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A Review of Children's Surgery in the National Health Plans of 124 countries: A Call for Inclusion into National Surgical, Obstetric, and Anesthesia Plans

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ABSTRACT

Objectives: This study aims to evaluate the priority given to surgical care for children within National Health Policies, Strategies, and Plans (NHPSPs).

Participants and setting: We reviewed the World Health Organization's (WHO) Country Planning Cycle Database for NHPSPs existing for 146 countries. Countries with NHPSPs in languages different from English, Spanish, or French were excluded. A total of 124 countries met the inclusion criteria.

Primary and secondary outcome measures: We searched for child-specific and surgery-specific terms in the NHPSP's missions, goals, and strategies using three analytic approaches: 1) count of the total number of mentions, 2) count of the number of policies with no mentions, and 3) count of the number of policies with five or more mentions. Outcomes were compared across WHO regional and World Bank income-level classifications.

Results: We found that the most frequently mentioned terms were "child*", "infant*", and "immuniz*". The most frequently mentioned surgery term was "surg*". Overall, 45% of NHPSPs discussed surgery and 7% discussed children's surgery. Child-specific terms were more frequently mentioned than procedure-specific terms. The majority (93%) of countries did not mention selected essential and cost-effective children's procedures. When stratified by WHO region, the African and the West Pacific regions most frequently discussed children's surgical care. When stratified by World Bank income level, low-income countries and lower-middle-income countries most frequently discussed pediatric surgery. However, in both stratifications, pediatric surgery only equated to less than 1% when compared to other terms.

Conclusion: The low prevalence of children's surgical search terms in NHPSPs indicates that children's surgical disease coverage in National Surgical, Obstetric, and Anesthesia Plans (NSOAPs) remains low. Increased awareness of children's surgical needs in national health plans is critical to improving children's health around the world and supporting universal health coverage for children.

Keywords: Pediatric Surgery, NSOAP, Universal Health Coverage

Strengths and limitations of the study

- This study uses national health plans as strong indicators to evaluate the level of priority given to pediatric surgical care in 124 countries.
- Our results highlight an important and drastically under-reported issue regarding the neglect of pediatric surgical disease in global health.
- National health plans were not available for 48 countries. Most of these countries belong to Europe and Americas regions and high-income and upper- middle income status.
- 27 national health plans in languages different from English, Spanish and French were not assessed. Most of these health plans belonged to European, and high-income and upper-middle income status.

INTRODUCTION

Worldwide an estimated 1.7 billion children and adolescents, predominantly from low- and middle-income countries (LMICs) lack access to safe, affordable, and timely surgical and anesthesia care.[1] Although surgery has gained increased awareness in the global health agenda in recent years,[2-4] surgery for children has received less attention. The burden of surgical disease among children in LMICs is high, with 15-20% of children in LMICs having surgically amenable conditions.[5-11] In addition, the consequences of untreated surgical conditions for children include life-long disabilities and social stigmatization.[5 9 12-25] National investments in surgical care for children are needed to improve the health of children in line with the goals of universal health coverage (UHC). [6 7 19 21 26] National Health Policies, Strategies and Plans (NHPSPs) are country-level frameworks to design and operate complex health systems, and are critical to align national strategies, policies, and goals for population health.[27] NHPSPs bring together stakeholders from across national and sub-national levels to develop a health system in line with national political, socio-economic, and historic complexities. NHPSPs are developed through cooperation with the World Health Organization (WHO) and facilitate definition and support of national priorities.[28] In addition, NHPSPs are vital to moving towards UHC, strengthening health systems, and improving effectiveness of international aid.[29]

Designing country-level plans within a NHPSP framework is recommended to each WHO Member State.[30] Of the 194 Member States, 155 countries have updated a NHPSP in the last 5 years, with 75% aimed at moving towards UHC.[27] NHPSPs is a strong measure of each country's priority to specific health conditions, and can help assess if surgical care is incorporated into national plans. A number of countries have recognized a lack of policy level strategy for improving surgical care. Eight countries have developed specific National Surgical, Obstetric, and Anesthesia Plans (NSOAPs) to address the gap in national strategic planning for improved access to surgical care.[31-33]

The Global Initiative for Children's Surgery (GICS) is a collaboration of over 150 providers from around the world committed to improving children's surgical care. GICS has developed guidelines in the Optimal Resources for Children's Surgery (OReCS) document to support the provision of care at every healthcare level based on infrastructure, service delivery, training, and research. [21 26 34 35] Utilizing the OReCS document in partnerships with international and national governing bodies may increase prioritization of children's surgical care in national health policies. Our study expands our understanding of prioritization of children's surgical care in national health policy and strategies. As

such, this study aimed to evaluate the level of priority given to surgical care for children within NHPSPs and provide recommendations on aligning these plans with the use of NSOAPs in LMICs.

METHODS

In the context of this manuscript, priority given to pediatric surgical care at a national level was defined as the inclusion of surgery-specific terms for children in the countries' NHPSPs. From 194 WHO Member States, 146 countries had NHPSPs available in the WHO's Country Planning Cycle Database.[36] All 146 NHPSPs were assessed for eligibility. Inclusion criteria included publication in English, Spanish, or French as these are part of the six WHO's official languages.[37] NHPSPs written in Russian and Arabic were not included due to a lack of resources to address these languages. No NHPSP was written in Chinese. Twenty-two NHPSPs were excluded because of being written in other languages. The vast majority of these NHPSPs were written in languages not included as part of the six WHO's official languages. In total, 124 NHPSPs were included in this review (**Figure 1, Supplemental material 1**).

