PLOS ONE

RESEARCH ARTICLE

A systematic review of the quality of conduct and reporting of systematic reviews and meta-analyses in paediatric surgery

Paul Stephen Cullis[1,2]*, **Katrin Gudlaugsdottir**[1], **James Andrews**[1,2]*

1 Department of Surgical Paediatrics, Royal Hospital for Children, Glasgow, United Kingdom, **2** School of Medicine, University of Glasgow, Glasgow, United Kingdom

* paul.cullis@nhs.net (PC); jamesandrews@nhs.net (JA)

Citation: Cullis PS, Gudlaugsdottir K, Andrews J (2017) A systematic review of the quality of conduct and reporting of systematic reviews and meta-analyses in paediatric surgery. PLoS ONE 12 (4): e0175213. https://doi.org/10.1371/journal.pone.0175213

Editor: Robert K Hills, Cardiff University, UNITED KINGDOM

Received: August 17, 2016

Accepted: March 22, 2017

Published: April 6, 2017

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Funding: The authors received no specific funding for this work.

Competing interests: The authors have declared that no competing interests exist.

Abstract

Objective

Our objective was to evaluate quality of conduct and reporting of published systematic reviews and meta-analyses in paediatric surgery. We also aimed to identify characteristics predictive of review quality.

Background

Systematic reviews summarise evidence by combining sources, but are potentially prone to bias. To counter this, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) was published to aid in reporting. Similarly, the Assessing the Methodological Quality of Systematic Reviews (AMSTAR) measurement tool was designed to appraise methodology. The paediatric surgical literature has seen an increasing number of reviews over the past decade, but quality has not been evaluated.

Methods

Adhering to PRISMA guidelines, we performed a systematic review with *a priori* design to identify systematic reviews and meta-analyses of interventions in paediatric surgery. From 01/2010 to 06/2016, we searched: MEDLINE, EMBASE, Cochrane, Centre for Reviews and Dissemination, Web of Science, Google Scholar, reference lists and journals. Two reviewers independently selected studies and extracted data. We assessed conduct and reporting using AMSTAR and PRISMA. Scores were calculated as the sum of reported items. We also extracted author, journal and article characteristics, and used them in exploratory analysis to determine which variables predict quality.

Results

112 articles fulfilled eligibility criteria (53 systematic reviews; 59 meta-analyses). Overall, 68% AMSTAR and 56.8% PRISMA items were reported adequately. Poorest scores were identified with regards *a priori* design, inclusion of structured summaries, including the grey literature, citing excluded articles and evaluating bias. 13 reviews were pre-registered and 6

in PRISMA-endorsing journals. The following predicted quality in univariate analysis:, word count, Cochrane review, journal h-index, impact factor, journal endorses PRISMA, PRISMA adherence suggested in author guidance, article mentions PRISMA, review includes comparison of interventions and review registration. The latter three variables were significant in multivariate regression.

Conclusions

There are gaps in the conduct and reporting of systematic reviews in paediatric surgery. More endorsement by journals of the PRISMA guideline may improve review quality, and the dissemination of reliable evidence to paediatric clinicians.

Background

Systematic reviews and meta-analyses have an increasingly important role in modern healthcare. They are used to appraise evidence, inform policy, construct guidelines and assess cost-effectiveness of interventions. However, both systematic reviews and meta-analyses can potentially be biased through the selection, analysis and reporting of included studies. In recent years, attempts have been made to encourage authors to report reviews following an agreed protocol and in doing so improve the conduct of reporting of such reviews. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement evolved from the earlier Quality of Reporting of Meta-analyses (QUORUM) collaboration checklist, both of which had been designed to form a framework of reporting for authors of systematic reviews and meta-analyses [1]. Since it's publication in 2009, PRISMA has been endorsed by many major healthcare journals, many more recommend adherence and its popularity is growing. Several extensions followed publication of PRISMA and there are still more developments underway, including tools focusing on the paediatric population. Whilst PRISMA encourages quality reporting of systematic reviews, the Assessing the Methodological Quality of Systematic Reviews (AMSTAR) measurement tool was designed to appraise systematic review methodology critically. It has since been validated and proven popular as a simple means of assessing the quality of reviews [2–3].

Research in surgery presents unique challenges in producing high quality evidence comparing interventions, but this is particularly true in the surgery of childhood. Ethical approval for research can be challenging in paediatrics, not least because of issues with consent [4]. Furthermore, recruitment is often challenging and the incidence of many paediatric conditions is low, which hinders the ability to power studies appropriately, especially when the outcome measure is itself uncommon. Examples of trials in paediatrics hindered by issues with study recruitment, include the VICI [5] and PLUTO [6] trials, and multicenter randomised-controlled trials comparing laparotomy with drainage for neonatal perforation [7–8]. Potentially as a consequence of such difficulties, retrospective case series account for almost half of the paediatric surgical literature. Despite their suitability, multicentre trials are uncommon [9]. Therefore, cumulative tools have become useful adjuncts in the paediatric surgical literature to draw conclusions on a multitude of smaller studies [10–11].

Our primary aim was to evaluate the quality of conduct and reporting of published systematic reviews and meta-analyses in paediatric surgery, including general surgery of childhood, neonatal surgery and paediatric urology. Our secondary aim was to identify any article, author or journal characteristics associated with high quality reviews.

Methods

We employed a methodology not dissimilar to Adie et al. (which did not focus on the paediatric surgical literature, but instead, the quality of reporting and methodology of systematic reviews and meta-analyses in the surgical literature in general [12] and McGee at al. (which focused on systematic reviews and meta-analyses of randomised controlled trials of any surgical interventions in children) [13].

Registration and protocol

Registration of the review with PROSPERO, an international prospective register of systematic reviews, was attempted, however, purely methodological reviews are not included in the database. The *a priori* review protocol may therefore be sought from: https://drive.google.com/open?id=0B49a9IgOcHHRbWlKYnRfR1ZYTjA. This systematic review was reported in accordance with the PRISMA statement[1].

Search strategy

A systematic search of the English literature was performed on 10th June 2016 to identify systematic reviews and meta-analyses focusing on paediatric surgical interventions published from 1st January 2010 to 10th June 2016. The former date was selected because the original PRISMA statement was published and disseminated in multiple medical and surgical journals in mid-2009. An initial electronic search was conducted using MEDLINE and EMBASE databases. The search strategy is shown in S1 Table and the PRISMA flow diagram in Fig 1. A similar search was performed of the Cochrane Database of Systematic Reviews (by searching all articles manually within the period studied under topics: Cancer, Child Health, Endocrine & Metabolic, Gastroenterology & Hepatology, Kidney Disease, Methodology, Neonatal Care, Pregnancy & Childbirth, Urology and Wounds), Centre for Reviews and Dissemination database (similar to the search conducted in S1 Table), Thomson Reuters Web of Science (similar to the search conducted in S1 Table), and Google Scholar (searching for articles with "surgery", "intervention" or "procedure" in the title and including either "paediatric", "pediatric", "neonatal", "neonate", "infant", "child", "children", "adolescent" or "toddler"). The reference lists of included articles were also searched, in addition to hand-searching of various relevant high-impact journals (S2 Table).

Eligibility criteria

Inclusion and exclusion criteria are highlighted in Table 1. The titles and abstracts of the retrieved articles were screened independently by two authors (P.S.C. and K.G.) using the inclusion criteria, and the full texts of yielded articles were subsequently sought. Eligibility criteria were then applied to the retrieved set of articles by the same authors. Disputes were presented to the third author (J.A.) and a consensus was reached. It should be noted that we took the definition of paediatric surgical interventions to include any performed commonly by a paediatric surgeon in the UK. Normally this role combines general surgery of childhood, paediatric urology and neonatal surgery only, as defined in the UK Joint Committee on Surgical Training's Certificate of Completion of Training documentation [14].

Data extraction

An electronic data collection form was developed by two authors (P.S.C. and K.G.). Data extraction was then performed independently, with interobserver reliability assessed using the kappa statistic. General characteristics of systematic reviews were extracted, including details of authors (number, gender, department, country(ies) of origin), the study (systematic review

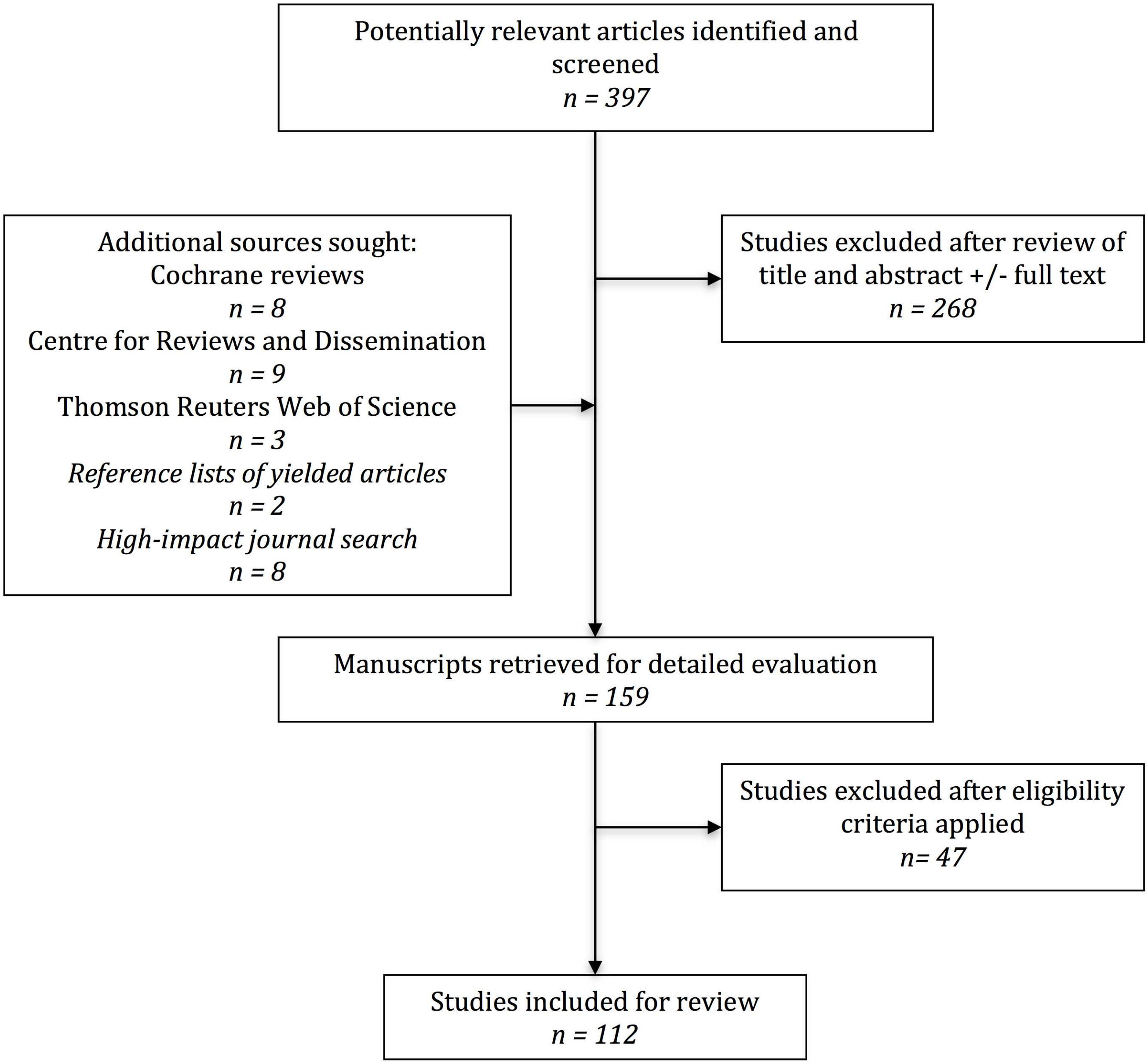

Fig 1. PRISMA flow diagram.

https://doi.org/10.1371/journal.pone.0175213.g001

or meta-analysis, type of comparison, number of studies included, funding sources), the journal (name, type, impact factor, h5 index, PRISMA endorsement, PRISMA adherence suggested in author guidelines) and the article (word count, registration, PRISMA adherence described). These were selected as descriptive comparators, however, most of these variables have been hypothesised as being associated with quality, and we used them in the exploratory analyses described later [12].

Quality appraisal

Quality of studies included was assessed by two means. The AMSTAR checklist was designed to evaluate systematic reviews and guide prospective review conduct. It consists of an 11-item

Table 1. Eligibility criteria employed.

