopic prostatectomy (RALP)" OR "Robot-assisted laparoscopic prostatectomy (RALP)" OR "Robot assisted laparoscopic prostatectomy" OR "Robot-assisted laparoscopic prostatectomy" OR RALP) OR ("Robot-assisted radical prostatectomy (RARP)" OR "Robot assisted radical prostatectomy (RARP)" OR "Robot-assisted radical prostatectomy" OR "Robot assisted radical prostatectomy" OR RARP) OR "Robotic prostatectomy" OR ("Robot-assisted prostatectomy" OR "Robot assisted prostatectomy") OR "Robotic radical prostatectomy" OR ("Robotic-assisted radical prostatectomy" OR "Robotic assisted radical prostatectomy")) OR ((MJMESH.EXACT.EXPLODE("Robotic Surgical Procedures:E.04.749.500") OR MJMESH.EXACT.EXPLODE("Robotic Surgical Procedures:L.01.313.500.750.100.710.800.500") OR MJMESH.EXACT.EXPLODE("Robotic Surgical Procedures:E.02.950.875.500")) OR ("Robotic Surgical Procedures" OR "Procedure, Robotic Surgical" OR "Procedures, Robotic Surgical" OR "Robotic Surgical Procedure" OR "Surgical Procedure, Robotic" OR "Surgical Procedures, Robotic")))) AND (ti("SYSTEMATIC REVIEWS") OR ti("SYSTEMATIC REVIEW")) AND (la.exact("ENG") AND pd(20000101-20201205))

8 – SCOPUS

- **Search date:** December 5, 2020
- **Number of articles found:** 7
- **Search Strategy:** (TITLE-ABS-KEY(Prostatectomy OR Prostatectomies OR "Prostatectomy, Suprapubic" OR "Prostatectomies, Suprapubic" OR "Suprapubic Prostatectomies" OR "Suprapubic Prostatectomy" OR "Prostatectomy, Retropubic" OR "Prostatectomies, Retropubic" OR "Retropubic Prostatectomies" O)) and ((TITLE-ABS-KEY(Robotics)) or ((ALL("Robot-assisted laparoscopic radical prostatectomy (RALRP)" OR "Robot assisted laparoscopic radical prostatectomy (RALRP)" OR "Robot assisted laparoscopic radical prostatectomy" OR "Robot-assisted laparoscopic radical prostatectomy" OR RALRP) OR ALL("Robotic assisted laparoscopic prostatectomy (RALP)" OR "Robot-assisted laparoscopic prostatectomy (RALP)" OR "Robot assisted laparoscopic prostatectomy" OR "Robot-assisted laparoscopic prostatectomy" OR RALP) OR ALL("Robot-assisted radical prostatectomy (RARP)" OR "Robot assisted radical prostatectomy (RARP)" OR "Robot-assisted radical prostatectomy" OR "Robot assisted radical prostatectomy" OR RARP) OR ALL("Robotic prostatectomy") OR ALL("Robot-assisted prostatectomy" OR "Robot assisted prostatectomy") OR ALL("Robotic radical prostatectomy") OR ALL("Robotic-assisted radical prostatectomy" OR "Robotic assisted radical prostatectomy"))) or (TITLE-ABS-KEY("Robotic Surgical Procedures" OR "Procedure, Robotic Surgical" OR "Procedures, Robotic Surgical" OR "Robotic Surgical Procedure" OR "Surgical Procedure, Robotic" OR "Surgical

Procedures, Robotic"))) and ((TITLE-ABS-KEY("SYSTEMATIC REVIEWS") OR TITLE-ABS-KEY("SYSTEMATIC REVIEW"))

APPENDIX C - INCLUDED SYSTEMATIC REVIEWS

Selected systematic review studies for analysis are listed below (C^{1-80}):

1. Abboudi H, Khan MS, Guru KA, et al. Learning curves for urological procedures: A systematic review. Review. BJU International. 2014;114(4):617-629. doi:10.1111/bju.12315

2. Allan C, Ilic D. Laparoscopic versus Robotic-Assisted Radical Prostatectomy for the Treatment of Localised Prostate Cancer: A Systematic Review. Review. Urologia Internationalis. 2016;96(4):373-378. doi:10.1159/000435861

3. Autorino R, Zargar H, White WM, et al. Current applications of near-infrared fluorescence imaging in robotic urologic surgery: A systematic review and critical analysis of the literature. Review. Urology. 2014;84(4):751-759. doi:10.1016/j.urology.2014.05.059