From September to October 2019, five investigators searched each country's NHPSPs mission, vision, goals, or strategies using 17 search terms related to child health and surgery-specific issues (Table 1). The terms selected terms were translated into Spanish by one of the coauthors who is a native speaker. The terms in French were established by the investigators and were validated by a native speaker health professional with expertise in global surgery (LMK) outside of the group of coauthors. The variations of the terms included for Spanish and French not always had an exact equivalent in English. **Supplemental material 2** includes a complete list of terms in the three languages assessed in this study.

Each NHPSP PDF file was searched using the search function for each term and subsequently counted by frequency. Search terms were selected based on a review of existing surgical and child health literature and international and national health policy reports. Specifically, search terms were chosen as common terms used in the current global surgery literature.[2 7 12] As well, we included the terms "circumcision", "open fracture fixation", and "inguinal hernia," as these are three most commonly performed and cost-effective children's surgical procedures.[21] We followed three different analytic approaches for each search term. First, we counted the total number of mentions of each search term. Second, we counted the number of policies that have no mention of any search term. Third, we counted the number of policies with 5 or more mentions for each search term. The

indicator of at least five mentions was established as a significant number following previous literature that evaluates the inclusion of surgery in African countries' health plans.[38] All data were stored in Microsoft Excel.

The NHPSPs were stratified according to the WHO regional divisions in the African region (AF), region of the Americas (AM), Eastern Mediterranean region (EM), South-East Asia region (SEA), European region (EU), and Western Pacific region (WP) to analyze geographic patterns countries. Likewise, the NHPSPs were stratified according to the World Bank's Fiscal Year 2019 income classification.[39] Descriptive statistics were performed in Microsoft Excel and used to analyze patterns in inclusion of search terms in NHPSPs among countries.

Ethical approval: This study does not involve human participants. Therefore, research approval was not applicable.

Patient and Public Involvement

It was not appropriate or possible to involve patients or the public in the design, or conduct, or reporting, or dissemination plans of our research.

RESULTS

From a total of 124 NHPSPs, the word roots "surg*" and "pediatric surgery" were mentioned at least once in 45% and 7% of NHPSPs, respectively (**Table 1)**. Only 11% of NHPSPs mentioned "surg*" more than five times and no NHPSP mentioned "pediatric surgery" more than five times. In comparison, over 50% of NHPSPs mentioned other common child-specific issues such as "immuniz*" (60% of NHPSPs), "infant" (39%), or "malnutrition" (54%). On average, "immuniz*" was 8 times more likely to mentioned than "pediatric surgery".

The term with the most mentions was "child*" with 2,142 mentions, followed by the terms "infant" and "immuniz*" with 285 (8%) and 280 (7%) mentions, respectively. Sixty-eight (55%) NHPSPs did not mention “surg*”. Terms mentioning specific procedures were the least likely to be mentioned including "circumcision" (7%), "open fracture fixation" (2%), and "inguinal hernia" (0%). Except from "inguinal hernia" (which had no mentions), from a regional perspective, these procedures were only mentioned in the West Pacific region, South East Asia region and African Region.

Table 1. Search terms in English, French, and Spanish with frequency of mentions and proportions of policies with no mentions, at least one mention and more than five mentions.

Search Terms English	Search Terms French	Search Terms Spanish	Total Mentions n (%) *3783 (100)*	Number of policies with **no** mentions of term n (%) *124 (100)*	Number of policies with **at least 1** mention of term n (%) *124 (100)*	Number of policies with **5 or more** mentions of term n (%) *124 (100)*
Surgery-specific						
surg*[a]	chirurgi*	cirug* / ciruj* /quirurgic*	269 (7.1)	68 (54.8)	56 (45.2)	14 (11.3)
injury	blessure*	lesion*	155 (4.1)	80 (64.5)	44 (35.5)	9 (7,3)
trauma	traumat*	trauma*	102 (2.7)	88 (71.0)	36 (29.0)	6 (5,8)
operation	operation / intervention	operacion*	75 (2.0)	90 (72.6)	18 (14.5)	5 (4.8)
operative	opératoire	operativo*	32 (0.8)	109 (87.9)	14 (11.3)	3 (2.4)
operating	opératoire / opérant	N/A	28 (0.7)	80 (64.5)	12 (9.7)	2 (1.6)
open fracture fixation	fixation de fracture ouverte / ostéosynthèse de fracture ouverte	fijacion de fractura abierta	3 (0.1)	121 (97.6)	3 (2.4)	0 (0.0)
inguinal hernia	hernie inguinale	hernia inguinal	0 (0.0)	124 (100.0)	0 (0.0)	0 (0.0)
pediatric surgery	chirurgie pédiatrique	cirujía pediátrica	9 (0.2)[f]	115 (92.7)	9 (7.3)	0 (0.0)
Children-specific						
child*[b]	enfant* / naissance	niñ*	2142 (56.6)	16 (12.9)	108 (87.1)	85 (68.5)
immuniz*[c]	immunis* / vaccin*	vacuna* inmuniz*	280 (7.4)	50 (40.3)	74 (59.7)	19 (15.3)
infant	bébé / infant*	infant*	285 (7.5)	48 (38.7)	76 (61.3)	21 (16.9)
malnutrition	malnutrition	desnutricion	242 (6.4)	67 (54.0)	57 (46.0)	17 (13.7)
stunt*[d]	retard de croissance	retraso en el crecimiento	67 (1.8)	89 (71.8)	35 (28.2)	4 (3.2)
pedia*[e]	pédiatr*	pedia*	44 (1.2)	101 (81.5)	23 (18.5)	1 (0.8)
wasting	dépérissement	anemia	33 (0.9)	106 (85.5)	18 (14.5)	1 (0.8)
circumcision	circoncision / posthectomie	Circuncisión	17 (0.4)	115 (92.7)	9 (7.3)	0 (0.0)