Inclusion criteria	Exclusion criteria
Study identified as a systematic review, with or without meta-analysis, data synthesis or quantitative overview	Studies focusing on other paediatric surgical specialties, foetal medicine or paediatric anaesthesia
English language	Grey literature (i.e. manuscripts not published in peer-review journals or books)
Published from 1st January 2010 to 10th June 2016 (online or in print)	Majority (>50%) patients within included studies of review adult (>18 years of age) and/or paediatric patient data not analysed separately
Full text published article	Non-human subjects
Studies focusing on intervention(s) during childhood within field of the general surgery of childhood or paediatric or urology, to include neonatal surgery	

https://doi.org/10.1371/journal.pone.0175213.t001

tool that we employed to score texts. A single point was given for each item if reporting was considered adequate, no points if inadequate, and not applicable if that item was not relevant to the text, for example, combining data in quantitative synthesis or assessing publication bias in the context of a systematic review without a meta-analysis [2]. Therefore, the maximum achievable score was 11. Secondly, we used the PRISMA checklist in a similar fashion, achieving a maximum score of 27 for texts [1]. Since for several items, such as those relating to meta-analysis in the context of a systematic review, scores were not applicable, AMSTAR and PRISMA items were to be reported as global percentages of applicable items. It is important to note that AMSTAR scores relate to methodological quality whilst PRISMA relates to reporting quality.

Sample size calculation

Sample size calculation was not performed as all systematic reviews published during the search period and meeting the eligibility criteria were to be included. The number of articles included would influence univariate and multivariate regression analyses. We did not limit the number of exploratory variables in regression analysis, however, because regression analysis was a secondary objective and because the journal, author, study and article characteristics were defined before statistical analysis.

Data analysis

A biostatistician was consulted for assistance with statistical analysis. Simple descriptive analysis was performed for variables relating to author, study, journal and article characteristics (see Data Extraction section). The general characteristics of systematic reviews extracted were used as exploratory variables of AMSTAR and PRISMA scores, separately. Namely, we included: number of authors, medical/surgical versus university department of first author, Anglophonic versus other country of origin of first author, review compares treatment versus no comparison, number of studies included, whether the study was funded, whether it was a Cochrane review or not, journal impact factor, journal h5 index, whether the journal endorses PRISMA, whether the journal suggests PRISMA adherence in author guidelines, article word count, whether the review was registered, and whether PRISMA adherence was reported. In univariate and multivariate modelling, a p value <0.05 was considered statistically significant. Univariate linear regression was first performed for each variable, and subsequently, those variables with a p value <0.1 were combined in stepwise backward multiple regression analysis. Those significant variables in each multiple regression analysis were combined in the final multiple regression model. The above analyses were performed on Minitab statistical software (release 16; Minitab, Minitab Inc, State College, Philadelphia).

Results

Search results

112 articles yielded met formal eligibility criteria and were included for analysis, comprising 53 systematic reviews which did not contain a meta-analysis, and 59 systematic reviews with meta-analyses. The PRISMA flow diagram is illustrated in Fig 1 and excluded studies and reasoning for exclusion are listed in Table 2 below [15–60].

General characteristics

The characteristics of studies included in the final analysis [61–172] are listed in Table 3. The mean number of authors per article was 5; 63.4% were affiliated with a department of paediatric surgery. Articles were published by 101 first authors, from a total of 22 countries. The UK was responsible for more publications than any other country (25.9%), followed by Canada (13.4%), China (13.4%) and the USA (10.7%). The majority (57.1%) of yielded articles were by first authors of anglophonic countries whilst 13.4% articles represented international collaborations.

Articles were published in 31 different journals with the majority from journals dedicated to paediatric surgery or urology (61.6%). Median h5 index was 31.5 whilst median impact factor was 1.4. The most popular three journals were: the Journal of Pediatric Surgery (24.1%), Pediatric Surgery International (17.9%) and the European Journal of Paediatric Surgery (12.5%). The top three journals (with more than one publication yielded) as rated by highest mean AMSTAR score achieved were: Cochrane Database of Systematic Reviews (93%), Annals of Surgery (55%) and the Journal of Urology (47%). For PRISMA scores, the respective top three journals were: Cochrane Database of Systematic Reviews (93%), Annals of Surgery (87%) and the Journal of Gastrointestinal Surgery (83%). Only 5.4% articles were published in PRISMA-endorsing journals whilst only 11.6% were published in journals which encourage PRISMA adherence.

More than one third of reviews were on the subject of gastrointestinal surgery, and two-thirds compared surgical interventions. Only 11.6% reviews were pre-registered. Median journal impact factor was 1.4 (IQR 0.9) and median h5 index was 31.5 (IQR 11.3).

AMSTAR and PRISMA scores

Figs 2 and 3 illustrate the proportion of systematic reviews, meta-analyses and both systematic reviews and meta-analyses that adequately reported each AMSTAR and PRISMA item. Overall, 68% AMSTAR and 56.8% PRISMA items were described adequately. AMSTAR items

Table 2. Excluded studies and reasoning.

Reason for exclusion	Articles excluded (reference number)
Not regarding specific paediatric surgical or urological interventions	16–25, 27–35, 37, 38, 41–52, 54–60
Majority (>50%) patients within included studies of review adult (>18 years of age) and/or paediatric patient data not analysed separately	15,36
Not a full text original manuscript	26, 39, 40, 53

https://doi.org/10.1371/journal.pone.0175213.t002

reported well were: 6. Characteristics of studies provided (88.3%) and 9. Methods to combine findings appropriate (93.1%). AMSTAR items which scored particularly poorly were: 1. *A priori* design (15.9%), 4. Grey literature searched (21.2%), 5. List of studies provided (8%), and 11.

Table 3. Characteristics of included studies.

Characteristic			n
Authors	Number of authors (%)	1–3	40 (35.7)
		4–6	49 (43.8)
		>6	23 (20.5)
	Department of first author (%)	Paediatric surgery or urology	71 (63.4)
		Other surgical subspecialty	18 (16.1)
		Research/university/epidemiology	17 (15.2)
	Gender of first author (%)	Male	73 (65.2)
		Female	39 (34.8)
	Country of first author (%)	UK	29 (25.9)
		Canada	15 (13.4)
		China	15 (13.4)
		USA	12 (10.7)
		Germany	7 (6.3)
		Netherlands	7 (6.3)
	First author from Anglophonic country (%)		64 (57.1)
	International collaborative authorship (%)		15 (13.4)
Journal	Type of journal (%)	Paediatric surgery or urology	69 (61.6)
		Other surgical subspecialty	19 (17)
		Surgery, in general	7 (6.3)
		Medicine, in general	6 (5.4)
		Cochrane	5 (4.5)
		Paediatrics	5 (4.5)
	Journal title (%)	Journal of Pediatric Surgery	27 (24.1)
		Pediatric Surgery International	20 (17.9)
		European Journal of Pediatric Surgery	14 (12.5)
		Journal of Pediatric Urology	5 (4.5)
		Cochrane	5 (4.5)
	h5 index (median with IQR, and range)		31.5 (11.3, 8–161)
	Impact factor (median with IQR, and range)		1.4 (0.9, 0–8.3)
	PRISMA-endorsing journal (%)		6 (5.4)
	PRISMA adherence advised by journal (%)		13 (11.6)
Article	Review theme (%)	Generic or emergency	32 (28.6)
		Gastrointestinal (upper or lower)	38 (33.9)
		Urology	26 (23.2)
		Thoracic	12 (10.7)
		Oncology	4 (3.6)
	Type of comparison (%)	Surgery vs surgery	70 (62.5)
		Non-surgery vs surgery	12 (10.7)
		No comparison	30 (26.8)
	Pre-registered (%)		13 (11.6)
	Funding (%)		16 (14.3)
	PRISMA adherence stated within article (%)		30 (26.8)
	Number of studies included (median with IQR, and range)		13 (17, 0–98)
	Word count (median with IQR, and range)		5798 (3028, 2000–47914)

https://doi.org/10.1371/journal.pone.0175213.t003

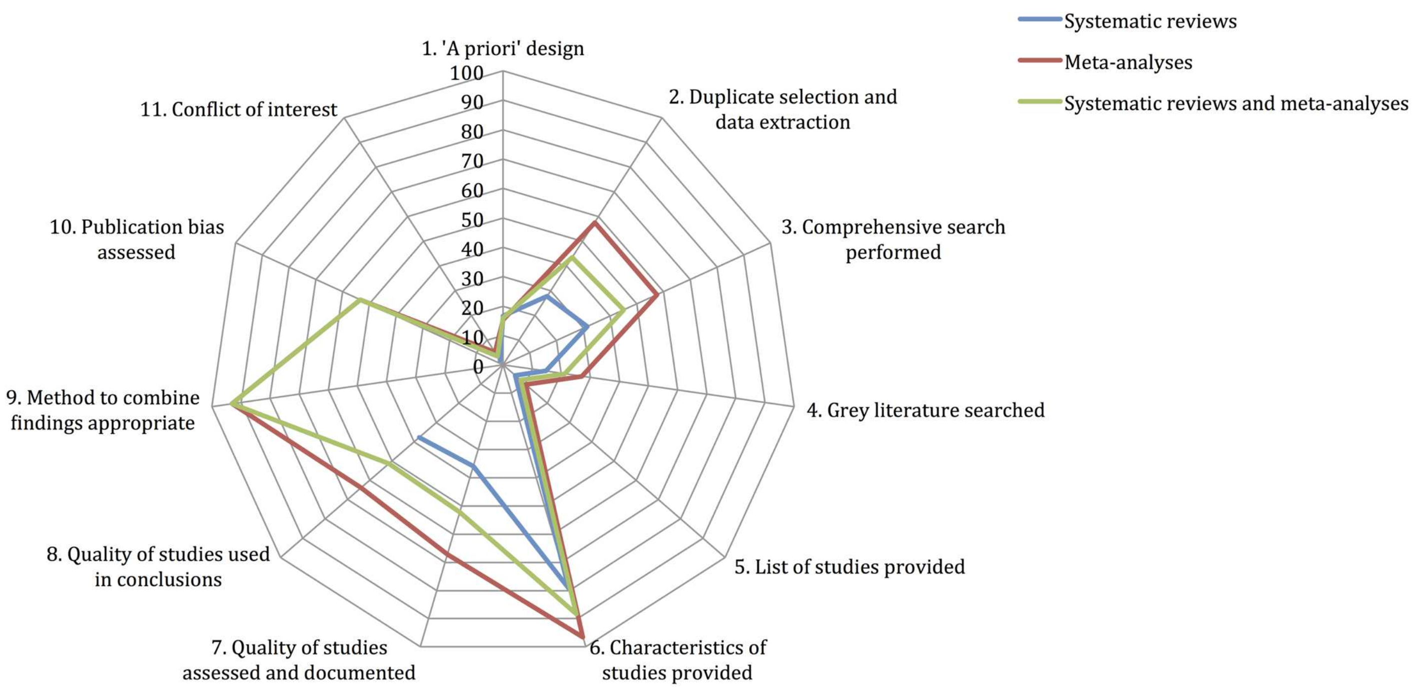

Fig 2. star chart illustrating AMSTAR scores achieved for systematic reviews, meta-analyses and their cumulative total, as percentage of adequately reported items.

https://doi.org/10.1371/journal.pone.0175213.g002

Conflict of interest inclusion (3.5%). Conversely, PRISMA items reported well were: 1. Title (90.3%), 3. Rationale (97.3%), 4. Aims/objectives (89.4%), 6. Eligibility criteria (83.2%), 9. Selection process (91.2%), 11. Variables (85%), 18. Study characteristics (83.8%) and 26.

