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A systematic review of capacity assessment tools in pediatric surgery: Global Assessment in Pediatric Surgery (GAPS) Phase I

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ABSTRACT

Background: The Lancet Commission on Global Surgery highlighted global surgical need but offered little insight into the specific surgical challenges of children in low-resource settings. Efforts to strengthen the quality of global pediatric surgical care have resulted in a proliferation of partnerships between low-and middle-income countries (LMICs) and high-income countries (HICs). Standardized tools able to reliably measure gaps in delivery and quality of care are important aids for these partnerships. We undertook a systematic review (SR) of capacity assessment tools (CATs) focused on needs assessment in pediatric surgery.
Methods: A comprehensive search strategy of multiple electronic databases was conducted per PRISMA guidelines without linguistic or temporal restrictions. CATs were selected according to pre-defined inclusion criteria. Articles were assessed by two independent reviewers. Methodological quality of studies was appraised using the COSMIN checklist with 4-point scale.
Results: The search strategy generated 16,641 original publications, of which three CATs were deemed eligible. Eligible tools were either excessively detailed or oversimplified. None used weighted scores to identify finer granularity between institutions. No CATs comprehensively included measures of resources, outcomes, accessibility/impact and training.
Discussion: The results of this study identify the need for a CAT capable of objectively measuring key aspects of surgical capacity and performance in a weighted tool designed for pediatric surgical centers in LMICs.
Type of Study: Systematic Review.
Level of Evidence: II.

Contents

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Global health has traditionally focused on addressing individual communicable and non-communicable (i.e. heart disease, diabetes) diseases in low-and middle-income countries (LMICs), with limited emphasis on the organization and delivery of surgical and anesthesia care [1–4]. The Lancet Commission on Global Surgery together with several other publications, reports and declarations have emphasized the significance of surgical burden of disease within global health and the need to improve the delivery of surgical care [2–6]. However, these reports made little reference to the specific and pressing challenges facing children's surgery [1]. Considering that children comprise more than 50% of the population in the least developed regions of the world, we can infer that the avertable surgical burden in children in LMICs is colossal [1,7]. Thus, developing strategies to improve the quality of pediatric surgical and trauma care in low-resource settings can significantly decrease child morbidity and mortality and promote economic development [8].

Recent efforts to strengthen capacity of global surgical care of children have resulted in a proliferation of various partnerships models between LMICs and high-income countries (HICs) in almost all sub-specialties of children's surgery [9–16]. However, the quality of these partnerships is highly variable, and the goals are often unclear or unspecified [9,12]. In order to guide these partnerships in identifying priorities for capacity improvement, as well as assist in the monitoring of improvements, it is critical to develop standardized capacity assessment tools that can reliably measure existing gaps in care [9].

The objective of this systematic review was to identify and assess all pediatric surgery capacity assessment tools in the aim of identifying one tool best suited to address the needs of centers providing pediatric surgery in LMICs.

1. Methods

We conducted a systematic review (SR) of pediatric surgical capacity assessment tools to ensure that all pediatric literature was evaluated. This SR took place between July 19, 2016 and November 1, 2016. It followed the 'Preferred reporting items for systematic reviews and meta-analysis (PRISMA)' guidelines [17] and was prospectively registered in PROSPERO (CRD42016042069).

1.1. Search strategy

The search strategy (Appendix A) was created in collaboration with a clinical librarian (EG) and peer-reviewed by a second independent clinical librarian. The search included no language restrictions but was limited to the pediatric population and human only studies, from inception to June 13, 2016. The following databases were included: Medline (Ovid), Embase (Ovid), Cochrane (Wiley), Africa-Wide Information (Ebsco), Allied & Complementary Medicine (Ovid), Biosis (Ovid), CINAHL (Ebsco), Global Health (Ovid), Latin-American and Caribbean Center on Health Sciences Information, PubMed (NLM) and Web of Science (Thomson Reuters). The systematic literature search identified articles that included variations of the terms "pediatric surgery", combined with variations of measurement tools and global/international concepts, found as text-words in the Title/Abstract/Keyword fields as well in the Medical Subject Headings (MesH). See Appendix A for the detailed search strategy (Medline search was extrapolated to all other databases).