For simplicity in the remaining text of this paper only English terms will be used to describe the statistics revealed by both English and French and Spanish search terms.
[a] *surg** includes surgery, surgeries, surgical, neurosurgery, and surgeon. [b] child* includes child, children, childbearing, childbirth, and childhood. [c] *immuniz** includes immunization, and immunized. [d] *stunt** includes stunting. [e] *pedia** includes pediatric and pediatrics. [f] Mentions of "pediatric surgery" were found in NHPSPs from Uganda, Democratic Republic of Congo, Congo, Chile, Tajikistan, Cambodia, China, Cook Islands, and Vietnam.

When stratified by region, the African region (63%) had the highest frequency of mentions for "surg*", which equates to 7% of the total mentions for this region (**Figure 2)**. Nine countries, including Congo, Uganda, Democratic Republic of Congo, Chile, Tajikistan, Cambodia, China, Cook Islands, and Vietnam mentioned "pediatric surgery" in their NHPSPs. The West Pacific region (44%) and the African region (33%) had the most frequent mentions of "pediatric surgery" and, when combined, make up to 77% of mentions for this search term. However, when compared to other terms, "pediatric surgery" only equates to 0.8% and 0.1% of total search term mentions in these regions, respectively. The Eastern Mediterranean region and the South East Asia region had no mentions of "pediatric surgery" in their NHPSPs (**Supplemental material 3**).

When stratified by income levels, LICs had the highest frequency of mentions for "surg*" (45%), which equates to 8% of the total mentions for this economic group (**Figure 3**). NHPSPs from LICs (33%) and LMICs (33%) concentrated the majority of mentions for "pediatric surgery" and combined make up to 66% of mentions for this term. However, when compared to other terms, "pediatric surgery" only equates to 0.2% and 0.3% of total search term mentions in these economic groups, respectively (**Supplemental material 3**).

DISCUSSION

Inclusion of children's surgical care coverage in NHPSPs and NSOAPs is improving the health of children and alignment of surgical care with UHC frameworks.[40-42] Our study provides evidence that the financing of surgical care for children and penetration of UHC policies for surgical coverage for children in NHPSPs is quite limited, with only 8% of national health plans addressing children's surgical needs specifically. Given that children's surgical care requires a unique set of workforce and infrastructure, this gap in inclusion of surgical needs for children is an opportunity to define children's surgical care as a part of national essential benefits packages.

Surgical care was more frequently discussed within NHPSPs in the Africa region in comparison to other regions. The European region NHPSPs had the lowest frequency of surgical-specific terms. This finding could reflect the number of countries, particularly in the WHO Africa region, that have created NSOAPs.[32] The Western Pacific region most frequently mentioned "pediatric surgery," despite a lack of NSOAPs in that region. As well, the Western Pacific region used language including "operation" more frequently than other regions, a finding that could indicate a lack of international consensus on NSOAP language. The Western Pacific region has had a long-standing

collaborative partnership in surgical training and provision of specialist surgical services in the region with the Royal Australasian College of Surgeons. Over the first 15 years of the partnership, operations done by trainees increased from 10% to 77% and nurse anesthetists were trained and deployed in each hospital.[43] In addition, collaborations between nations has recently resulted in 13 of the 14 countries collectively measuring the first four Lancet Commission global surgery indicators.[44] This type of collaborative partnerships could serve as key examples of integrating surgical care on national levels.

When stratified by income level, LICs were most likely to mention surgery specific search terms in addition to children-specific search terms compared to HICs, a finding consistent with the increasing number of LICs that are developing NSOAPs. Overall, however, the low frequency of children-specific surgical procedures could be reflective of a lack of global consensus on defining essential surgical procedures for children. This finding suggests an opportunity to define surgical procedures for children such that future NHPSPs and NSOAPs can target prevalent surgical conditions and cost-effective care to improve the health of children in national UHC goals. This has partially been done with the latest edition of the *Disease Control Priorities 3*, mainly for congenital conditions.[40]

Although surgical conditions are high burden for children in many LMICs, a list of cost-effective, essential surgical procedures for children needs to be defined if children's surgical procedures are to be included in NHPSPs and NSOAPs. Although this list has not been defined for children's surgery, the OReCS document outlines a multi-faceted strategy for integrating procedure-specific surgical care for children into NSOAPs. The document is designed in the form of a template to guide planning at all healthcare levels to provide safe and high-quality surgical care for children. The utility of the OReCS document in conjunction with national child health policy plans, NHPSPs, and NSOAPs could serve as a starting point for integrating child-specific surgical care into existing or developing plans.