4. Bai Y, Pu C, Yuan H, et al. Assessing the Impact of Barbed Suture on Vesicourethral Anastomosis During Minimally Invasive Radical Prostatectomy: A Systematic Review and Meta-analysis. Urology. Jun 2015;85(6):1368-75. doi:10.1016/j.urology.2015.02.033

5. Baladakis J, Perera M, Bolton D, Lawrentschuk N, Adam A. Is There an Optimal Curative Option in HIV-Positive Men with Localized Prostate Cancer? A Systematic Review. Curr Urol. Jul 2019;12(4):169-176. doi:10.1159/000499309

6. Bellangino M, Verrill C, Leslie T, Bell RW, Hamdy FC, Lamb AD. Systematic Review of Studies Reporting Positive Surgical Margins After Bladder

Neck Sparing Radical Prostatectomy. Review. Current Urology Reports. 2017;18(12)doi:10.1007/s11934-017-0745-0

7. Berryhill R, Jhaveri J, Yadav R, et al. Robotic prostatectomy: a review of outcomes compared with laparoscopic and open approaches. Urology. Jul 2008;72(1):15-23. doi:10.1016/j.urology.2007.12.038

8. Bertolo R, Tracey A, Dasgupta P, et al. Supra-pubic versus urethral catheter after robot-assisted radical prostatectomy: systematic review of current evidence. Review. World Journal of Urology. Sep 2018;36(9):1365-1372. doi:10.1007/s00345-018-2275-x

9. Bertolo R, Hung A, Porpiglia F, Bove P, Schleicher M, Dasgupta P. Systematic review of augmented reality in urological interventions: the evidences of an impact on surgical outcomes are yet to come. World Journal of Urology. Mar 2019 2019:1-10. doi:http://dx.doi.org/10.1007/s00345-019-02711-z

10. Cao L, Yang Z, Qi L, Chen M. Robot-assisted and laparoscopic vs open radical prostatectomy in clinically localized prostate cancer: perioperative, functional, and oncological outcomes: A Systematic review and meta-analysis. Medicine (Baltimore). May 2019;98(22):e15770. doi:10.1097/MD.0000000000015770

11. Carneiro A, Cha JD, Baccaglini W, et al. Should aspirin be suspended prior to robot-assisted radical prostatectomy? A systematic review and meta-analysis. Review. Therapeutic Advances in Urology. 2019;11doi:10.1177/1756287218816595

12. Cathcart P, Murphy DG, Moon D, Costello AJ, Frydenberg M. Perioperative, functional and oncological outcomes after open and minimally

invasive prostate cancer surgery: experience from Australasia. BJU Int. Apr 2011;107 Suppl 3:11-9. doi:10.1111/j.1464-410X.2011.10053.x

13. Checcucci E, Amparore D, De Luca S, Autorino R, Fiori C, Porpiglia F. Precision prostate cancer surgery: an overview of new technologies and techniques. Minerva Urol Nefrol. Oct 2019;71(5):487-501. doi:10.23736/S0393-2249.19.03365-4

14. Checcucci E, Veccia A, Fiori C, et al. Retzius-sparing robot-assisted radical prostatectomy vs the standard approach: a systematic review and analysis of comparative outcomes. BJU Int. Jan 2020;125(1):8-16. doi:10.1111/bju.14887

15. Choo MSMD, Kim MMD, Ku JHMDP, Kwak CMDP, Kim HHMDP, Jeong CWMDP. Extended versus Standard Pelvic Lymph Node Dissection in Radical Prostatectomy on Oncological and Functional Outcomes: A Systematic Review and Meta-Analysis. Annals of Surgical Oncology. 2017;24(7):2047-2054. doi:http://dx.doi.org/10.1245/s10434-017-5822-6

16. Coelho RF, Rocco B, Patel MB, et al. Retropubic, laparoscopic, and robot-assisted radical prostatectomy: a critical review of outcomes reported by high-volume centers. J Endourol. Dec 2010;24(12):2003-15. doi:10.1089/end.2010.0295

17. De Carlo F, Celestino F, Verri C, Masedu F, Liberati E, Di Stasi SM. Retropubic, laparoscopic, and robot-assisted radical prostatectomy: Surgical, oncological, and functional outcomes: A systematic review. Review. Urologia Internationalis. 2014;93(4):373-383. doi:10.1159/000366008

18. De Hong C, Liang Ren L, Qiang W, et al. Comparison of efficacy and safety of conventional laparoscopic radical prostatectomy by the transperitoneal

versus extraperitoneal procedure. Sci Rep. Oct 2015;5:14442. doi:10.1038/srep14442

19. Du Y, Long Q, Guan B, et al. Robot-Assisted Radical Prostatectomy Is More Beneficial for Prostate Cancer Patients: A System Review and Meta-Analysis. Med Sci Monit. 2018/01 2018;24:272-287.