1.2. Inclusion criteria

Inclusion criteria were as follows: the tool must have self-identified as a surgical capacity assessment tool, the study must have reported on institutions with surgical capacities treating children up to 18 years of age, the tool must have been comprised of questionnaires or surveys, and the study must have included as one of its objectives the development of a measurement instrument, its evaluation, or its validation. Exclusion criteria included: diagnostic or screening instruments, prognostic studies (i.e. prediction models), instruments evaluating outcomes (i.e. complications, mortality, etc.), and comprehensive surgical capacity assessments not focused on pediatric surgery or trauma.

1.3. Critical appraisal

Two reviewers (YY, ESL), first independently assessed eligibility of studies based on titles and abstracts. A second round of review by YY and ESL analyzed the selected full-text articles and their respective reference lists for eligibility based on the inclusion criteria. Any disagreements between the reviewers regarding a study's inclusion were evaluated by a senior author (DP).

The methodological quality of the included studies was assessed using the COnsensus-based Standards for the selection of health Measurement INstruments (COSMIN) checklist with 4-point scale [18–21]. The COSMIN checklist is a critical appraisal tool for evaluating the methodological quality of studies of health measurement instruments. Assessment of the methodological quality was performed independently by two reviewers (YY, ESL), and consensus was achieved through discussion whenever required.

1.4. Data abstraction

Information was extracted from the included articles by two reviewers in an independent fashion using a formal data extraction tool (Appendix B). If available, the following data items were extracted from all studies selected for inclusion: general characteristics of the instruments (i.e. construct, sub-scales, number of items, version, etc.), characteristics of the institutions in which the measurement properties were assessed, and results of the measurement properties. Items not available were noted. Items were separated into four categories (resources, outcome, accessibility/impact, and training) in order to provide a comprehensive overview of the different types of questions included in each tool.

The data extracted was reviewed by a senior author. Discrepancies in data extraction were reviewed by all three reviewers together and changes were made based on a consensus between the majority (two) of the reviewers. Pilot data extraction of the first 30% of full texts included was performed to standardize the process of extraction.

2. Results

The search strategy of the systematic review identified 19,868 records. After removal of duplicates, 16,641 titles and/or abstracts were retained for eligibility, of which 15 full text articles were reviewed in detail. A total of 12 tools did not fit the inclusion criteria and were excluded; 10 studies were deemed to be prognostic tools or predication models and 2 tools were not specific to children. After final review, 3 capacity assessment tools were included in the systematic review (PRISMA Diagram: Fig. 1). The three tools are the Pediatric Surgery Personnel, Infrastructure, Procedures, Equipment, Supplies (Pedi-PIPES); the Children's Surgical Center Designations with Scope of Practice (CSCDSP); and the Checklist for a Children's Trauma Room (CCTR).

Table 1 provides a synopsis of the reference articles and capacity assessment tools included in this SR. Both Pedi-PIPES and CSCDSP's aims were to assess pediatric surgical capacity. The goal of the CCTR was to provide a list of equipment and supplies to prevent "disastrous" omission when stocking the trauma room. The number of items in each tool varied from 27 in the CSCDSP, 118 in Pedi-PIPES, to 165 in CCTR [22–24]. Unlike the other two tools, Pedi-PIPES focused exclusively on assessment of centers in LMICs [24]. All tools were available exclusively in English [22–24]. Funding for the development of Pedi-PIPES was provided by SurgeonOverSeas (SOSAS) and the Children's Hospital Association and the American College of Surgeons for CSCDSP [24]. There were no funding details available for the CCTR [22].

All tools were created by groups working in HICs; Pedi-PIPES also had a contribution from pediatric surgeons in LMICs and was first

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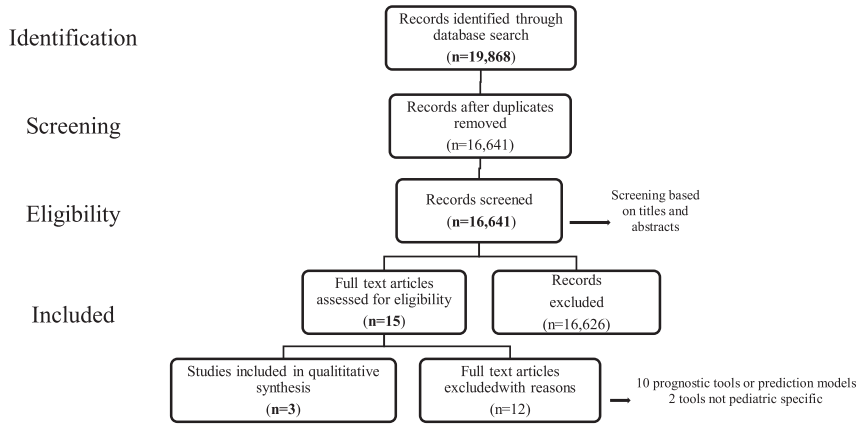