Nigeria can serve as an example of successfully integrating the OReCS document with NSOAPS and NHPSPs through the lens of UHC (**Figure 4**). Nigeria's robust development of a national surgical plan is integrated into the national health plan and specifically includes the provision and strengthening of children and adolescents surgical care within the existing healthcare systems. This model highlights the utility of using national plans that can address multiple sectors of surgical delivery in a coordinated manner. Due to the subspecialized nature of children's surgical care, organized referral systems, specialized centers, and specialized workforce are required simultaneously for optimal outcomes.

The OReCS document serves as a specific guide to scale-up surgical care in an organized manner by addressing all levels of healthcare in the country including referral systems and workforce expansion. Going forward, the success of Nigeria's integration of children's surgical care within national health plans can serve as a template for other countries to follow.

Surgically amenable conditions will increasingly impact children around the world, as over a quarter of the global population is under fifteen years of age and approximately 50% of the population in LICs are under the age of 15.[41 42] Inclusion of children's surgical policies in NHPSPs and WHO regional health plans is critical to meeting the United Nation's Strategic Development Goals (SDG)-3 goals of achieving 80% coverage of essential healthcare services while protecting 100% of patients from impoverishing and catastrophic health expenditures.[45]

Limitations

Our study limitations include being unable to locate NHPSPs for all countries on the WHO Country Planning Cycle Database. Of the 48 countries not included, 73% were from HICs or UMICs which may have biased the results as HICs and UMICs were less likely to report surgical-specific and child-specific search terms than LICs or LMICs. Additionally, our study excluded 22 NHPSPs written in languages other than English, Spanish, and French. Of the 22 studies, 91% were from HICs or UMICs. We also used limited search terms to assess inclusion of children's surgery in the NHPSP reviews, potentially underestimating the number of plans with surgical care embedded. Although this occurrence may be small as we searched for the major terms of surg* and ped*, there is a possibility of missing key terms. Deeper analyses of NHPSPs through additional search terms and other qualitative approaches may provide a more robust and thorough search through the plans. Finally, NHPSPs represent only one part of UHC schemes. Further study on national budget and healthy policy literature and documents is important in defining the penetration of UHC schemes on surgical care provision for children at national health system levels.

Conclusion

We have an opportunity to incorporate children's surgical care as part of national health plans and impact children around the world. Inclusion of surgical care for children in national health policy frameworks is essential to reducing surgical disease morbidity and mortality in this population, and our study results in the following key policy recommendations for Member States:

1. Countries should use the Global Initiative for Children's Surgery's Optimal Resources for Children's Surgery (OReCS) guidelines to assess the current state of surgical care for children

across multiple health system perspectives and facilitate collaboration with a broad range of health policy and children's surgery stakeholders.

2. Individual countries should define an essential package of children's surgical care across all specialties based on country-level surgical needs for children using language consistent across Member States.
3. Inclusion of children's surgical needs in WHO NHPSPs and NSOAPs should be prioritized in order to address country-level surgical needs for children.

Autor contributorship:

Conceptualization: ERS, HR, KL, CCC, YL, JR, NT, RG; Methodology: ERS, HR, KL, CCC, YL, JR, NT, RG; Data collection: CCC, YL, JR, NT, RG; Formal analysis and investigation: CCC; Writing - original draft preparation: ERS, KL, CCC, YL; Writing - review and editing: ERS, KL, CCC, PT, EAA, SWB, LS, JM, HR; Supervision: ERS.

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Patient and Public Involvement

It was not appropriate or possible to involve patients or the public in the design, or conduct, or reporting, or dissemination plans of our research

Data sharing statement: All data for this study are available in a public, open access repository.

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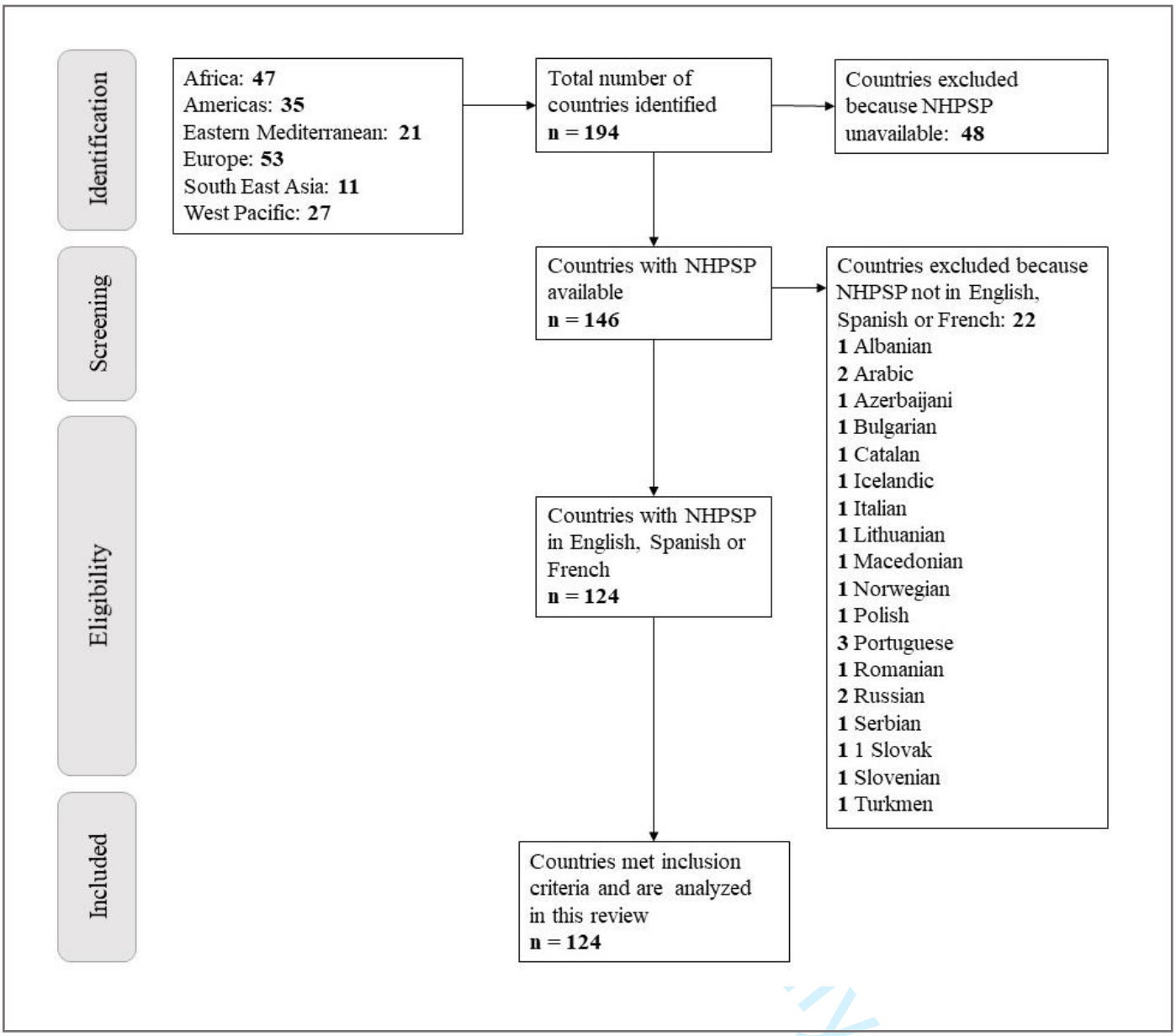
FIGURE LEGEND