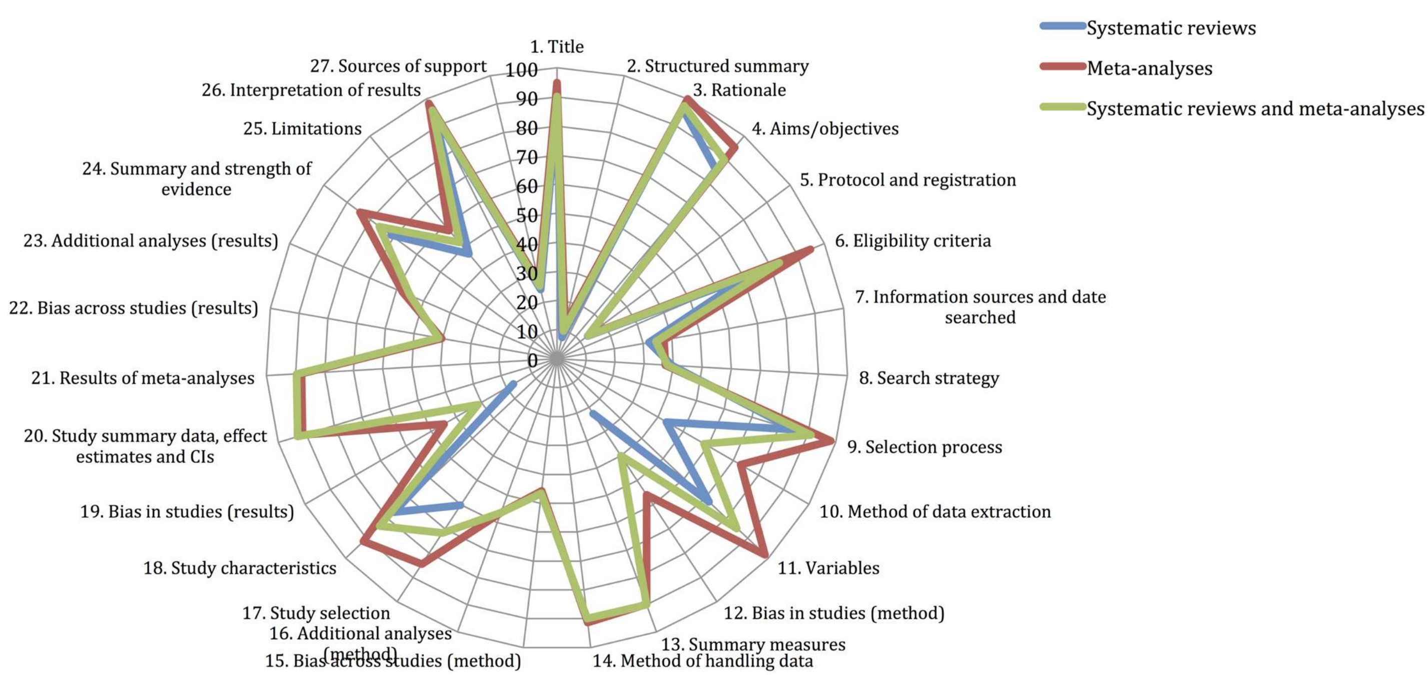

Fig 3. star chart illustrating PRISMA scores achieved for systematic reviews, meta-analyses and their cumulative total, as percentage of adequately reported items.

https://doi.org/10.1371/journal.pone.0175213.g003

Interpretation of results (95.6%). PRISMA items which scored particularly poorly were: 2. Structured summary (9.7%), 5. Protocol and registration (13.3%), 7. Information sources and date searched (34.5%), 12. Bias in studies with regards methods (39.8%), 15. Bias across studies with regards methods (46.7%), 19. Bias in studies with regards results (31.5%), 22. Bias across studies with regards results (41.4%), and 27. Sources of support (25.7%). meta-analyses achieved notably higher scores for each AMSTAR and PRISMA item, except for AMSTAR item 1. *A priori* design and PRISMA item 8. Search strategy.

Interobserver reliability

The overall kappa statistic for AMSTAR and PRISMA items was 0.89, equating to almost perfect agreement. For no items was agreement less than substantial. Three items were rated <0.7: (a) AMSTAR item 2. Duplicate study selection and data extraction, (b) AMSTAR item 3. Comprehensive literature search, and (c) PRISMA item 8. Full electronic search strategy. For AMSTAR item 2 and PRISMA item 8, the wording of manuscripts was often unclear such that deciding on whether these criteria were fulfilled was challenging. For AMSTAR item 3, there was some initial uncertainty as to whether or not searching the reference lists of retrieved articles counted as a supplementary strategy in its own right.

Statistical analyses

Linear regression of exploratory variables using AMSTAR and PRISMA separately as dependent variables identified several significant trends displayed in Tables 4 and 5. The following factors were significant in univariate linear regression with regards AMSTAR score: first author affiliation with research institute or university, review includes a comparison of interventions, article word count, article is a Cochrane review, journal h-index, journal impact factor, journal endorses PRISMA, journal suggests PRISMA adherence in the author guidance, and review registration. In its respective multiple regression analysis, the following variables were significant: first author affiliation with research institute or university and review registration. The following factors were significant in univariate linear regression with regards PRISMA score: review includes a comparison of interventions, article word count, article is a

Table 4. showing only those variables that were identified as significant ($p < 0.05$) in univariate regression for AMSTAR scores and the results of subsequent input to multiple regression, again showing only significant results. The overall model fit for final multiple regression equation was R^2 = 0.51. Change in AMSTAR score refers to the expected change in AMSTAR score with a unit increase in the variable assessed with all other variables being constant. N.B. systematic review (SR); meta-analysis (MA); confidence interval (CI).

	UNIVARIATE REGRESSION	MULTIVARIATE REGRESSION
Exploratory variable	**Expected change in AMSTAR score (as % change with 95% CI)**	**Expected change in AMSTAR score (as % change with 95% CI)**
First author affiliated with research institute/ university versus no affiliation	+13 (0.2 to 25.7)	
SR or MA compares treatment versus no comparison	+29.6 (20.6 to 38.5)	+25.3 (18 to 32.6)
Article word count (per 1000 words)	+1.7 (1 to 2.5)	
Cochrane review versus non-Cochrane	+55.1 (35.1 to 75.1)	
Journal h-index	+0.4 (0.3 to 0.6)	
Journal impact factor	+6.3 (3.9 to 8.7)	
Journal endorses PRISMA versus no endorsement	+50.5 (32.2 to 68.9)	
Journal suggests PRISMA adherence versus does not	+32.5 (19.4 to 45.7)	
Review registered versus not	+43 (31.3 to 55.3)	+37.8 (27.6 to 48)

https://doi.org/10.1371/journal.pone.0175213.t004

Table 5. showing only those variables that were identified as significant ($p < 0.05$) in univariate regression for PRISMA scores and the results of subsequent input to multiple regression, again showing only significant results. The overall model fit for final multiple regression equation was R^2 = 0.29. N.B. Change in PRISMA score refers to the expected change in PRISMA score with a unit increase in the variable assessed with all other variables being constant. NB. systematic review (SR); meta-analysis (MA); confidence interval (CI).

	UNIVARIATE REGRESSION	MULTIVARIATE REGRESSION
Exploratory variable	**Expected change in PRISMA score (as % change with 95% CI)**	**Expected change in PRISMA score (as % change with 95% CI)**
SR or MA compares treatment versus no comparison	+21.5 (13.8 to 29.2)	+19.6 (12.3 to 26.9)
Article word count (per 1000 words)	+1.2 (0.6 to 1.8)	
Cochrane review versus non-Cochrane	+31.7 (14 to 49.3)	
Journal h-index	+0.3 (0.2 to 0.4)	
Journal impact factor	+4.9 (2.9 to 6.8)	
Journal endorses PRISMA versus no endorsement	+29.6 (13.5 to 45.8)	
Journal suggests PRISMA adherence versus does not	+23.3 (12.1 to 34.5)	
Article mentions PRISMA versus does not	+16.3 (8.1 to 24.4)	+13.6 (6.3 to 20.8)
Review registered versus not	+26.2 (15.2 to 37.1)	

https://doi.org/10.1371/journal.pone.0175213.t005

Cochrane review, journal h-index, journal impact factor, journal endorses PRISMA, journal suggests PRISMA adherence in the author guidance, review article mentions PRISMA adherence, and the review registration. In its respective multiple regression analysis, the following variables were significant: review includes a comparison of intervention and review article mentions PRISMA adherence.

Discussion

Findings in context

This review has evaluated the adequacy of systematic reviews and meta-analyses in the published paediatric surgical literature, and has highlighted areas of particular concern with regards the conduct and methodology of such reviews. Overall, compliance with the AMSTAR checklist was moderate, with two thirds (68%) of AMSTAR items reported adequately amongst all reviews. Similarly, compliance with the PRISMA guidelines was poorer with approximately half (56.8%) of PRISMA items reported adequately. Globally poor scores were identified with regards *a priori* design, review registration, inclusion of structured summaries, including the grey literature, citing excluded articles, evaluating bias and inclusion of conflict of interest statements.

Overall, meta-analyses score higher with regards AMSTAR scores and PRISMA compliance, than systematic reviews alone. AMSTAR score was positively associated with the review registration and first author affiliation with a research institute or university, whilst compliance with PRISMA was positively associated with the review article mentioning PRISMA adherence and including a comparison of surgical interventions (the latter variable may be explained however by the increased likelihood that meta-analyses compared interventions). No other review characteristics were significant in the final multivariate regression analyses.

The Oxford level of evidence grading system highlights that cumulative evidence obtained from several studies combined is of higher quality than their individual research study components, reflected in the fact that systematic reviews are a step above their constituent studies [10]. It is therefore an easy and often incorrect assumption that systematic reviews and meta-analyses equate to quality evidence. The GRADE system, however, places less strength on systematic reviews and meta-analyses but still considers such cumulative analyses of RCTs the highest possible form of evidence alongside individual RCTs [11]. The methodology and reporting of systematic reviews and meta-analyses are prone to flaws as much as any other form of medical research, and the Oxford grading system does make this clear. We have highlighted that paediatric surgery is no different with this regard.

Only two reviews achieved perfect scores with regards the AMSTAR criteria [122,157]; no articles were considered perfect in relation to their PRISMA score. We, the authors, are no less guilty of failing to report all items on the PRISMA checklist to their entirety in the past [80,173]; with the current study, best attempts were made to follow the checklist. It is paramount that investigators planning systematic reviews and meta-analyses adhere to PRISMA guidance, to ensure methodological robustness and, by improving quality of reporting, optimise the communication of the review and findings to its readers. In turn, this should help clinicians keep up-to-date with the current evidence, and subsequently, improve the care of children affected by surgical conditions.

The issue of reporting in paediatric surgery is not limited to systematic reviews and meta-analyses. Randomised controlled trials remain rare, accounting for <0.05% of all publications in the field of paediatric surgery [174]. Similar to the PRISMA statement, the Consolidated Standards of Reporting Trials (CONSORT) guideline was designed to improve reporting of trials by means of a standardised, evidence-based checklist [175]. Despite its first publication in 1996, trials in paediatric surgical specialties are poorly reported, with only 2% of trials meeting the full CONSORT criteria [176]. Recently, paediatric surgical guidelines have been scrutinised in a similar manner. Shaywer et al. used the Appraisal of Guidelines for Research and Evaluation Instrument to assess the quality of guidelines published in major paediatric surgical journals. Whilst specific areas achieved moderate scores, overall quality was considered poor and they highlighted that important aspects of guidelines are still underreported [177].

A priori study design was adequately reported in only 16% of studies. To explore whether or not this was a reporting or methodological issue, we searched the Centre for Reviews and Dissemination database to identify registered reviews. This confirmed that this low figure relates to failings to register reviews rather than failure to report registration, with PROSPERO, at least. We did not identify a single article that was registered yet did not document this amongst its text. Having a pre-determined protocol is important because it may restrict the opportunities for biased *post hoc* changes in methodology [178]. Our data suggests a positive association between review registration and quality. We were unable to identify any other such association in the literature with regards systematic reviews, however, there is evidence that registration is positively associated with better reporting of clinical trials [179]. Inclusion of the grey literature was considered adequate for 21% of included studies. This is another important aspect of reviews to minimise publication bias. 8% studies achieved adequate scores for providing lists of studies. To achieve this, the AMSTAR checklist is clear that a list of both included *and* excluded studies must be provided [2]. Almost all studies provided the former citations, yet only 9 provided the latter, most of which were Cochrane reviews. Similarly, only 3.5% studies were considered adequate in relation to conflict of interest statements. The AMSTAR checklist insists that both the sources of support or funding for the review itself *and* the included studies must be reported[2]. Again it is the latter aspect that is, in general, poorly reported. This is reflected in the fact PRISMA item 27 Funding was adequately reported in 26% studies, an item which we considered adequate if only the review funding was listed as worded in the PRISMA checklist.