Fig. 1. PRISMA Diagram.

implemented in several West African countries (i.e. Nigeria, Niger, Benin, Togo, Ghana, Burkina Faso, Côte d'Ivoire, Liberia, Sierra Leone, Guinea, Gambia, and Senegal) [22–24].

All tools were previously based on capacity assessment tools aimed for adult surgical centers [22–24]. For example, the CCTR was based on a similar tool meant for adult trauma rooms at the Parkland Hospital Emergency Department in Dallas, Texas [22]. Pedi-PIPES is a modified version of the SOSAS PIPES [24]. The SOSAS PIPES tool itself was developed by SOSAS in an attempt to simplify the World Health Organization Tool for Situational Analysis to Assess Emergency and Essential Surgical Care (WHO TSA), and enable easy comparison between institutions and over time [25,26]. The SOSAS PIPES modifications were made based on consensus within a small group of pediatric surgeons (four American and five African pediatric surgeons) [24]. Though the Children's Hospital Association and the American College of Surgeons created the CSCDSP based on a literature review and expert consensus, the WHO TSA factored heavily in its development [23]. The method of creation of the CCTR was not detailed by the authors [22].

Neither the CSCDSP nor the CCTR included any index enabling longitudinal comparison between institutions [22,23]. Pedi-PIPES is divided into four sections (personnel, procedures, equipment and supplies) and has an associated score, calculated as follows [24]: points are allocated in each of the four sections and allotted to each data item equally, depending on whether or not the item is "always available" (1 point) or "not always available" (0 points), to yield a total score for each section [24]. The total scores for all sections are summed to yield a Total Pedi-PIPES score [24]. The PIPES-index is calculated by dividing the Total Pedi-PIPES score by the number of items (118) and then multiplied by 10 [24]. This index does not have a maximum score, and there is no score weighting [24].

Concerning the subjects addressed within each tool, all tools focused disproportionately on resources followed by accessibility [22–24]. Outcome of surgical procedures was only addressed by the CSCDSP [23]. No tool addressed training [22–24]. When comparing pediatric and neonatal specific components of the tools, neonatal items were substantially underrepresented with a maximum of 11% of items referring exclusively to neonates in the CSCDSP tool [22–24]. Moreover, only 17% of questions in Pedi-PIPES were pediatric specific. Further details are presented in Fig. 2. Advantages and limitations of each tool are detailed in Table 2.

To our knowledge, no tools have been interrogated for internal consistency, inter- and intra-rater reliability, or construct validity. All tools scored poorly on all aspects of the COSMIN Checklist with 4-point scale including: internal consistency, reliability, measurement error, structural validity, hypothesis testing, criterion validation, and responsiveness [22–24].

Table 1
Description of reference articles and capacity assessment tools.

	Reference article	Year of creation	Cited	Language of Tool	Funding	Aim of assessment tool	Classification of economy where tool was created	Based on previously published surgical capacity assessment tools		Method of creation	Weighted index
								Adults	Children		
Pedi-PIPES	Okoye, Mekam T., et al. "A pilot survey of pediatric surgical capacity in West Africa." *World journal of surgery* 39.3 (2015): 669–676 [22].	2015	6	English	Surgeon OverSeas	Assess capacity to provide Essential and Emergency Surgical Care to children in LMICs	LMIC	SOSAS PIPES (WHO Situational Analysis Tool)	-	Expert consensus panel editing the SOSAS PIPES tool for adults	No
Children's Surgical Center Designations with Scope of Practice	Oldham, Keith T. "Optimal Resources for Children's Surgical Care." *Journal of the American College of Surgeons* 220.5 (2015): 970–971 [20].	2013	16	English	Children's Hospital Association and the American College of Surgeons	To optimize the delivery of children's surgical care and develop consensus recommendations	HIC	WHO Situational Analysis Tool	-	Literature review and expert opinion	No
Checklist for a Children's Trauma Room	Morse, TS, JA Haller, and B. Othersen. "Checklist for a Children's Trauma Room." *Journal of Trauma-Injury Infection and Critical Care* 16.10 (1976): 763–765 [29].	1976	2	English	Unknown	Prevent disastrous omissions when the trauma room is being stocked	HIC	Parkland Hospital Emergency Department (Dallas)	-	Unknown	No