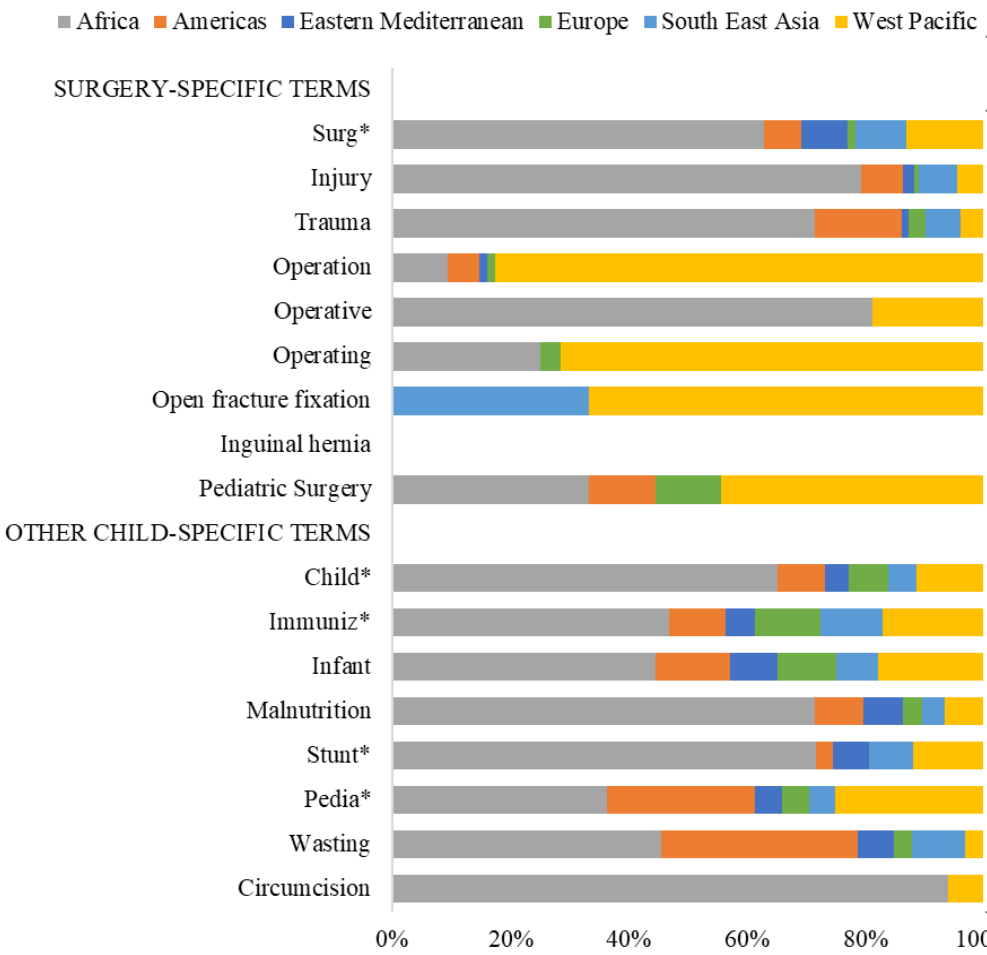
Figure 1. Flowchart of data search process.

Figure 2. Percentages of search terms in English, French, and Spanish stratified by WHO's region.

Figure 3. Percentages of search terms in English, French, and Spanish stratified by World Bank's income classification level.