McGee et al. have evaluated the quality of conduct and reporting of systematic reviews of RCTs of surgical procedures in children[13]. This was not limited to paediatric surgery and urology, but instead all surgical subspecialty publications were included, and publications until the end of 2010 were assessed, largely before publication of PRISMA. Despite the broad nature of reviews and lengthy timescale assessed, only 15 systematic reviews were included in the final analysis, compared with 112 in our study. This difference likely reflects the paucity of RCTs in surgical subspecialties of childhood and the snowballing popularity of systematic reviews and meta-analyses in the surgical literature. Similar to the current study, McGee et al. found that PRISMA items 15 and 22, relating to the risk of bias across studies with regards their methods and results, achieved some of the lowest PRISMA scores. An important difference between our study and theirs is the proportion of included studies from the Cochrane Collaboration. Almost 90% of their systematic reviews were from this database, as opposed to <5% in the current study. This fact reflects many other differences in PRISMA scores achieved. They found that PRISMA item 1 was poorly reported i.e. the inclusion of systematic review or meta-analysis in the review title. Nevertheless, the Cochrane Collaboration tends not to include either "systematic review" or "meta-analysis" within the title, perhaps because inclusion in the database implies its systematic review methodology. On the contrary, McGee et al. found PRISMA items for registration, structured summary, search strategy and limitations, and AMSTAR items for *a priori* design, comprehensive literature search and list of studies provided to be adequate for most reviews. We noted the contrary however Cochrane reviews are consistently good at providing these items. We similarly noted AMSTAR items for publication bias and conflicts of interest to be poorly reported globally. McGee et al. did not perform any further statistical analyses to determine if there are any variables that predict higher review quality.

Braga et al. [180] evaluated the quality of systematic reviews and meta-analyses in paediatric urology published in major urological journals from 2000 to 2009 using the AMSTAR tool. 12 studies were included in the final analysis. They similarly identified poor reporting of the AMSTAR item 4 Inclusion of the grey literature. Contrary to our findings, they noted that *a priori* design, a full list of excluded studies and conflict of interests were provided by the majority of studies. We also identified a published conference abstract by Salim et al. [181] which evaluated the paediatric surgical literature using the AMSTAR tool. The authors appeared to have evaluated all systematic reviews in the field of paediatric surgery as opposed to those assessing surgical interventions alone as we did. 44 articles were included in their final analysis. Similar to our findings, publication bias is highlighted as a particularly poorly reported item with only 20% systematic reviews fulfilling this criteria adequately, and AMSTAR scores for items relating to duplicate study selection and comprehensive literature search being moderately well reported too.

Weakness and limitations

Our review has of course its limitations. We attempted to identify all systematic reviews and meta-analyses since 2010 of surgical interventions in children in a pragmatic fashion as performed by a paediatric surgeon. This role itself is variable worldwide. Despite our best efforts, we may have missed articles either through the initial search or human error during the screening process. It is important to note that no MESH terms exist that are relevant to the specialties of paediatric surgery, paediatric urology or neonatal surgery. Ideally MESH terms would have been used in the initial search. Human error may also have affected the data extraction process. Furthermore, our scoring systems were binary in that AMSTAR and PRISMA criteria were either adequate or not, similar to the article by Adie et al. [12] It could be argued, however, that a scaled scoring system, such as that employed by McGee et al. [13], would have been more intuitive, accommodating for those criteria where adequacy was partly achieved. We minimised these limitations/risks by having two authors perform screening, selection and extraction independently, and interobserver reliability was high overall. We did not assess the grey literature, which may seem ironic considering our findings that systematic reviews and meta-analyses infrequently search this domain, but our aim was only to assess the published literature. It is also an assumption that if an AMSTAR or PRISMA item is not mentioned amongst the text of an manuscript that it did not occur. This, of course, will be false at times, although as mentioned earlier, no reviews which failed to mention registration were registered on PROSPERO. To our knowledge, neither PRISMA or AMSTAR scoring has not been formally validated. We are not aware of any research that has been published linking such scores with either effects of bias or an exaggeration of treatment effects. In our analysis, we allocated each article an aggregate score, however, this homogenises the quality assessment and is therefore a limitation of this study. By providing star charts (and the raw data), the reader may appreciate the adequacy of reporting of each AMSTAR and PRISMA criterion however. Finally, our secondary objective was to identify any article, author or journal characteristics associated with high quality reviews, however, we included all articles published within the period assessed and selected the exploratory characteristics to be used in regression modelling before yielding articles. Therefore, in total, we included 14 variables in regression analysis, some of which were inter-related, e.g. h-index and impact factor, or journal PRISMA endorsement and journal suggests PRISMA adherence. It would have been more statistically valid to limit the number of exploratory variables and avoid including closely associated variables.

We have highlighted areas for improvement in the literature, but we must consider means in which reporting and methodology of systematic reviews and meta-analyses in the surgery of childhood can be further improved. If more journals were to endorse PRISMA, or at least, to insist that authors adhere to its checklist, then the quality of reporting would be expected to improve. Of note, official and unofficial PRISMA endorsement were significant only on univariate linear regression, through articles mentioning PRISMA adherence was significantly associated with higher review quality in multiple regression analysis. Only the Cochrane Database of Systematic Reviews and PLOS ONE are official PRISMA endorsers, and only five other journals suggest adherence in their author guidelines, namely Annals of Surgery, BJU International, BMJ Open, the International Journal of Surgery, and the Journal of Trauma and Acute Care Surgery. Since more than half of all systematic reviews and meta-analyses in our study were published in the major paediatric surgical journals, their endorsement, or at least a change in their author guidelines, would have a significant impact in the quality of reporting in the specialty in the future.

Conclusion

In conclusion, we have highlighted areas for improvement in quality of reporting and methodology of systematic reviews and meta-analyses in the paediatric surgical literature. *A priori* review registration, reviews including comparisons of interventions, and articles mentioning PRISMA, were characteristics associated with higher quality reviews. The latter variable is likely the reason why PRISMA adherence was not associated with higher review quality on final multivariate regression. Journals and investigators alike should take note of the benefits of PRISMA adherence in producing high quality systematic reviews and meta-analyses, which should have a positive impact on the accurate dissemination of knowledge to clinicians and in turn, the quality of surgical care received by children.

Supporting information

S1 PRISMA Checklist. PRISMA checklist items reported and their location within the text.
(DOCX)

S1 Table. The search strategy employed for EMBASE and MEDLINE. Last search performed on 10th June 2016.
(DOCX)

S2 Table. Lists the hand-searched high impact journals.
(DOCX)

S1 Dataset. Raw cumulative AMSTAR and PRISMA scores for each systematic review analysed. Reporting.
(XLSX)

Acknowledgments

We, the authors, are grateful for the assistance provided by staff at the School of Mathematics and Statistics of the University of Glasgow and the University of Strathclyde, UK, and for the methodological inspiration provided by the excellent articles by Adie et al. [12] and McGee et al. [13] which formed the framework for this systematic review's methodology.

Author Contributions

Conceptualization: PSC.

Data curation: PSC KG.

Formal analysis: PSC.

Investigation: PSC KG.

Methodology: PSC KG JA.

Project administration: PSC JA.

Resources: PSC KG.

Supervision: PSC JA.

Validation: PSC KG JA.

Visualization: PSC JA.

Writing – original draft: PSC.

Writing – review & editing: PSC KG JA.

References

1. Moher D. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. Annals of Internal Medicine Ann Intern Med. 2009; 151(4):264. PMID: 19622511
2. Shea BJ, Hamel C, Wells GA, Bouter LM, Kristjansson E, Grimshaw J, et al. AMSTAR is a reliable and valid measurement tool to assess the methodological quality of systematic reviews. Journal of Clinical Epidemiology. 2009; 62(10):1013–20. https://doi.org/10.1016/j.jclinepi.2008.10.009 PMID: 19230606
3. Shea BJ, Bouter LM, Peterson J, Boers M, Andersson N, Ortiz Z, et al. External Validation of a Measurement Tool to Assess Systematic Reviews (AMSTAR). PLoS ONE. 2007; 2(12).
4. Macrae D. Conducting clinical trials in pediatrics. Critical Care Medicine. 2009; 37(S).
5. Snoek KG, Capolupo I, van Rosmalen J, Hout Lde J, Vijfhuize S, Greenough A, et al. Conventional mechanical ventilation versus high-frequency oscillatory ventilation for congenital diaphragmatic hernia: a randomized clinical trial (the VICI-trial). Annals of Surgery. 2016; 263(5):867–874. https://doi.org/10.1097/SLA.0000000000001533 PMID: 26692079

6. Morris RK, Malin GL, Quinlan-Jones E, Middleton LJ, Diwakar L, Hemming K, et al. The Percutaneous shunting in Lower Urinary Tract Obstruction (PLUTO) study and randomised controlled trial: evaluation of the effectiveness, cost-effectiveness and acceptability of percutaneous vesicoamniotic shunting for lower urinary tract obstruction. Health Technol Assess. 2013; 17(59):1–232. https://doi.org/10.3310/hta17590 PMID: 24331029

7. Rees CM, Eaton S, Kiely EM, Wade AM, McHugh K, Pierro A. Peritoneal Drainage or Laparotomy for Neonatal Bowel Perforation?: A Randomized Controlled Trial. Annals of surgery. 2008; 248(1):44–51. https://doi.org/10.1097/SLA.0b013e318176bf81 PMID: 18580206

8. Moss RL, Dimmitt RA, Barnhart DC, Sylvester KG, Brown RL, Powell DM, et al. Laparotomy versus peritoneal drainage for necrotizing enterocolitis and perforation. New England Journal of Medicine. 2006; 354:2225–34. https://doi.org/10.1056/NEJMoa054605 PMID: 16723614

9. Allin B, Aveyard N, Campion-Smith T, Floyd E, Kimpton J, Swarbrick K, et al. What Evidence Underlies Clinical Practice in Paediatric Surgery? A Systematic Review Assessing Choice of Study Design. PLOS ONE. 2016; 11(3).

10. OCEBM Levels of Evidence Working Group [Internet]. Oxford: "The Oxford Levels of Evidence 2". Oxford Centre for Evidence-Based Medicine. Available from: http://www.cebm.net/index.aspx?o=5653

11. Eaton S. Combining data from multiple studies: An introduction to meta-analysis in paediatric surgery. Journal of Pediatric Surgery. 2013; 48(2):281–7. https://doi.org/10.1016/j.jpedsurg.2012.11.004 PMID: 23414852

12. Adie S, Ma D, Harris IA, Naylor JM, Craig JC. Quality of Conduct and Reporting of Meta-analyses of Surgical Interventions. Annals of Surgery. 2015; 261(4):685–94. https://doi.org/10.1097/SLA.0000000000000836 PMID: 25575252

13. McGee RG, Craig JC, Rogerson TE, Webster AC. Systematic reviews of surgical procedures in children: Quantity, coverage and quality: Reviews of surgical procedures. Journal of Paediatrics and Child Health. 2013; 49(4):319–24. https://doi.org/10.1111/jpc.12156 PMID: 23530924

14. Autorino R, Eden C, El-Ghoneimi A, Guazzoni G, Buffi N, Peters CA, et al. Robot-assisted and Laparoscopic Repair of Ureteropelvic Junction Obstruction: A Systematic Review and Meta-analysis. European Urology. 2014; 65(2):430–52. https://doi.org/10.1016/j.eururo.2013.06.053 PMID: 23856037

15. Anon. Certification Guidelines for Paediatric Surgery. Joint Committee on Surgical Training. 2016. Available from: http://www.jcst.org/quality-assurance/documents/certification-guidelines/

16. Beres AL, Baird R. An institutional analysis and systematic review with meta-analysis of pneumatic versus hydrostatic reduction for pediatric intussusception. Surgery. 2013; 154(2):328–34. https://doi.org/10.1016/j.surg.2013.04.036 PMID: 23889959

17. Chua ME, Mendoza JS, Gaston MJV, Luna SL, Morales ML. Hormonal therapy using gonadotropin releasing hormone for improvement of fertility index among children with cryptorchidism: a meta-analysis and systematic review. Journal of Pediatric Surgery. 2014; 49(11):1659–67. https://doi.org/10.1016/j.jpedsurg.2014.06.013 PMID: 25475814

18. Connor MJ, Springford LR, Kapetanakis VV, Giuliani S. Esophageal atresia and transitional care—step 1: a systematic review and meta-analysis of the literature to define the prevalence of chronic long-term problems. The American Journal of Surgery. 2015; 209(4):747–59. https://doi.org/10.1016/j.amjsurg.2014.09.019 PMID: 25605033

19. Coyle D, Puri P. Hirschsprung's disease in children with Mowat–Wilson syndrome. Pediatric Surgery International. 2015; 31(8):711–7. https://doi.org/10.1007/s00383-015-3732-x PMID: 26156877

20. D'Antonio F, Virgone C, Rizzo G, Khalil A, Baud D, Cohen-Overbeek TE, et al. Prenatal Risk Factors and Outcomes in Gastroschisis: A Meta-Analysis. Pediatrics. 2015; 136(1):e159–69. https://doi.org/10.1542/peds.2015-0017 PMID: 26122809

21. Das A, Shah PS. Octreotide for the treatment of chylothorax in neonates. In: The Cochrane Collaboration, editor. Cochrane Database of Systematic Reviews [Internet]. Chichester, UK: John Wiley & Sons, Ltd; 2010 [cited 2016 Jul 5].