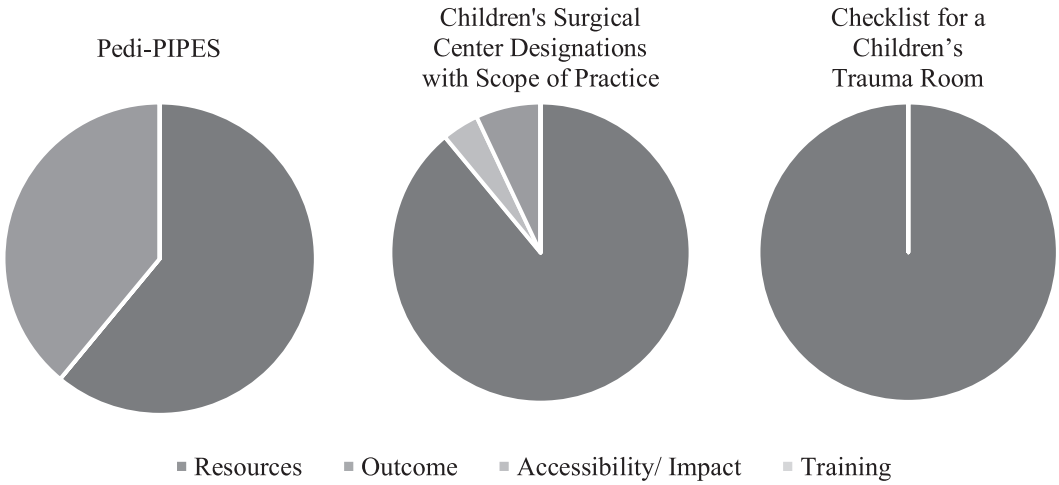

Fig. 2. Number data points in each CAT stratified by subject.

3. Discussion

This systematic review identified three capacity assessment tools aimed at evaluating surgical capacity in pediatric centers in both HICs and LMICs (Table 1). There have been no published attempts to date to validate these tools. Moreover, of the three tools only Pedi-PIPES has a quantitative component [24]. However, the Pedi-PIPES index is a non-weighted sum of the tool's data points based on a dichotomous evaluation of each item, thus missing any granularity between "available" and "not available" [24]. Neither the Pedi-PIPES tool, nor its index, have undergone formal validation [24]. All three tools are disproportionately focused on resource assessment with little reference to impact, accessibility, or outcome [22–24]. The selection of items in these tools were not based on patient outcomes and thus, no association can be drawn between these capacity assessment tools and improved surgical outcomes [22–24]. Furthermore, no tool has addressed training capacity, quality assurance measures (i.e. morbidity and mortality rounds, tumor board meetings, trauma meetings, etc.) or research endeavors [22–24]. Thus, existing pediatric capacity assessment tools all suffer from various shortcomings. Certain capacity assessment tools include an exhaustive list of all possible material resources while other tools include only the most basic resources carried by most primary health-care facilities (i.e. sutures, cautery). To avoid oversimplification or excessive detail data points need to be carefully selected to include a variety of resources covering both basic and complex care. At present, capacity assessment tools are ill-suited for the scope of pediatric surgical practice and poorly adapted to the limitations of LMICs.

Guidelines created by the American College of Surgeons, British Association of Pediatric Surgery, and the Global Initiative for Children's Surgery have identified resources for pediatric surgical care stratified by the level of care facility [27–29]. However, none of these guidelines provide a quantitative method of evaluating or comparing centers.

Table 2
Advantages and disadvantages of selected capacity assessment tools.