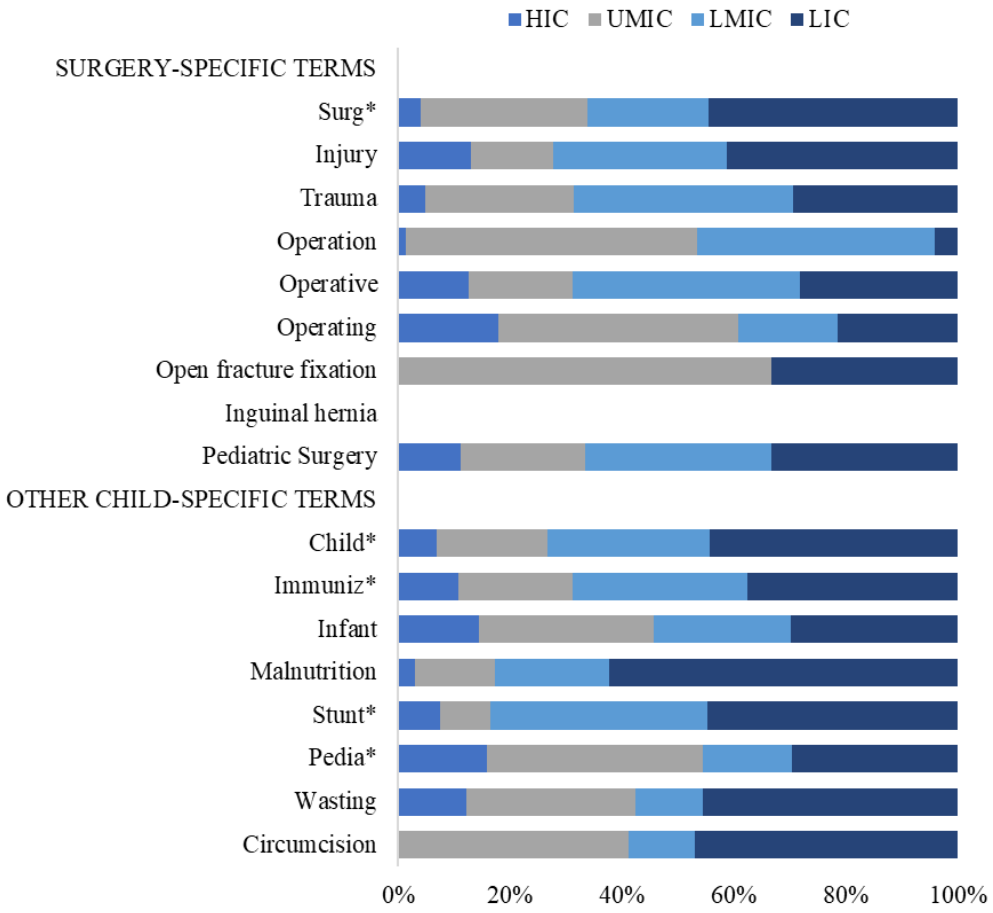
Figure 4. Example of Nigeria: Inclusion of children's surgical care within national health plans.


Identification
Screening
Eligibility
Included
Africa: 47
Americas: 35
Eastern Mediterranean: 21
Europe: 53
South East Asia: 11
West Pacific: 27
Total number of countries identified
n = 194
Countries excluded because NHPSP unavailable: 48
Countries with NHPSP available
n = 146
Countries excluded because NHPSP not in English, Spanish or French: 22
1 Albanian
2 Arabic
1 Azerbaijani
1 Bulgarian
1 Catalan
1 Icelandic
1 Italian
1 Lithuanian
1 Macedonian
1 Norwegian
1 Polish
3 Portuguese
1 Romanian
2 Russian
1 Serbian
1 1 Slovak
1 Slovenian
1 Turkmen
Countries with NHPSP in English, Spanish or French
n = 124
Countries met inclusion criteria and are analyzed in this review
n = 124



	AF %	AM %	EM %	EU %	SEA %	WP %
SURGERY-SPECIFIC TERMS						
Surg*	63	6	8	1	9	13
Injury	79	7	2	1	6	5
Trauma	72	15	1	3	6	4
Operation	9	5	1	1	0	83
Operative	81	0	0	0	0	19
Operating	25	0	0	4	0	71
Open fracture fixation	0	0	0	0	33	67
Inguinal hernia	0	0	0	0	0	0
Pediatric Surgery	33	11	0	11	0	44
OTHER CHILD-SPECIFIC TERMS						
Child*	65	8	4	7	5	11
Immuniz*	47	10	5	11	10	17
Infant	45	13	8	10	7	18
Malnutrition	71	8	7	3	4	7
Stunt*	72	3	6	0	7	12
Pedia*	36	25	5	5	5	25
Wasting	45	33	6	3	9	3
Circumcision	94	0	0	0	0	6

For simplicity, only the English terms are used to describe the aggregated statistics of English, Spanish, and French search terms.
[a] *surg** includes surgery, surgeries, surgical, neurosurgery, and surgeon. [b] child* includes child, children, childbearing, childbirth, and childhood. [c] *immuniz** includes immunization, and immunized. [d] *stunt** includes stunting. [e] *pedia** includes pediatric and pediatrics.