20. Fernando H, Garcia C, Hossack T, et al. Incidence, Predictive Factors and Preventive Measures for Inguinal Hernia following Robotic and Laparoscopic Radical Prostatectomy: A Systematic Review. J Urol. 06 2019;201(6):1072-1079. doi:10.1097/JU.0000000000000133

21. Ferronha F, Barros F, Santos VV, Ravery V, Delmas V. Is there any evidence of superiority between retropubic, laparoscopic or robot-assisted radical prostatectomy? Int Braz J Urol. 2011 Mar-Apr 2011;37(2):146-58; discussion 159-60.

22. Ficarra V, Cavalleri S, Novara G, Aragona M, Artibani W. Evidence from Robot-Assisted Laparoscopic Radical Prostatectomy: A Systematic Review. Review. European Urology. 2007;51(1):45-56. doi:10.1016/j.eururo.2006.06.017

23. Ficarra V, Novara G, Ahlering TE, et al. Systematic review and meta-analysis of studies reporting potency rates after robot-assisted radical prostatectomy. Review. European Urology. 2012;62(3):418-430. doi:10.1016/j.eururo.2012.05.046

24. Ficarra V, Novara G, Artibani W, et al. Retropubic, Laparoscopic, and Robot-Assisted Radical Prostatectomy: A Systematic Review and Cumulative Analysis of Comparative Studies. Review. European Urology. 2009;55(5):1037-1063. doi:10.1016/j.eururo.2009.01.036

25. Ficarra V, Novara G, Rosen RC, et al. Systematic review and meta-analysis of studies reporting urinary continence recovery after robot-assisted radical prostatectomy. Review. European Urology. 2012;62(3):405-417. doi:10.1016/j.eururo.2012.05.045

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APPENDIX D - INCLUDED STUDIES

Selected studies for analysis are listed below (D^{1-268}):

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APPENDIX E – Global descriptive statistics

Distribution of different post-prostatectomy erectile dysfunction classification criteria by number of patients (columns 1-5, from left to right). The other columns show descriptive statistics of the mean erectile function rates and standard error of the mean (SE) weighted by the number of patients (Np), stratified by different surgical techniques (RRP x LRP x RARP) and time after surgery (1, 3, 6, 12 and more than 18 months).