	Advantages	Limitations
Pedi-PIPES	Developed for LMICs Developed for children Developed by professionals in LMICs and HICs Implemented in several west African countries Includes an associated score Addressed resources and accessibility	Available only in English Based on tool for adults Developed using expert consensus only No weighted index for comparison Previously based on capacity assessment tools aimed for adult surgical centers Did not address training Inadequate emphasis on neonatal specific questions Not interrogated for internal consistency, inter- / intra-rater reliability, or construct validity
Children's Surgical Center Designations with Scope of Practice	Developed for children Based on literature review and expert consensus Concise Addressed resources, outcomes, and accessibility	Not developed for LMICs Available only in English Developed by professionals in HICs only No weighted index for comparison Previously based on capacity assessment tools aimed for adult surgical centers Did not address training Inadequate emphasis on neonatal specific questions Not interrogated for internal consistency, inter- / intra-rater reliability, or construct validity
Checklist for a Children's Trauma Room	Developed for children Addressed resources only	Not developed for LMICs Available only in English Developed by professionals in HICs only No weighted index for comparison Previously based on capacity assessment tools aimed for adult surgical centers Did not address training No emphasis on neonatal specific questions Not interrogated for internal consistency, inter- / intra-rater reliability, or construct validity

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Current literature has focused on the descriptive assessment of surgical capacity in different LMICs [7]. However, literature aimed at developing methods to improve this capacity is lacking, even though investing in surgical care for children is highly cost-effective in several cases and provides societal benefits [30]. The past 10 years have seen an exponential increase in attempts to quantify, analyze, and scale up surgical capacity in LMICs for the general population [1,3,9,31–35]. This is evidenced by the number of tools and guidelines detailing necessary resources for optimal surgical care across pediatric and adult populations. To evaluate recent efforts in determining global surgical capacity, assessment tools in use and potential areas of study, two SRs have been published to examine the different types of adult surgical CATs and their development [36,37].

WHO TSA was the first capacity and quality assessment tool with the aim of identifying and comparing lacunae in surgical capacity [26]. Developed in 2007 by the WHO Global Initiative for Emergency and Essential Surgical Care, the WHO TSA is composed of 256 data items based mostly on resources [25,26,38]. Kwon et al. developed a method to calculate an index based on the WHO TSA tool, however, reliability of the quantitative analysis was poor due to high response variability [25,26,37,39]. The goal of SOSAS PIPES was to create a surgical CAT, simpler than the TSA, with a quantitative analytic dimension allowing comparison between institutions as well as within the same institution over time [25]. SOSAS PIPES, the Lancet Commission on Global Surgery Humanitarian Assessment Tool, and the Harvard Humanitarian Initiative are all tools, based on the WHO TSA, used to qualitatively assess surgical capacity in LMIC [1,32,37,40–48]. Combined, these tools have been used to assess surgical capacity in over 30 countries [37]. However, none of these tools have been used to evaluate evolution of surgical capacity in an institution or success of capacity building initiatives.

The global burden of surgical disease is heavily skewed towards LMICs [1]. The burden of surgical disease in children in LMICs is difficult to assess due to poor quality epidemiological data [7]. Most of our current assessments are derived from hospital data or national estimates based on under-powered populations [7]. Children below 17 years of age make up 35–48% of the population in LMICs, suggesting that the burden of surgical disease is very significant in this population [1,7,49–51]. Though existing data may not be validated, it is believed to severely underestimate the burden of surgical disease [1,3,7]. Due to this need, partnerships between institutions in HICs and LMICs have been developed to scale up the pediatric surgical workforce. However, there are no methods to adequately assess health systems and follow improvements made from partnerships [7,52].

Current tools are comprised of a checklist-style assessment of material and human resources as well as infrastructure but disregard other important issues such as, accessibility, impact, training and outcome (Table 2). Accessibility to surgical care in LMICs is a complex issue but must be accounted for in any tool aimed at detailing surgical capacity, yet only Pedi-PIPES substantially addresses the issue of accessibility [1,24]. Closely linked to accessibility is impact; referring to the effect the institution has on the population it serves (i.e. averted disability adjusted life years, catchment area, procedures performed, etc.). Education in LMICs has not been a focus of any optimal resource guidelines on children's surgery [22–24,27–29]. Resident involvement in surgical care has shown to decrease morbidity and mortality as well as serve as a valid method of increasing surgical capacity in LMICs [7,53–57]. The link between improved outcomes and the presence of postgraduate surgical programs supports the addition of training in guidelines and tools that hope to increase surgical capacity. Outcome is arguably the most important indicator of surgical quality. Unfortunately, outcome information of children's surgery in LMICs is not readily available due to poor epidemiological data and precarious record keeping practices [7]. At present no CATs reflects on or integrates outcomes of surgical care in children. Thus, there is a significant need for a tool that incorporates data points on resources, accessibility/impact, outcome and training, and features a quantitative analytical component capable of generating a weighted score for each variable.