22. Dellenmark-Blom M, Chaplin JE, Gatzinsky V, Jönsson L, Abrahamson K. Health-related quality of life among children, young people and adults with esophageal atresia: a review of the literature and recommendations for future research. Quality of Life Research. 2015; 24(10):2433–45. https://doi.org/10.1007/s11136-015-0975-x PMID: 25829227

23. Dicken BJ, Sergi C, Rescorla FJ, Breckler F, Sigalet D. Medical management of motility disorders in patients with intestinal failure: a focus on necrotizing enterocolitis, gastroschisis, and intestinal atresia. Journal of Pediatric Surgery. 2011; 46(8):1618–30. https://doi.org/10.1016/j.jpedsurg.2011.04.002 PMID: 21843732

24. Doodnath R, Puri P. A systematic review and meta-analysis of Hirschsprung's disease presenting after childhood. Pediatric Surgery International. 2010; 26(11):1107–10. https://doi.org/10.1007/s00383-010-2694-2 PMID: 20725836

25. Downard CD, Renaud E, St. Peter SD, Abdullah F, Islam S, Saito JM, et al. Treatment of necrotizing enterocolitis: an American Pediatric Surgical Association Outcomes and Clinical Trials Committee systematic review. Journal of Pediatric Surgery. 2012; 47(11):2111–22. https://doi.org/10.1016/j.jpedsurg.2012.08.011 PMID: 23164007

26. Ekenze SO, Ajuzieogu OV, Nwomeh BC. Neonatal surgery in Africa: a systematic review and meta-analysis of challenges of management and outcome. The Lancet. 2015; 385:S35.

27. Espinel AG, Shah RK, McCormick ME, Krakovitz PR, Boss EF. Patient Satisfaction in Pediatric Surgical Care: A Systematic Review. Otolaryngology—Head and Neck Surgery. 2014; 150(5):739–49. https://doi.org/10.1177/0194599814527232 PMID: 24671459

28. Evans C, van Woerden HC. The effect of surgical training and hospital characteristics on patient outcomes after pediatric surgery: a systematic review. Journal of Pediatric Surgery. 2011; 46(11):2119–27. https://doi.org/10.1016/j.jpedsurg.2011.06.033 PMID: 22075342

29. Fotso Kamdem A, Nerich V, Auber F, Jantchou P, Ecarnot F, Woronoff-Lemsi M- C. Quality assessment of economic evaluation studies in pediatric surgery: A systematic review. Journal of Pediatric Surgery. 2015; 50(4):659–87. https://doi.org/10.1016/j.jpedsurg.2015.01.012 PMID: 25840083

30. Friedmacher F, Puri P. Rectal suction biopsy for the diagnosis of Hirschsprung's disease: a systematic review of diagnostic accuracy and complications. Pediatric Surgery International. 2015; 31(9):821–30. https://doi.org/10.1007/s00383-015-3742-8 PMID: 26156878

31. Grant NH, Dorling J, Thornton JG. Elective preterm birth for fetal gastroschisis. In: The Cochrane Collaboration, editor. Cochrane Database of Systematic Reviews [Internet]. Chichester, UK: John Wiley & Sons, Ltd; 2013 [cited 2016 Jul 5].

32. Grivell RM, Andersen C, Dodd JM. Prenatal versus postnatal repair procedures for spina bifida for improving infant and maternal outcomes. In: The Cochrane Collaboration, editor. Cochrane Database of Systematic Reviews [Internet]. Chichester, UK: John Wiley & Sons, Ltd; 2014 [cited 2016 Jul 5].

33. Hall NJ, Kapadia MZ, Eaton S, Chan WWY, Nickel C, Pierro A, et al. Outcome reporting in randomised controlled trials and meta-analyses of appendicitis treatments in children: a systematic review. Trials [Internet]. 2015 Dec [cited 2016 Jul 5]; 16(1). Available from: http://www.trialsjournal.com/content/16/1/275

34. Hofmann AD, Duess JW, Puri P. Congenital anomalies of the kidney and urinary tract (CAKUT) associated with Hirschsprung's disease: a systematic review. Pediatric Surgery International. 2014; 30(8):757–61. https://doi.org/10.1007/s00383-014-3529-3 PMID: 24974188

35. Hofmeester MJ, Draaisma JMTH, Versteegh HP, Huibregtse ECP, van Rooij IALM, de Blaauw I. Perioperative Nutritional Management in Congenital Perineal and Vestibular Fistulas: A Systematic Review. Eur J Pediatr Surg. 2015; 25(5):389–96. https://doi.org/10.1055/s-0034-1544052 PMID: 25654619

36. Huang EY, Chen C, Abdullah F, Aspelund G, Barnhart DC, Calkins CM, et al. Strategies for the prevention of central venous catheter infections: an American Pediatric Surgical Association Outcomes and Clinical Trials Committee systematic review. Journal of Pediatric Surgery. 2011; 46(10):2000–11. https://doi.org/10.1016/j.jpedsurg.2011.06.017 PMID: 22008341

37. Lauriti G, Zani A, Aufieri R, Cananzi M, Chiesa PL, Eaton S, et al. Incidence, Prevention, and Treatment of Parenteral Nutrition–Associated Cholestasis and Intestinal Failure–Associated Liver Disease in Infants and Children A Systematic Review. Journal of Parenteral and Enteral Nutrition. 2014; 38(1):70–85. https://doi.org/10.1177/0148607113496280 PMID: 23894170

38. Maguire SA, Upadhyaya M, Evans A, Mann MK, Haroon MM, Tempest V, et al. A systematic review of abusive visceral injuries in childhood—Their range and recognition. Child Abuse & Neglect. 2013; 37(7):430–45.

39. Mahant S, Cohen E, Weinstein M, Wadhwa A. Video-assisted thoracoscopic surgery vs chest drain with fibrinolytics for the treatment of pleural empyema in children: a systematic review of randomized controlled trials. Arch Pediatr Adolesc Med. 2010; 164(2):201–3. https://doi.org/10.1001/archpediatrics.2009.271 PMID: 20124153

40. Marshall AP, St. Peter SD, Huang EY, Yu C, Tice J, Wang L, Sharp SW, Blakely ML. Early Versus Interval Appendectomy for Children With Perforated Appendicitis: An Individual Patient Data Meta-Analysis of Randomized Trials. Journal of Surgical Research 2013; 179(2), 0022/4804.

41. Martin K, VanHouwelingen L, Bütter A. The significance of pseudoaneurysms in the nonoperative management of pediatric blunt splenic trauma. Journal of Pediatric Surgery. 2011; 46(5):933–7. https://doi.org/10.1016/j.jpedsurg.2011.02.031 PMID: 21616255

42. McAteer JP, LaRiviere CA, Drugas GT, Abdullah F, Oldham KT, Goldin AB. Influence of surgeon experience, hospital volume, and specialty designation on outcomes in pediatric surgery: a systematic review. JAMA Pediatr. 2013; 167(5):468–75. https://doi.org/10.1001/jamapediatrics.2013.25 PMID: 23529612

43. Mc Laughlin D, Friedmacher F, Puri P. The impact of Clostridium difficile on paediatric surgical practice: a systematic review. Pediatric Surgery International. 2014; 30(8):853–9. https://doi.org/10.1007/s00383-014-3543-5 PMID: 25008231

44. Rangel SJ, Calkins CM, Cowles RA, Barnhart DC, Huang EY, Abdullah F, et al. Parenteral nutrition–associated cholestasis: an American Pediatric Surgical Association Outcomes and Clinical Trials Committee systematic review. Journal of Pediatric Surgery. 2012; 47(1):225–40. https://doi.org/10.1016/j.jpedsurg.2011.10.007 PMID: 22244423

45. Righetti L. Inflammatory fibroid polyps in children: A new case report and a systematic review of the pediatric literature. World Journal of Clinical Pediatrics. 2015; 4(4):160. https://doi.org/10.5409/wjcp.v4.i4.160 PMID: 26566490

46. Routh JC, McGee SM, Ashley RA, Reinberg Y, Vandersteen DR. Predicting Renal Outcomes in Children With Anterior Urethral Valves: A Systematic Review. The Journal of Urology. 2010; 184(4):1615–9.

47. (Sebastian) van As A. Paediatric trauma care. African Journal of Paediatric Surgery. 2010;7(3):129.

48. Shalaby MS, Di Rollo D, Adikibi B, Brindley N. Left sided colo-colic intussusception in a child with acute lymphoblastic leukemia: A case report and systematic review of the literature. Journal of Pediatric Surgery Case Reports. 2014; 2(5):228–31.

49. Shteynshlyuger A, Yu J. Familial testicular torsion: A meta analysis suggests inheritance. Journal of Pediatric Urology. 2013; 9(5):683–90. https://doi.org/10.1016/j.jpurol.2012.08.002 PMID: 23017841

50. Stanger JD, Oliveira C, Blackmore C, Avitzur Y, Wales PW. The impact of multi-disciplinary intestinal rehabilitation programs on the outcome of pediatric patients with intestinal failure: A systematic review and meta-analysis. Journal of Pediatric Surgery. 2013; 48(5):983–92. https://doi.org/10.1016/j.jpedsurg.2013.02.070 PMID: 23701771

51. Suominen JS, Jawaid WB, Losty PD. Testicular microlithiasis and associated testicular malignancies in childhood: A systematic review: Testicular Microlithiasis and Malignancies. Pediatric Blood & Cancer. 2015; 62(3):385–8.

52. Svensson JF, Hall NJ, Eaton S, Pierro A, Wester T. A review of conservative treatment of acute appendicitis. Eur J Pediatr Surg. 2012; 22(3):185–94. https://doi.org/10.1055/s-0032-1320014 PMID: 22767171

53. Szylberg Ł, Marszałek A. Diagnosis of Hirschsprung's disease with particular emphasis on histopathology. A systematic review of current literature. Gastroenterology Review. 2014; 5:264–9.

54. Thompson AJ, McSwain SD, Webb SA, Stroud MA, Streck CJ. Venous thromboembolism prophylaxis in the pediatric trauma population. Journal of Pediatric Surgery. 2013; 48(6):1413–21. https://doi.org/10.1016/j.jpedsurg.2013.02.059 PMID: 23845640

55. van der Heijden MJE, Oliai Araghi S, van Dijk M, Jeekel J, Hunink MGM. The Effects of Perioperative Music Interventions in Pediatric Surgery: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. Laks J, editor. PLOS ONE. 2015 6; 10(8):e0133608. https://doi.org/10.1371/journal.pone.0133608 PMID: 26247769

56. van der Vlies CH, Saltzherr TP, Wilde JCH, van Delden OM, de Haan RJ, Goslings JC. The failure rate of nonoperative management in children with splenic or liver injury with contrast blush on computed tomography: a systematic review. Journal of Pediatric Surgery. 2010; 45(5):1044–9. https://doi.org/10.1016/j.jpedsurg.2010.01.002 PMID: 20438952

57. Westgarth-Taylor C, de Lijster L, van Bogerijen G, Millar AJW, Karpelowsky J. A prospective assessment of renal oxygenation in children undergoing laparoscopy using near-infrared spectroscopy. Surgical Endoscopy. 2013; 27(10):3696–704. https://doi.org/10.1007/s00464-013-2950-3 PMID: 23605192

58. White JT, Samples DC, Prieto JC, Tarasiewicz I. Systematic Review of Urologic Outcomes from Tethered Cord Release in Occult Spinal Dysraphism in Children. Current Urology Reports [Internet]. 2015 Nov [cited 2016 Jul 5]; 16(11). Available from: http://link.springer.com/10.1007/s11934-015-0550-6

59. Zani-Ruttenstock E, Zani A, Bullman E, Lapidus-Krol E, Pierro A. Are paediatric operations evidence based? A prospective analysis of general surgery practice in a teaching paediatric hospital. Pediatric Surgery International. 2015; 31(1):53–9. https://doi.org/10.1007/s00383-014-3624-5 PMID: 25367096

60. Zhong H, Wang F. Contralateral metachronous hernia following negative laparoscopic evaluation for contralateral patent processus vaginalis: a meta-analysis. J Laparoendosc Adv Surg Tech A. 2014; 24(2):111–6. https://doi.org/10.1089/lap.2013.0429 PMID: 24180355