	HIC %	UMIC %	LMIC %	LIC %
Surg*	4	30	22	45
Injury	13	15	31	41
Trauma	5	26	39	29
Operation	1	52	43	4
Operative	13	19	41	28
Operating	18	43	18	21
Open fracture fixation	0	67	0	33
Inguinal hernia	0	0	0	0
Pediatric Surgery	11	22	33	33
Child*	7	20	29	44
Immuniz*	11	20	31	38
Infant	14	31	25	30
Malnutrition	3	14	20	62
Stunt*	7	9	39	45
Pedia*	16	39	16	30
Wasting	12	30	12	45
Circumcision	0	41	12	47

HIC=High Income Countries, UMIC=Upper-Middle-Income Countries, LMIC=Lower-Middle-Income Countries, LIC=Low Income Countries.

For simplicity, only the English terms are used to describe the aggregated statistics of English, Spanish, and French search terms.
[a] *surg** includes surgery, surgeries, surgical, neurosurgery, and surgeon. [b] child* includes child, children, childbearing, childbirth, and childhood.
[c] *immuniz** includes immunization, and immunized. [d] *stunt** includes stunting. [e] *pedia** includes pediatric and pediatrics.

Recommendations include:

INFRASTRUCTURE

Creation of one federal children's hospital.

Availability of a package of essential children's surgery at all healthcare levels, including the provision of specialized equipment and supplies.

WORKFORCE

Provision of specialized human resources for children's surgery.

SERVICE DELIVERY

Integrate and create efficient referral system for children's surgery.

Increase capacity of tertiary levels of care for advanced surgical care for children.

Availability of critical care and pre-hospital services.

Supplemental material 1: Country health plans stratified by WHO's region and World Bank's income classification level.

	Total	Excluded because NHPSP unavailable	Excluded because not in English, Spanish, or French	Total available for search
	n (%)	n (%)	n (%)	n (%)
	194 (100.0)	*48 (100.0)*	*22 (100.0)*	*124 (100.0)*
WHO region				
Africa	47 (24.2)	7 (14.6)	2 (9.1)	38 (30.6)
Americas	35 (18.0)	10 (20.8)	1 (4.5)	24 (19.4)
Eastern Mediterranean	21 (10.8)	7 (15.6)	2 (9.1)	12 (9.7)
Europe	53 (27.3)	17 (35.4)	17 (77.3)	19 (15.3)
South East Asia	11 (5.7)	3 (6.3)	0 (0.0)	8 (6.5)
West Pacific	27 (13.9)	4 (8.3)	0 (0.0)	23 (18.5)
World Bank Income Classification Level				
HIC	56 (28.9)	25 (52.1)	9 (40.9)	22 (17.7)
UMIC	61 (31.4)	10 (20.8)	11 (50.0)	40 (32.2)
LMIC	44 (22.7)	7 (14.6)	2 (9.1)	35 (28.5)
LIC	33 (17.0)	6 (12.5)	0 (0.0)	27 (21.8)

HIC=High Income Countries, UMIC=Upper-Middle-Income Countries, LMIC=Lower-Middle-Income Countries, LIC=Low Income Countries.

Supplemental material 2: Complete list of search terms and associated variations found in NHPSPs, stratified by language English, French, and Spanish.

ENGLISH		FRENCH		SPANISH	
Search Terms	**Variations found**	**Search Terms**	**Variations found**	**Search Terms**	**Variations found**
Surgery-specific					
surg*	surgery, surgeries, surgical, neurosurgery, and surgeon	chirurgi*	chirurgie, chirurgien, chirurgicale, chirurgicaux, chirurgiens, neurochirurgien, médicochirurgicaux, chirurgical	cirug* / ciruj*/ quirurgic*	cirugía, cirujano, cirujanos, quirúrgico
injury		blessure*	blessure, blessures	lesion*	lesión, lesiones
trauma		traumat*	traumatismes, traumatique, traumatology	trauma*	trauma, traumatismo
operation		operation / intervention		operacion*	operación, operaciones
operative		opératoire		operativo*	operativo, operativos
operating		opératoire / opérant		N/A	
open fracture fixation		fixation de fracture ouverte / ostéosynthèse de fracture ouverte		fijación de fractura abierta	
inguinal hernia		hernie inguinale		hernia inguinal	
pediatric surgery		chirurgie pédiatrique		cirugía pediátrica	
Children-specific					
child*	child, children, childbearing, childbirth, childhood	enfant* / naissance	enfant, enfants, enfance,	niñ*	niño,niños, niña, niñas, niñez
immuniz*	immunization, immunized	immunis* / vaccin*	Immunisation, vacciné	vacuna* inmuniz*	vacuna, vacunación, vacunaciones, inmunización, inmunizaciones
infant		bébé / infant*	infantile	infant*	infante, infantes, infantil
malnutrition		malnutrition		desnutrición	
stunt*	stunting	retard de croissance		retraso en el crecimiento	
pedia*	pediatric, pediatrics	pédiatr*	pédiatrique, pédiatriques, pédiatres, pédiatrie,	pedia*	pediátrico, pediatría, pediátrica, pediatras,
wasting		dépérissement		anemia	
circumcision		circoncision / posthectomie		circuncisión	

Supplemental material 3: Search Terms in English, French, and Spanish with number of citations stratified by WHO regions and World Bank income classification level.