This study serves as the basis for the development of the Global Assessment of Pediatric Surgery (GAPS), an objective, evidence-based CAT specifically designed for pediatric surgical centers in low- and middle-income countries (LMICs). Based on the findings of this systematic review, we will create an evidenced-based CAT that incorporates the advantages of the current tools while consciously addressing their limitations (Table 2). We plan to establish construct validity by proving that the items in GAPS successfully differentiates between level of care and will create a weighted tool based on outcomes. We hope the GAPS will serve as a feasible method for use assessment of health care facilities and in prioritizing and monitoring global surgical capacity development efforts.

4. Conclusion

As partnerships between LMIC and HIC surgical centers continue to multiply, there is a growing need to establish these partnerships on clearly defined and articulated goals, themselves based on the objectively determined needs of the LMIC partners. Thus, to maximize the impact and effectiveness of these partnerships a comprehensive tool is needed to identify the quality of provision of pediatric surgical care in host institutions, and identify potential deficiencies. This implementation step will be the aim next phase of our study, the development and validation of The Global Assessment of Pediatric Surgery (GAPS). GAPS, a validated outcomes-based pediatric surgical capacity tool will serve as an objective measure of needs, while simultaneously identifying gaps, providing the framework for increasing care capacity and monitoring improvements made through international partnerships.

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Appendix A. Medline Search Strategy

Medline [Ovid] (June 13, 2016)

Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) 1946 to Present

#	Searches	Results
1	exp Specialties, Surgical/	180,962
2	exp Surgical Procedures, Operative/	2,685,912
3	su.fs.	1,723,842
4	(surger* or surgic* or procedure* or operati*).tw,kf.	2,559,499
5	Surgery Department, Hospital/	4067
6	perioperative care/	10,168
7	preoperative period/	3623
8	exp Postoperative Complications/ or Postoperative Care/ or exp. Postoperative Period/	537,781
9	(preop* or pre-op* or presurg* or pre-surg* or perop* or periop* or peri-op* or perisurg* or peri-surg* or intraop* or intra-op* or postop* or postsurg* or (post adj2 op*)).tw,kf.	718,951
10	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9	4,687,635
11	exp pediatrics/ or exp. adolescent/ or exp. child/ or exp. infant/ or Adolescent Medicine/	3,136,125
12	(newborn* or new-born* or neonat* or neo-nat* or infan* or child* or adolesc* or paediatr* or pediatr* or baby* or babies* or toddler* or kid or kids or boy* or girl* or juvenile* or teen* or youth* or	2,056,805

(continued on next page)

(continued)