61. Aikenhead A, Knai C, Lobstein T. Effectiveness and cost-effectiveness of paediatric bariatric surgery: a systematic review: Review of bariatric surgery in youth. Clinical Obesity. 2011; 1(1):12–25. https://doi.org/10.1111/j.1758-8111.2010.00003.x PMID: 25586971

62. Al-Hozaim O, Al-Maary J, AlQahtani A, Zamakhshary M. Laparoscopic-assisted anorectal pull-through for anorectal malformations: a systematic review and the need for standardization of outcome reporting. Journal of Pediatric Surgery. 2010; 45(7):1500–4. https://doi.org/10.1016/j.jpedsurg.2009.12.001 PMID: 20638532

63. Allen CJ, Valle EJ, Thorson CM, Hogan AR, Perez EA, Namias N, et al. Pediatric emergency department thoracotomy: A large case series and systematic review. Journal of Pediatric Surgery. 2015; 50 (1):177–81. https://doi.org/10.1016/j.jpedsurg.2014.10.042 PMID: 25598119

64. Allin BSR, Tse WHW, Marven S, Johnson PRV, Knight M. Challenges of Improving the Evidence Base in Smaller Surgical Specialties, as Highlighted by a Systematic Review of Gastroschisis Management. Lau WYJ, editor. PLOS ONE. 2015; 10(1):e0116908. https://doi.org/10.1371/journal.pone.0116908 PMID: 25621838

65. Alzahem A. Laparoscopic versus open inguinal herniotomy in infants and children: a meta-analysis. Pediatric Surgery International. 2011; 27(6):605–12. https://doi.org/10.1007/s00383-010-2840-x PMID: 21290136

66. Apelt N, Featherstone N, Giuliani S. Laparoscopic treatment of intussusception in children: A systematic review. Journal of Pediatric Surgery. 2013; 48(8):1789–93. https://doi.org/10.1016/j.jpedsurg.2013.05.024 PMID: 23932624

67. Aworanti O, Awadalla S. Management of recurrent tracheoesophageal fistulas: a systematic review. Eur J Pediatr Surg. 2014; 24(5):365–75. https://doi.org/10.1055/s-0034-1370780 PMID: 24683108

68. Baker L, Beres AL, Baird R. A systematic review and meta-analysis of gastrostomy insertion techniques in children. Journal of Pediatric Surgery. 2015; 50(5):718–25. https://doi.org/10.1016/j.jpedsurg.2015.02.021 PMID: 25783383

69. Berger M, Ure B, Lacher M. Mitomycin C in the therapy of recurrent esophageal strictures: hype or hope? Eur J Pediatr Surg. 2012; 22(2):109–16. https://doi.org/10.1055/s-0032-1311695 PMID: 22517516

70. Billingham MJ, Basterfield SJ. Pediatric surgical technique: laparoscopic or open approach? A systematic review and meta-analysis. Eur J Pediatr Surg. 2010; 20(2):73–7. https://doi.org/10.1055/s-0029-1241871 PMID: 19882502

71. Black JA, White B, Viner RM, Simmons RK. Bariatric surgery for obese children and adolescents: a systematic review and meta-analysis: Pediatric bariatric surgery: a meta-analysis. Obesity Reviews. 2013; 14(8):634–44. https://doi.org/10.1111/obr.12037 PMID: 23577666

72. Borruto FA, Impellizzeri P, Antonuccio P, Finocchiaro A, Scalfari G, Arena F, et al. Laparoscopic vs open varicocelectomy in children and adolescents: review of the recent literature and meta-analysis. Journal of Pediatric Surgery. 2010; 45(12):2464–9. https://doi.org/10.1016/j.jpedsurg.2010.07.007 PMID: 21129568

73. Castagnetti M, El-Ghoneimi A. Surgical Management of Primary Severe Hypospadias in Children: Systematic 20-Year Review. The Journal of Urology. 2010; 184(4):1469–75. https://doi.org/10.1016/j.juro.2010.06.044 PMID: 20727541

74. Castagnetti M, Gnech M, Angelini L, Rigamonti W, Bagnara V, Esposito C. Does Preputial Reconstruction Increase Complication Rate of Hypospadias Repair? 20-Year Systematic Review and Meta-Analysis. Frontiers in Pediatrics [Internet]. 2016 Apr 28 [cited 2016 Jul 5]; 4. Available from: http://journal.frontiersin.org/Article/10.3389/fped.2016.00041/abstract

75. Chan E, Wayne C, Nasr A, FRCSC for Canadian Association of Pediatric Surgeon Evidence-Based Resource. Ideal timing of orchiopexy: a systematic review. Pediatr Surg Int. 2014; 30(1):87–97. https://doi.org/10.1007/s00383-013-3429-y PMID: 24232174

76. Chan E, Wayne C, Nasr A. Minimally invasive versus open repair of Bochdalek hernia: a meta-analysis. Journal of Pediatric Surgery. 2014; 49(5):694–9. https://doi.org/10.1016/j.jpedsurg.2014.02.049 PMID: 24851750

77. Chang S-J, Hsu C-K, Hsieh C-H, Yang SS-D. Comparing the efficacy and safety between robotic-assisted versus open pyeloplasty in children: a systematic review and meta-analysis. World Journal of Urology. 2015; 33(11):1855–65. https://doi.org/10.1007/s00345-015-1526-3 PMID: 25754944

78. Chen Y, Nah SA, Laksmi NK, Ong CCP, Chua JHY, Jacobsen A, et al. Transanal endorectal pull-through versus transabdominal approach for Hirschsprung's disease: A systematic review and meta-analysis. Journal of Pediatric Surgery. 2013; 48(3):642–51. https://doi.org/10.1016/j.jpedsurg.2012.12.036 PMID: 23480925

79. Corbett HJ, Mullassery D. Outcomes of endopyelotomy for pelviureteric junction obstruction in the paediatric population: A systematic review. Journal of Pediatric Urology. 2015; 11(6):328–36. https://doi.org/10.1016/j.jpurol.2015.08.014 PMID: 26553288

80. Cullis PS, Siminas S, Losty PD. Is Screening of Intestinal Foregut Anatomy in Heterotaxy Patients Really Necessary?: A Systematic Review in Search of the Evidence. Annals of surgery [Internet]. 2015 [cited 2016 Jul 5]; Available from: http://europepmc.org/abstract/med/26704743

81. Cundy TP, Harling L, Hughes-Hallett A, Mayer EK, Najmaldin AS, Athanasiou T, et al. Meta-analysis of robot-assisted vs conventional laparoscopic and open pyeloplasty in children: Robot-assisted vs laparoscopic and open pyeloplasty in children. BJU International. 2014; 114(4):582–94. PMID: 25383399

82. Cundy TP, Harling L, Marcus HJ, Athanasiou T, Darzi AW. Meta analysis of robot-assisted versus conventional laparoscopic fundoplication in children. Journal of Pediatric Surgery. 2014; 49(4):646–52. https://doi.org/10.1016/j.jpedsurg.2013.12.014 PMID: 24726129

83. Cundy TP, Marcus HJ, Clark J, Hughes-Hallett A, Mayer EK, Najmaldin AS, et al. Robot-assisted minimally invasive surgery for pediatric solid tumors: a systematic review of feasibility and current status. Eur J Pediatr Surg. 2014; 24(2):127–35. https://doi.org/10.1055/s-0033-1347297 PMID: 23686663

84. Ding J, Xia Y, Zhang Z, Liao G, Pan Y, Liu S, et al. Single-incision versus conventional three-incision laparoscopic appendicectomy for appendicitis: A systematic review and meta-analysis. Journal of Pediatric Surgery. 2013; 48(5):1088–98. https://doi.org/10.1016/j.jpedsurg.2013.01.026 PMID: 23701788

85. Dingemann C, Ure B, Dingemann J. Thoracoscopic procedures in pediatric surgery: what is the evidence? Eur J Pediatr Surg. 2014; 24(1):14–9. https://doi.org/10.1055/s-0033-1350060 PMID: 23852720

86. Dingemann J, Ure BM. Systematic review of level 1 evidence for laparoscopic pediatric surgery: do our procedures comply with the requirements of evidence-based medicine? Eur J Pediatr Surg. 2013; 23(6):474–9. https://doi.org/10.1055/s-0033-1333639 PMID: 23444068

87. Ells LJ, Mead E, Atkinson G, Corpeleijn E, Roberts K, Viner R, et al. Surgery for the treatment of obesity in children and adolescents. In: The Cochrane Collaboration, editor. Cochrane Database of Systematic Reviews [Internet]. Chichester, UK: John Wiley & Sons, Ltd; 2015 [cited 2016 Jul 5].

88. Elyas R, Guerra LA, Pike J, DeCarli C, Betolli M, Bass J, et al. Is Staging Beneficial for Fowler-Stephens Orchiopexy? A Systematic Review. The Journal of Urology. 2010; 183(5):2012–9. https://doi.org/10.1016/j.juro.2010.01.035 PMID: 20303527

89. Esposito C, St. Peter SD, Escolino M, Juang D, Settimi A, Holcomb GW. Laparoscopic Versus Open Inguinal Hernia Repair in Pediatric Patients: A Systematic Review. Journal of Laparoendoscopic & Advanced Surgical Techniques. 2014; 24(11):811–8.

90. Feng S, Qiu Y, Li X, Yang H, Wang C, Yang J, et al. Laparoscopic versus open splenectomy in children: a systematic review and meta-analysis. Pediatric Surgery International. 2016; 32(3):253–9. https://doi.org/10.1007/s00383-015-3845-2 PMID: 26661732

91. Feng S, Zhao L, Liao Z, Chen X. Open versus laparoscopic inguinal herniotomy in children: a systematic review and meta-analysis focusing on postoperative complications. Surgical Laparoscopy Endoscopy & Percutaneous Techniques. 2015; 25(4):275–280.

92. Friedmacher F, Puri P. Residual aganglionosis after pull-through operation for Hirschsprung's disease: a systematic review and meta-analysis. Pediatric Surgery International. 2011; 27(10):1053–7. https://doi.org/10.1007/s00383-011-2958-5 PMID: 21789665

93. Friedmacher F, Puri P. Delayed primary anastomosis for management of long-gap esophageal atresia: a meta-analysis of complications and long-term outcome. Pediatric Surgery International. 2012; 28(9):899–906. https://doi.org/10.1007/s00383-012-3142-2 PMID: 22875461

94. Frongia G, Kessler M, Weih S, Nickkholgh A, Mehrabi A, Holland-Cunz S. Comparison of LILT and STEP procedures in children with short bowel syndrome—A systematic review of the literature. Journal of Pediatric Surgery. 2013; 48(8):1794–805. https://doi.org/10.1016/j.jpedsurg.2013.05.018 PMID: 23932625

95. Gallo G, Zwaveling S, Groen H, Van der Zee D, Hulscher J. Long-gap esophageal atresia: a meta-analysis of jejunal interposition, colon interposition, and gastric pull-up. Eur J Pediatr Surg. 2012; 22 (6):420–5. https://doi.org/10.1055/s-0032-1331459 PMID: 23212741

96. Gosemann J-H, Friedmacher F, Ure B, Lacher M. Open Versus Transanal Pull-Through for Hirschsprung Disease: A Systematic Review of Long-Term Outcome. European Journal of Pediatric Surgery. 2013; 23(2):094–102.