Erectile Function Criteria		Total Frequencies				Cohort	1 month (%)				3 months (%)				6 months (%)				12 months (%)				> 18 months (%)			
		Nr	Np	%	Cum %		Nr	Np	Mean	SE	Nr	Np	Mean	SE	Nr	Np	Mean	SE	Nr	Np	Mean	SE	Nr	Np	Mean	SE
1-	**ESI**	303	97,637	74.1	74.1	RRP	3	1,420	**17.42**	.23	1	1,853	**15.08**	.24	1	3,411	**28.52**	.41	3	10,882	**40.81**	.21	4	31,560	**60.08**	.10
						LRP	9	2,890	**10.04**	.13	4	10,459	**26.26**	.12	4	14,936	**44.19**	.13	5	25,375	**54.60**	.08	2	8,141	**45.99**	.18
						RARP	26	4,778	**33.98**	.20	73	12,113	**37.96**	.14	68	11,424	**52.24**	.17	64	18,064	**61.17**	.12	36	13,446	**74.53**	.16
2-	**SHIM > 21**	33	7,218	5.5	79.5	RRP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	1	576	**27.80**	.00	7	729	**56.52**	.51	3	435	**57.32**	.89
						LRP	0	0	**N.A.**	N.A.	2	618	**26.01**	.14	3	763	**43.17**	.30	6	1,207	**61.85**	.27	3	864	**76.01**	.08
						RARP	4	1,372	**33.70**	.41	4	1,372	**47.15**	.25	8	2,413	**57.23**	.23	1	3,602	**70.25**	.31	0	0	**N.A.**	N.A.
3-	**SHIM > 16**	15	4,942	3.7	83.3	RRP	0	0	**N.A.**	N.A.	2	600	**30.00**	.39	2	600	**43.50**	.46	4	943	**24.85**	.42	0	0	**N.A.**	N.A.
						LRP	2	510	**18.00**	.00	2	510	**34.00**	.00	2	510	**43.00**	.00	2	510	**61.00**	.00	1	1,000	**65.00**	.00
						RARP	0	0	**N.A.**	N.A.	3	2,230	**23.78**	1.43	5	4,390	**51.12**	1.20	4	2,073	**24.96**	.28	1	196	**59.00**	.00
4-	**SHIM > 15**	13	3,536	2.7	86.0	RRP	0	0	**N.A.**	N.A.	4	4,300	**38.88**	.42	0	0	**N.A.**	N.A.	5	6,200	**N.A.**	N.A.	0	0	**N.A.**	N.A.
						LRP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.
						RARP	3	1,181	**43.29**	.07	6	2,293	**60.00**	.19	6	2,293	**72.58**	.07	8	2,916	**70.60**	.40	1	500	**40.50**	.00
5-	**Full**	2	2,996	2.3	88.2	RRP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	2	2,996	**51.00**	.21
						LRP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.
						RARP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.
6-	**UCLA-PCI baseline**	15	2,229	1.7	89.9	RRP	2	256	**14.51**	.30	2	256	**17.38**	.44	4	1,011	**33.05**	.41	3	876	**39.32**	.56	2	755	**46.28**	.45
						LRP	2	169	**11.71**	.29	2	169	**17.83**	.41	2	169	**20.34**	.60	1	45	**8.40**	.00	0	0	**N.A.**	N.A.
						RARP	2	138	**30.36**	1.17	4	227	**37.25**	.68	9	1,049	**37.57**	.85	6	878	**44.48**	1.16	1	447	**20.00**	.00

7-	**HRQOL no bother**	2	2,002	1.5	91.5	RRP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	1	111 7	**22.00**	.00	1	1,117	**24.00**	.00
						LRP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.
						RARP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	1	885	**19.00**	.00	1	885	**23.00**	.00
8-	**Not described**	15	1,829	1.4	92.8	RRP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	1	100	**40.00**	.00	2	159	**59.32**	.90	1	100	**65.00**	.00
						LRP	1	60	**7.30**	.00	4	360	**25.07**	1.15	4	360	**39.76**	1.00	7	1,362	**47.44**	.29	5	1,246	**79.86**	.27
						RARP	1	60	**16.90**	.00	2	110	**34.07**	1.39	4	218	**55.74**	1.79	4	218	**64.46**	1.44	1	40	**21.00**	.00
9-	**SHIM > 17**	14	1,763	1.3	94.2	RRP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	3	275	**45.55**	1.35	1	50	**65.00**	.00
						LRP	1	60	**28.50**	.00	2	184	**35.28**	.24	2	184	**47.35**	.06	5	791	**61.82**	.44	0	0	**N.A.**	N.A.
						RARP	1	60	**42.00**	.00	2	90	**54.33**	.85	2	105	**51.81**	1.57	5	652	**56.74**	.50	1	50	**45.00**	.00
10-	**SHIM > 20**	7	1,410	1.1	95.3	RRP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	3	90	**65.63**	.29	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.
						LRP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	1	600	**43.00**	.00	2	620	**66.81**	.02	0	0	**N.A.**	N.A.
						RARP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.
11-	**SHIM > 19**	2	952	.7	96.0	RRP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	1	845	**61.90**	.00	0	0	**N.A.**	N.A.
						LRP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.
						RARP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	1	107	**53.00**	.00	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.
12-	**EPIC baseline**	4	938	.7	96.7	RRP	1	163	**30.70**	.00	1	163	**35.00**	.00	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.
						LRP	1	490	**14.30**	.00	2	612	**20.40**	.01	1	122	**42.60**	.00	2	612	**36.21**	.37	1	490	**37.10**	.00
						RARP	1	163	**32.70**	.00	1	163	**38.90**	.00	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.
13-	**SHIM baseline**	9	773	.6	97.3	RRP	0	0	**N.A.**	N.A.	3	334	**38.50**	1.04	1	70	**11.00**	.00	2	264	**75.06**	.48	0	0	**N.A.**	N.A.
						LRP	0	0	**N.A.**	N.A.	4	339	**18.91**	.74	2	204	**23.59**	.70	2	135	**56.45**	1.00	1	50	**48.10**	.00
						RARP	0	0	**N.A.**	N.A.	1	50	**46.00**	.00	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.