#	Searches	Results
	pubescen* or preadolesc* or prepubesc* or preteen or tween).tw,kf.	
13	(paediatr* or pediatr*).jw.	505,316
14	11 or 12 or 13	3,767,887
15	10 and 14	862,085
16	st.fs.	602,856
17	Data Collection/	86,097
18	Checklist/	3565
19	exp "surveys and questionnaires"/	788,223
20	exp Forecasting/	75,736
21	exp "Outcome and Process Assessment"/	846,604
22	"Quality of Health Care"/	62,182
23	limit 22 to yr. = "1968–1979"	6349
24	exp quality indicators, health care/	15,699
25	Quality Assurance, Health Care/	52,034
26	exp quality improvement/	11,410
27	exp health services research/	139,705
28	Health Services/	22,691
29	limit 28 to yr. = "1974–1979"	2628
30	Research/	192,971
31	limit 30 to yr. = "1966–1979"	16,970
32	Health Resources/	10,141
33	(qualit* adj2 (assurance* or improv* or indicator* or improv* or assess* or measure* or control*)).tw,kf.	193,487
34	16 or 17 or 18 or 19 or 20 or 21 or 23 or 24 or 25 or 26 or 27 or 29 or 31 or 32 or 33	2,401,134
35	15 and 34	165,512
36	(((data adj1 (collect* or aggregat*)) or aggregat* or (initiative* or standard* or measurement* or checklist* or check-list* or survey* or questionnair* or tool or tools or interview* or index or scale* or indicator*)) adj3 (surger* or surgic* or procedure* or operati* or preop* or pre-op* or presurg* or pre-surg* or perop* or periop* or peri-op* or perisurg* or peri-surg* or intraop* or intra-op* or postop* or postsurg* or (post adj2 op*))).ab.	77,135
37	(((data adj1 (collect* or aggregat*)) or (initiative* or standard* or measurement* or checklist* or check-list* or survey* or questionnair* or tool or tools or interview* or index or scale or indicator*)) and (surger* or surgic* or procedure* or operati* or preop* or pre-op* or presurg* or pre-surg* or perop* or periop* or peri-op* or perisurg* or peri-surg* or intraop* or intra-op* or postop* or postsurg* or (post adj2 op*))).ti,kf.	21,876
38	36 or 37	95,407
39	14 and 38	17,105
40	35 or 39	175,978
41	Global Health/	35,190
42	exp "united states dept. of health and human services"/	75,785
43	united states agency for international development/	55
44	exp world health organization/	29,797
45	international agencies/	7710
46	exp internationality/	145,152
47	exp societies, hospital/	4877
48	Hospitals/ or Societies/	82,699
49	limit 48 to yr. = "1966–1977"	8754
50	exp societies, medical/	63,467
51	Advisory Committees/	7959
52	(global* or international* or world* or humanitarian*).kf.	17,739
53	(global* or international* or world* or humanitarian* or agency or agencies or association* or society or societies or nation* or federation* or iNGO or NGO or organization* or task force* or committee* or academy or commission).ti. /freq = 2	44,456
54	(global* or international* or world* or humanitarian* or agency or agencies or association* or society or societies* or nation* or federation* or iNGO or NGO or organization* or task force* or committee* or academy or commission).ab. /freq = 5	73,051
55	((WHO or lancet or unicef) adj (commission or index or global* or survey* or situational or tool* or checklist* or check-list* or surg* or indicator* or safe*)).tw,kf.	1168
56	41 or 42 or 43 or 44 or 45 or 46 or 47 or 49 or 50 or 51 or 52 or 53 or 54 or 55	442,675
57	40 and 56	4526
58	Animals/ not (Animals/ and Humans/)	4,230,832
59	57 not 58	4521
60	remove duplicates from 59	4403

Please contact the author for the full Search strategy in all databases.

Appendix B. Data Extraction Sheet

1. Tool Name
2. Article Information
   - Author
   - Title
   - Journal
   - Year Published
   - DOI
3. Tool specifics
   - A. Language of tool
   - B. Funding agency of tool
   - C. Aim of assessment tool
   - D. Name of assessment tool
   - E. Country of assessment tool
   - F. Classification of economy where assessment tool was created/validated
   - G. Tool based on previously published surgical capacity assessment tool
     1. Original capacity assessment tool
4. Details of Tool
   - H. Number of items
     1. Resources
     2. Outcome
     3. Accessibility/Impact
     4. Training
   - B. Method of development
   - C. Score
     1. Calculation of score
   - D. Year of tool created
5. Consistency & Reliability
   - E. Cronbach's Alpha
   - F. Intraclass correlation coefficient
   - G. Percentage of missing items
   - H. Handling of missing items
   - I. Administered in how many different institutions
     1. Administered in how many secondary or primary centers
     2. Administered in how many tertiary centers
   - F. Administered in how many countries
   - G. Method with which pilot institutions were chosen
   - H. Instrument administered at least twice in the same institutions
   - I. Administrators independent
   - J. Time interval between administrations
   - K. Test conditions similar for both administrations
6. Validity
   - L. Reassessment of relevance of all items
   - M. Confirmation of face validity
   - N. Expertise of the people involved in formulation of tool
   - O. Criterion used or employed considered as a reasonable gold standard
7. Hypothesis Testing
   - P. Hypotheses regarding correlations formulated a priori
   - Q. Expected direction of correlations

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