97. Graziano K, Islam S, Dasgupta R, Lopez ME, Austin M, Chen LE, et al. Asymptomatic malrotation: Diagnosis and surgical management. Journal of Pediatric Surgery. 2015; 50(10):1783–90. https://doi.org/10.1016/j.jpedsurg.2015.06.019 PMID: 26205079

98. Guo J, Liang Z, Zhang H, Yang C, Pu J, Mei H, et al. Laparoscopic versus open orchiopexy for non-palpable undescended testes in children: a systemic review and meta-analysis. Pediatric Surgery International. 2011; 27(9):943–52. https://doi.org/10.1007/s00383-011-2889-1 PMID: 21476074

99. Hall NJ, Jones CE, Eaton S, Stanton MP, Burge DM. Is interval appendicectomy justified after successful nonoperative treatment of an appendix mass in children? A systematic review. Journal of Pediatric Surgery. 2011; 46(4):767–71. https://doi.org/10.1016/j.jpedsurg.2011.01.019 PMID: 21496553

100. Healy DA, Doyle D, Moynagh E, Maguire M, Ahmed I, Ahmed AS, et al. Systematic Review and Meta-Analysis on the Influence of Surgeon Specialization on Outcomes Following Appendicectomy in Children. Medicine [Internet]. 2015 [cited 2016 Jul 5]; 94(32). Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4616707/

101. Healy JM, Olgun LF, Hittelman AB, Ozgediz D, Caty MG. Pediatric incidental appendectomy: a systematic review. Pediatric Surgery International. 2016; 32(4):321–35. https://doi.org/10.1007/s00383-015-3839-0 PMID: 26590816

102. Heloury Y, Muthucumaru M, Panabokke G, Cheng W, Kimber C, Leclair MD. Minimally invasive adrenalectomy in children. Journal of Pediatric Surgery. 2012; 47(2):415–21. https://doi.org/10.1016/j.jpedsurg.2011.08.003 PMID: 22325405

103. Huang Y, Wu Y, Shan W, Zeng L, Huang L. An updated meta-analysis of laparoscopic versus open pyeloplasty for ureteropelvic junction obstruction in children. International journal of clinical and experimental medicine. 2015; 8(4):4922. PMID: 26131065

104. Ishii H, Griffin S, Somani BK. Flexible ureteroscopy and lasertripsy (FURSL) for paediatric renal calculi: Results from a systematic review. Journal of Pediatric Urology. 2014; 10(6):1020–5. https://doi.org/10.1016/j.jpurol.2014.08.003 PMID: 25241397

105. Ishii H, Griffin S, Somani BK. Ureteroscopy for stone disease in the paediatric population: a systematic review: Ureteroscopy for stone disease in children. BJU International. 2015; 115(6):867–73. https://doi.org/10.1111/bju.12927 PMID: 25203925

106. Ito Y. Does frenotomy improve breast-feeding difficulties in infants with ankyloglossia?: Frenotomy in infants with ankyloglossia. Pediatrics International. 2014; 56(4):497–505. https://doi.org/10.1111/ped.12429 PMID: 24978831

107. Jia W-Q, Tian J-H, Yang K-H, Ma B, Liu Y-L, Zhang P, et al. Open versus Laparoscopic Pyloromyotomy for Pyloric Stenosis: A Meta-analysis of Randomized Controlled Trials. European Journal of Pediatric Surgery. 2011; 21(2):77–81. https://doi.org/10.1055/s-0030-1261926 PMID: 20957601

108. Kapralik J, Wayne C, Chan E, Nasr A. Surgical versus conservative management of congenital pulmonary airway malformation in children: A systematic review and meta-analysis. Journal of Pediatric Surgery. 2016; 51(3):508–12. https://doi.org/10.1016/j.jpedsurg.2015.11.022 PMID: 26775193

109. Kunz SN, Tieder JS, Whitlock K, Jackson JC, Avansino JR. Primary fascial closure versus staged closure with silo in patients with gastroschisis: A meta-analysis. Journal of Pediatric Surgery. 2013; 48(4):845–57. https://doi.org/10.1016/j.jpedsurg.2013.01.020 PMID: 23583145

110. Landisch R, Abdel-Hafeez A- H, Massoumi R, Christensen M, Shillingford A, Wagner AJ. Observation versus prophylactic Ladd procedure for asymptomatic intestinal rotational abnormalities in heterotaxy syndrome: A systematic review. Journal of Pediatric Surgery. 2015; 50(11):1971–4. https://doi.org/10.1016/j.jpedsurg.2015.08.002 PMID: 26358665

111. Lane V, Vajda P, Subramaniam R. Paediatric sutureless circumcision: a systematic literature review. Pediatric Surgery International. 2010; 26(2):141–4. https://doi.org/10.1007/s00383-009-2475-y PMID: 19707772

112. Lansdale N, Alam S, Losty PD, Jesudason EC. Neonatal endosurgical congenital diaphragmatic hernia repair: a systematic review and meta-analysis. Annals of surgery. 2010; 252(1):20–26. https://doi.org/10.1097/SLA.0b013e3181dca0e8 PMID: 20505506

113. Lee SL, Islam S, Cassidy LD, Abdullah F, Arca MJ. Antibiotics and appendicitis in the pediatric population: an American Pediatric Surgical Association Outcomes and Clinical Trials Committee Systematic Review. Journal of Pediatric Surgery. 2010; 45(11):2181–5. https://doi.org/10.1016/j.jpedsurg.2010.06.038 PMID: 21034941

114. LeeVan E, Zmora O, Cazzulino F, Burke RV, Zagory J, Upperman JS. Management of pediatric blunt renal trauma: A systematic review. Journal of Trauma and Acute Care Surgery. 2016; 80(3):519–28. https://doi.org/10.1097/TA.0000000000000950 PMID: 26713980

115. Liang Z, Guo J, Zhang H, Yang C, Pu J, Mei H, et al. Lymphatic sparing versus lymphatic non-sparing laparoscopic varicocelectomy in children and adolescents: a systematic review and meta-analysis. Eur J Pediatr Surg. 2011; 21(3):147–53. https://doi.org/10.1055/s-0031-1271733 PMID: 21351044

116. Lishuang M, Zhen C, Guoliang Q, Zhen Z, Chen W, Long L, et al. Laparoscopic portoenterostomy versus open portoenterostomy for the treatment of biliary atresia: a systematic review and meta-analysis

of comparative studies. Pediatric Surgery International. 2015; 31(3):261–9. https://doi.org/10.1007/s00383-015-3662-7 PMID: 25627699

117. Livingston MH, Shawyer AC, Rosenbaum PL, Jones SA, Walton JM. Fundoplication and gastrostomy versus percutaneous gastrojejunostomy for gastroesophageal reflux in children with neurologic impairment: A systematic review and meta-analysis. Journal of Pediatric Surgery. 2015; 50(5):707–14. https://doi.org/10.1016/j.jpedsurg.2015.02.020 PMID: 25783384

118. Mauritz FA, Blomberg BA, Stellato RK, van der Zee DC, Siersema PD, van Herwaarden-Lindeboom MYA. Complete Versus Partial Fundoplication in Children with Gastroesophageal Reflux Disease: Results of a Systematic Review and Meta-analysis. Journal of Gastrointestinal Surgery. 2013; 17(10):1883–92. https://doi.org/10.1007/s11605-013-2305-3 PMID: 23943388

119. Mauritz FA, van Herwaarden-Lindeboom MYA, Stomp W, Zwaveling S, Fischer K, Houwen RHJ, et al. The Effects and Efficacy of Antireflux Surgery in Children with Gastroesophageal Reflux Disease: A Systematic Review. Journal of Gastrointestinal Surgery. 2011; 15(10):1872–8. https://doi.org/10.1007/s11605-011-1644-1 PMID: 21800225

120. Mei H, Pu J, Yang C, Zhang H, Zheng L, Tong Q. Laparoscopic versus open pyeloplasty for ureteropelvic junction obstruction in children: a systematic review and meta-analysis. J Endourol. 2011; 25(5):727–36. https://doi.org/10.1089/end.2010.0544 PMID: 21476861

121. Mullassery D, Farrelly P, Losty PD. Does aggressive surgical resection improve survival in advanced stage 3 and 4 neuroblastoma? A systematic review and meta-analysis. Pediatr Hematol Oncol. 2014; 31(8):703–16. https://doi.org/10.3109/08880018.2014.947009 PMID: 25247398

122. Nagler EV, Williams G, Hodson EM, Craig JC. Interventions for primary vesicoureteric reflux. The Cochrane Library [Internet]. 2011 [cited 2016 Jul 5]

123. Narayanan SK, Chen Y, Narasimhan KL, Cohen RC. Hepaticoduodenostomy versus hepaticojejunostomy after resection of choledochal cyst: A systematic review and meta-analysis. Journal of Pediatric Surgery. 2013; 48(11):2336–42. https://doi.org/10.1016/j.jpedsurg.2013.07.020 PMID: 24210209

124. Nasr A, Fecteau A, Wales PW. Comparison of the Nuss and the Ravitch procedure for pectus excavatum repair: a meta-analysis. Journal of Pediatric Surgery. 2010; 45(5):880–6. https://doi.org/10.1016/j.jpedsurg.2010.02.012 PMID: 20438918

125. Nasr A, Langer JC. Mechanical traction techniques for long-gap esophageal atresia: a critical appraisal. Eur J Pediatr Surg. 2013; 23(3):191–7. https://doi.org/10.1055/s-0033-1347916 PMID: 23720210

126. Nataraja RM, Loukogeorgakis SP, Sherwood WJ, Clarke SA, Haddad MJ. The Incidence of Intraabdominal Abscess Formation Following Laparoscopic Appendicectomy in Children: A Systematic Review and Meta-analysis. Journal of Laparoendoscopic & Advanced Surgical Techniques. 2013; 23(9):795–802.

127. Nicolau AE. Is laparoscopy still needed in blunt abdominal trauma. Chirurgia. 2011; 106(1):59–66. PMID: 21520776

128. Oliveira DEG, da Cruz ML, Liguori R, Garrone G, Leslie B, Ottoni SL, et al. Neophalloplasty in boys with aphallia: A systematic review. Journal of Pediatric Urology. 2016; 12(1):19–24. https://doi.org/10.1016/j.jpurol.2015.10.003 PMID: 26778186

129. Oomen MWN, Hoekstra LT, Bakx R, Ubbink DT, Heij HA. Open Versus Laparoscopic Pyloromyotomy for Hypertrophic Pyloric Stenosis: A Systematic Review and Meta-Analysis Focusing on Major Complications. Surgical Endoscopy. 2012; 26(8):2104–10. https://doi.org/10.1007/s00464-012-2174-y PMID: 22350232

130. Parolini F, Armellini A, Boroni G, Bagolan P, Alberti D. The management of newborns with esophageal atresia and right aortic arch: A systematic review or still unsolved problem. Journal of Pediatric Surgery. 2016; 51(2):304–9. https://doi.org/10.1016/j.jpedsurg.2015.10.043 PMID: 26592954

131. Parolini F, Morandi A, Macchini F, Gentilino V, Zanini A, Leva E. Cervical/thoracotomic/thoracoscopic approaches for H-type congenital tracheo-esophageal fistula: A systematic review. International Journal of Pediatric Otorhinolaryngology. 2014; 78(7):985–9. https://doi.org/10.1016/j.ijporl.2014.04.011 PMID: 24856837

132. Peters RT, Goh YL, Veitch JM, Khalil BA, Morabito A. Morbidity and mortality in total esophagogastric dissociation: A systematic review. Journal of Pediatric Surgery. 2013; 48(4):707–12. https://doi.org/10.1016/j.jpedsurg.2012.11.049 PMID: 23583122

133. Peycelon M, Audry G, Irtan S. Minimally invasive surgery in childhood cancer: a challenging future. Eur J Pediatr Surg. 2014; 24(6):443–9. https://doi.org/10.1055/s-0034-1396419 PMID: 25478667

134. Pfistermuller KLM, McArdle AJ, Cuckow PM. Meta-analysis of complication rates of the tubularized incised plate (TIP) repair. Journal of Pediatric Urology. 2015; 11(2):54–9. https://doi.org/10.1016/j.jpurol.2014.12.006 PMID: 25819601

135. Puligandla PS, Grabowski J, Austin M, Hedrick H, Renaud E, Arnold M, et al. Management of congenital diaphragmatic hernia: A systematic review from the APSA outcomes and evidence based practice committee. Journal of Pediatric Surgery. 2015; 50(11):1958–70. https://doi.org/10.1016/j.jpedsurg.2015.09.010 PMID: 26463502

136. Reddy PP, Defoor WR. Ureteroscopy: The standard of care in the management of upper tract urolithiasis in children. Indian J Urol. 2010; 26(4):555–63. https://doi.org/10.4103/0970-1591.74459 PMID: 21369390

137. Romao RLP, Nasr A, Chiu PPL, Langer JC. What is the best prosthetic material for patch repair of congenital diaphragmatic hernia? Comparison and meta-analysis of porcine small intestinal submucosa and polytetrafluoroethylene. Journal of Pediatric Surgery. 2012; 47(8):1496–500. https://doi.org/10.1016/j.jpedsurg.2012.01.009 PMID: 22901906

138. Ross AR, Eaton S, Zani A, Ade-Ajayi N, Pierro A, Hall NJ. The role of preformed silos in the management of infants with gastroschisis: a systematic review and meta-analysis. Pediatric Surgery International. 2015 May; 31(5):473–83. https://doi.org/10.1007/s00383-015-3691-2 PMID: 25758783

139. Ruttenstock E, Puri P. Systematic review and meta-analysis of enterocolitis after one-stage transanal pull-through procedure for Hirschsprung's disease. Pediatric Surgery International. 2010; 26(11):1101–5. https://doi.org/10.1007/s00383-010-2695-1 PMID: 20711596

140. Rynja SP, de Jong TPVM, Bosch JLHR, de Kort LMO. Functional, cosmetic and psychosexual results in adult men who underwent hypospadias correction in childhood. Journal of Pediatric Urology. 2011; 7(5):504–15. https://doi.org/10.1016/j.jpurol.2011.02.008 PMID: 21429804

141. Saldaña LJ, Targarona EM. Single-Incision Pediatric Endosurgery: A Systematic Review. Journal of Laparoendoscopic & Advanced Surgical Techniques. 2013; 23(5):467–80.