						RRP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	1	168	**17.00**	.00
14-	**SHIM > 22**	10	723	.58	97.8	LRP	4	50	**14.01**	.92	4	50	**41.99**	1.69	4	50	**79.99**	1.07	0	0	**N.A.**	N.A.	1	171	**8.00**	.00
						RARP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	4	334	**68.75**	.16	0	0	**N.A.**	N.A.
						RRP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	1	220	**2.90**	.00
15-	**No problem**	2	626	.58	98.3	LRP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.
						RARP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	1	406	**2.30**	.00
						RRP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	2	389	**30.84**	.46
16-	**SHIM > 18**	2	389	.36	98.6	LRP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.
						RARP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.
						RRP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	1	372	**20.00**	.00	0	0	**N.A.**	N.A.
17-	**HRQOL baseline**	1	372	.39	98.9	LRP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.
						RARP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.
						RRP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	1	86	**46.00**	.00	0	0	**N.A.**	N.A.
18-	**Baseline 100 %**	5	359	.39	99.2	LRP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	1	40	**25.00**	.00	1	93	**35.90**	.00	0	0	**N.A.**	N.A.
						RARP	1	40	**29.00**	.00	0	0	**N.A.**	N.A.	1	100	**30.00**	.00	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.
						RRP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.
19-	**SHIM > 10**	2	274	.27	99.4	LRP	2	274	**14.95**	.37	2	274	**36.30**	.09	2	274	**38.15**	.00	2	274	**67.80**	.04	0	0	**N.A.**	N.A.
						RARP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.
						RRP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	1	75	**37.00**	.00	0	0	**N.A.**	N.A.
20-	**SFSS baseline**	2	150	.16	99.6	LRP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	1	75	**45.00**	.00	0	0	**N.A.**	N.A.
						RARP	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.	0	0	**N.A.**	N.A.

						RRP	0	0	**N.A**	N.A.	0	0	**N.A**	N.A.	0	0	**N.A**	N.A.	0	0	**N.A**	N.A.	0	0	**N.A**	N.A.
21-	**PR-**																							
	25					LRP	0	0	**N.A**	N.A.	0	0	**N.A**	N.A.	0	0	**N.A**	N.A.	0	0	**N.A**	N.A.	0	0	**N.A**	N.A.
	base	2	107	.1	99.8																			
	line					RAR P	0	0	**N.A**	N.A.	0	0	**N.A**	N.A.	2	107	**39.49**	.15	0	0	**N.A**	N.A.	0	0	**N.A**	N.A.
						RRP	0	0	**N.A**	N.A.	0	0	**N.A**	N.A.	0	0	**N.A**	N.A.	0	0	**N.A**	N.A.	0	0	**N.A**	N.A.
22-	**Base**																							
	line	3	104	.1	99.9	LRP	0	0	**N.A**	N.A.	0	0	**N.A**	N.A.	0	0	**N.A**	N.A.	0	0	**N.A**	N.A.	0	0	**N.A**	N.A.
	80%					RAR P	3	104	**17.42**	.95	3	104	**41.24**	1.26	3	104	**58.63**	1.30	3	104	**72.16**	.84	2	64	**73.81**	.76
						RRP	0	0	**N.A**	N.A.	0	0	**N.A**	N.A.	0	0	**N.A**	N.A.	1	11	**64.00**	.00	0	0	**N.A**	N.A.
23-	**SHIM**																							
	> 11	2	21	.02	100.0	LRP	0	0	**N.A**	N.A.	0	0	**N.A**	N.A.	0	0	**N.A**	N.A.	1	10	**90.00**	.00	0	0	**N.A**	N.A.
						RAR P	0	0	**N.A**	N.A.	0	0	**N.A**	N.A.	0	0	**N.A**	N.A.	0	0	**N.A**	N.A.	0	0	**N.A**	N.A.

Legend: Nr: number of reports; Np: number of patients; SE: standard error of mean. Cum %: cumulative percent. N.A.: Not Avaliable.