142. Sauerland S, Jaschinski T, Neugebauer EA. Laparoscopic versus open surgery for suspected appendicitis. Cochrane Database Syst Rev. 2010;(10):CD001546. https://doi.org/10.1002/14651858.CD001546.pub3 PMID: 20927725

143. Scholfield DW, Ram AD. Laparoscopic Duhamel Procedure for Hirschsprung's Disease: Systematic Review and Meta-analysis. Journal of Laparoendoscopic & Advanced Surgical Techniques. 2016 Jan; 26(1):53–61.

144. Sharp N, St Peter S. Treatment of Idiopathic Achalasia in the Pediatric Population: A Systematic Review. European Journal of Pediatric Surgery. 2015; 26(2):143–9. https://doi.org/10.1055/s-0035-1544174 PMID: 25643252

145. Shawyer AC, D'Souza J, Pemberton J, Flageole H. The management of postoperative reflux in congenital esophageal atresia–tracheoesophageal fistula: a systematic review. Pediatric Surgery International. 2014; 30(10):987–96. https://doi.org/10.1007/s00383-014-3548-0 PMID: 25011995

146. Shawyer AC, Livingston MH, Cook DJ, Braga LH. Laparoscopic versus open repair of recto-bladderneck and recto-prostatic anorectal malformations: a systematic review and meta-analysis. Pediatric Surgery International. 2015; 31(1):17–30. https://doi.org/10.1007/s00383-014-3626-3 PMID: 25316437

147. Shen H-J, Xu M, Zhu H-Y, Yang C, Li F, Li K, et al. Laparoscopic versus open surgery in children with choledochal cysts: a meta-analysis. Pediatric Surgery International. 2015; 31(6):529–34. https://doi.org/10.1007/s00383-015-3705-0 PMID: 25895070

148. Siddiqui MRS, Abdulaal Y, Nisar A, Ali H, Hasan F. A meta-analysis of outcomes after open and laparoscopic Nissen's fundoplication for gastro-oesophageal reflux disease in children. Pediatric Surgery International. 2011; 27(4):359–66. https://doi.org/10.1007/s00383-010-2698-y PMID: 20734053

149. Siminas S, Losty PD. Current Surgical Management of Pediatric Idiopathic Constipation: A Systematic Review of Published Studies. Annals of Surgery. 2015; 262(6):925–33. https://doi.org/10.1097/SLA.0000000000001191 PMID: 25775070

150. Sklar CM, Chan E, Nasr A. Laparoscopic Versus Open Reduction of Intussusception in Children: A Retrospective Review and Meta-analysis. Journal of Laparoendoscopic & Advanced Surgical Techniques. 2014; 24(7):518–22.

151. Sola JE, Tepas JJ, Koniaris LG. Peritoneal Drainage versus Laparotomy for Necrotizing Enterocolitis and Intestinal Perforation: A Meta-Analysis. Journal of Surgical Research. 2010; 161(1):95–100. https://doi.org/10.1016/j.jss.2009.05.007 PMID: 19691973

152. Symeonidis EN, Nasioudis D, Economopoulos KP. Laparoendoscopic single-site surgery (LESS) for major urological procedures in the pediatric population: A systematic review. International Journal of Surgery. 2016; 29:53–61. https://doi.org/10.1016/j.ijsu.2016.03.040 PMID: 27000720

153. Tan Y-W, Khalil A, Kakade M, Carvalho JS, Bradley S, Cleeve S, et al. Screening and Treatment of Intestinal Rotational Abnormalities in Heterotaxy: A Systematic Review and Meta-Analysis. The Journal of Pediatrics. 2016; 171:153–162.e3. https://doi.org/10.1016/j.jpeds.2015.12.074 PMID: 26868865

154. Terui K, Nagata K, Ito M, Yamoto M, Shiraishi M, Taguchi T, et al. Surgical approaches for neonatal congenital diaphragmatic hernia: a systematic review and meta-analysis. Pediatric Surgery International. 2015; 31(10):891–7. https://doi.org/10.1007/s00383-015-3765-1 PMID: 26280741

155. Thomson D, Allin B, Long A-M, Bradnock T, Walker G, Knight M. Laparoscopic assistance for primary transanal pull-through in Hirschsprung's disease: a systematic review and meta-analysis. BMJ Open. 2015; 5(3):e006063. https://doi.org/10.1136/bmjopen-2014-006063 PMID: 25805527

156. Thyoka M, Timmis A, Mhango T, Roebuck DJ. Balloon dilatation of anastomotic strictures secondary to surgical repair of oesophageal atresia: a systematic review. Pediatric Radiology. 2013; 43(8):898–901. https://doi.org/10.1007/s00247-013-2693-2 PMID: 23877544

157. van Dalen EC, de Lijster MS, Leijssen LG, Michiels EM, Kremer LC, Caron HN, et al. Minimally invasive surgery versus open surgery for the treatment of solid abdominal and thoracic neoplasms in children. In: The Cochrane Collaboration, editor. Cochrane Database of Systematic Reviews [Internet]. Chichester, UK: John Wiley & Sons, Ltd; 2015 [cited 2016 Jul 5].

158. Vanden Berg RNW, Bierman EN, Noord MV, Rice HE, Routh JC. Nephron-sparing surgery for Wilms tumor: A systematic review. Urol Oncol. 2016; 34(1):24–32. https://doi.org/10.1016/j.urolonc.2015.07.003 PMID: 26254695

159. van den Hondel D, Sloots C, Meeussen C, Wijnen R. To split or not to split: colostomy complications for anorectal malformations or hirschsprung disease: a single center experience and a systematic review of the literature. Eur J Pediatr Surg. 2014; 24(1):61–9. https://doi.org/10.1055/s-0033-1351663 PMID: 23918670

160. Vernon-Roberts A, Sullivan PB. Fundoplication versus postoperative medication for gastro-oesophageal reflux in children with neurological impairment undergoing gastrostomy. In: The Cochrane Collaboration, editor. Cochrane Database of Systematic Reviews [Internet]. Chichester, UK: John Wiley & Sons, Ltd; 2013 [cited 2016 Jul 5].

161. Wang F, Xu Y, Zhong H. Systematic review and meta-analysis of studies comparing the perimeatal-based flap and tubularized incised-plate techniques for primary hypospadias repair. Pediatric Surgery International. 2013; 29(8):811–21. https://doi.org/10.1007/s00383-013-3335-3 PMID: 23793987

162. Wayne C, Chan E, Nasr A, Canadian Association of Paediatric Surgeons Evidence-Based Resource. What is the ideal surgical approach for intra-abdominal testes? A systematic review. Pediatr Surg Int. 2015; 31(4):327–38. https://doi.org/10.1007/s00383-015-3676-1 PMID: 25663531

163. Weih S, Kessler M, Fonouni H, Golriz M, Hafezi M, Mehrabi A, et al. Current practice and future perspectives in the treatment of short bowel syndrome in children—a systematic review. Langenbeck's Archives of Surgery. 2012; 397(7):1043–51. https://doi.org/10.1007/s00423-011-0874-8 PMID: 22105773

164. Wenk K, Sick B, Sasse T, Moehrlen U, Meuli M, Vuille-dit-Bille RN. Incidence of metachronous contralateral inguinal hernias in children following unilateral repair—A meta-analysis of prospective studies. Journal of Pediatric Surgery. 2015; 50(12):2147–54. https://doi.org/10.1016/j.jpedsurg.2015.08.056 PMID: 26455468

165. Wilkinson DJ, Farrelly P, Kenny SE. Outcomes in distal hypospadias: A systematic review of the Mathieu and tubularized incised plate repairs. Journal of Pediatric Urology. 2012; 8(3):307–12. https://doi.org/10.1016/j.jpurol.2010.11.008 PMID: 21159560

166. Wright I, Cole E, Farrokhyar F, Pemberton J, Lorenzo AJ, Braga LH. Effect of Preoperative Hormonal Stimulation on Postoperative Complication Rates After Proximal Hypospadias Repair: A Systematic Review. The Journal of Urology. 2013; 190(2):652–60. https://doi.org/10.1016/j.juro.2013.02.3234 PMID: 23597451

167. Yang C, Zhang H, Pu J, Mei H, Zheng L, Tong Q. Laparoscopic vs open herniorrhaphy in the management of pediatric inguinal hernia: a systemic review and meta-analysis. Journal of Pediatric Surgery. 2011; 46(9):1824–34. https://doi.org/10.1016/j.jpedsurg.2011.04.001 PMID: 21929997

168. Yang G, Wang X, Jiang W, Ma J, Zhao J, Liu W. Postoperative intussusceptions in children and infants: a systematic review. Pediatric Surgery International. 2013; 29(12):1273–9. https://doi.org/10.1007/s00383-013-3345-1 PMID: 23852556

169. Youssef F, Gorgy A, Arbash G, Puligandla PS, Baird RJ. Flap versus fascial closure for gastroschisis: a systematic review and meta-analysis. J Pediatr Surg. 2016; 51(5):718–25. https://doi.org/10.1016/j.jpedsurg.2016.02.010 PMID: 26970850

170. Zani A, Ade-Ajayi N, Cancelliere LA, Kemal KI, Patel S, Desai AP. Is single incision pediatric endoscopic surgery more painful than standard laparoscopy in children? Personal experience and review of the literature. Minerva Pediatr. 2015; 67(6):457–63. PMID: 25034218

171. Zhao L, Liao Z, Feng S, Wu P, Chen G. Single-incision versus conventional laparoscopic appendicectomy in children: a systematic review and meta-analysis. Pediatric Surgery International. 2015; 31(4):347–53. https://doi.org/10.1007/s00383-015-3680-5 PMID: 25667049

172. Zhu Y, Wu Y, Pu Q, Ma L, Liao H, Liu L. Minimally invasive surgery for congenital diaphragmatic hernia: a meta-analysis. Hernia. 2016; 20(2):297–302. https://doi.org/10.1007/s10029-015-1423-0 PMID: 26438082

173. Lip SZL, Murchison LED, Cullis PS, Govan L, Carachi R. A meta-analysis of the risk of boys with isolated cryptorchidism developing testicular cancer in later life. Arch Dis Child. 2013; 98(1):20–26. https://doi.org/10.1136/archdischild-2012-302051 PMID: 23193201

174. Ostlie DJ, Peter SDS. The current state of evidence-based pediatric surgery. Journal of Pediatric Surgery. 2010; 45(10):1940–6. https://doi.org/10.1016/j.jpedsurg.2010.05.008 PMID: 20920710

175. Schulz KF, Altman DG, Moher D. CONSORT 2010 Statement: Updated Guidelines for Reporting Parallel Group Randomised Trials. PLoS Med. 2010; 7(3).

176. Blakely ML, Kao LS, Tsao K, Huang EY, Tsai A, Tanaka S, et al. Adherence of Randomized Trials Within Children's Surgical Specialties Published During 2000 to 2009 to Standard Reporting Guidelines. Journal of the American College of Surgeons. 2013; 217(3).

177. Shawyer AC, Livingston MH, Manja V, Brouwers MC. The quality of guidelines in pediatric surgery: can we all AGREE? Pediatr Surg Intl. 2014; 31(1):61–8.

178. Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gøtzsche PC, Ioannidis JPA, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. British Medical Journal. 2009; 339:b2700. https://doi.org/10.1136/bmj.b2700 PMID: 19622552

179. Reveiz L, Cortés-Jofré M, Asenjo Lobos C, Nicita G, Ciapponi A, Garcìa-Dieguez M, et al. Influence of trial registration on reporting quality of randomized trials: Study from highest ranked journals. Journal of Clinical Epidemiology. 2010; 63(11):1216–1222. https://doi.org/10.1016/j.jclinepi.2010.01.013 PMID: 20430576

180. Braga LH, Pemberton J, Demaria J, Lorenzo AJ. Methodological Concerns and Quality Appraisal of Contemporary Systematic Reviews and Meta-Analyses in Pediatric Urology. Journal of Urology. 2011; 186(:266–72. https://doi.org/10.1016/j.juro.2011.03.044 PMID: 21600615

181. Salim A, Mullassery D, Losty PD. Quality of systematic reviews and meta-analyses studies published in paediatric surgery. Br J Surg. 2013; 100(S7):2.