	WHO Region						World Bank Income Classification Level				TOTAL
	AF n (%) *2330 (100.0)*	AM n (%) *325 (100.0)*	EM n (%) *175 (100.0)*	EU n (%) *224 (100.0)*	SEA n (%) *209 (100.0)*	WP n (%) *520 (100.0)*	HIC n (%) *286 (100.0)*	UMIC n (%) *838 (100.0)*	LMIC n (%) *1065 (100.0)*	LIC n (%) *1594 (100.0)*	n (%) *3783 (100.0)*
Surgery-specific											
Surg*	169 (7.3)	17 (5.2)	21 (12.0)	4 (1.8)	23 (11.0)	35 (6.7)	11 (3.8)	80 (9.5)	58 (5.4)	120 (7.5)	269 (7.1)
Injury	123 (5.3)	11 (3.4)	3 (1.7)	1 (0.4)	10 (4.8)	7 (1.3)	20 (7.0)	23 (2.7)	48 (4.5)	64 (4.0)	155 (4.1)
Trauma	73 (3.1)	15 (4.6)	1 (0.6)	3 (1.3)	6 (2.9)	4 (0.8)	5 (1.7)	27 (3.2)	40 (3.8)	30 (1.9)	102 (2.7)
Operation	7 (0.3)	4 (1.2)	1 (0.6)	1 (0.4)	0 (0.0)	62 (11.9)	1 (0.3)	39 (4.7)	32 (3.0)	3 (0.2)	75 (2.0)
Operative	26 (1.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	6 (1.2)	4 (1.4)	6 (0.7)	13 (1.2)	9 (0.6)	32 (0.8)
Operating	7 (0.3)	0 (0.0)	0 (0.0)	1 (0.4)	0 (0.0)	20 (3.8)	5 (1.7)	12 (1.4)	5 (0.5)	6 (0.4)	28 (0.7)
Open Frac. Fix.	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.5)	2 (0.4)	0 (0.0)	2 (0.2)	0 (0.0)	1 (0.1)	3 (0.1)
Inguinal Hernia	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
'Pediatric Surgery'	3 (0.1)	1 (0.3)	0 (0.0)	1 (0.4)	0 (0.0)	4 (0.8)	1 (0.3)	2 (0.2)	3 (0.3)	3 (0.2)	9 (0.2)
Children-specific											
Child*	1396 (59.9)	170 (52.3)	88 (50.3)	143 (63.8)	101 (48.3)	244 (46.9)	145 (50.7)	426 (50.8)	620 (58.2)	951 (59.7)	2142 (56.6)
Immuniz*	131 (5.6)	27 (8.3)	14 (8.0)	31 (13.8)	29 (13.9)	48 (9.2)	30 (10.5)	57 (6.8)	88 (8.3)	105 (6.6)	280 (7.4)
Infant	127 (5.5)	36 (11.1)	23 (13.1)	28 (12.5)	20 (9.6)	51 (9.8)	41 (14.3)	89 (10.6)	70 (6.6)	85 (5.3)	285 (7.5)
Malnutrition	173 (7.4)	20 (6.2)	16 (9.1)	8 (3.6)	9 (4.3)	16 (3.1)	7 (2.4)	35 (4.2)	49 (4.6)	151 (9.5)	242 (6.4)
Stunt*	48 (2.1)	2 (0.6)	4 (2.3)	0 (0.0)	5 (2.4)	8 (1.5)	5 (1.7)	6 (0.7)	26 (2.4)	30 (1.9)	67 (1.8)
Pedia*	16 (0.7)	11 (3.4)	2 (1.1)	2 (0.9)	2 (1.0)	11 (2.1)	7 (2.4)	17 (2.0)	7 (0.7)	13 (0.8)	44 (1.2)
Wasting	15 (0.6)	11 (3.4)	2 (1.1)	1 (0.4)	3 (1.4)	1 (0.2)	4 (1.4)	10 (1.2)	4 (0.4)	15 (0.9)	33 (0.9)
Circumcision	16 (0.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.2)	0(0.0)	7 (0.8)	2 (0.2)	8 (0.5)	17 (0.4)

AF=African region, AM=American region, EM= Eastern Mediterranean region, EU=European region, SEA=South East Asia region, WP=West Pacific region.
HIC=High Income Countries, UMIC=Upper-Middle-Income Countries, LMIC=Lower-Middle-Income Countries, LIC=Low Income Countries.
For simplicity, only the English terms are used to describe the aggregated statistics of English, Spanish, and French search terms.
[a] *surg** includes surgery, surgeries, surgical, neurosurgery, and surgeon. [b] child* includes child, children, childbearing, childbirth, and childhood. [c] *immuniz** includes immunization, and immunized. [d] *stunt** includes stunting. [e] *pedia** includes pediatric and pediatrics.

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Keywords:	Health policy < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, PAEDIATRICS, SURGERY

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A Global and Regional Overview of the Inclusion of Pediatric Surgery in the National Health Plans of 124 countries: An Ecological Study

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ABSTRACT

Objectives: This study evaluates the priority given to surgical care for children within National Health Policies, Strategies, and Plans (NHPSPs).

Participants and setting: We reviewed the NHPSPs available in the World Health Organization's (WHO) Country Planning Cycle Database. Countries with NHPSPs in languages different from English, Spanish, French, or Chinese were excluded. A total of 124 countries met the inclusion criteria.

Primary and secondary outcome measures: We searched for child-specific and surgery-specific terms in the NHPSPs' missions, goals, and strategies using three analytic approaches: 1) count of the total number of mentions, 2) count of the number of policies with no mentions, and 3) count of the number of policies with five or more mentions. Outcomes were compared across WHO regional and World Bank income-level classifications.

Results: We found that the most frequently mentioned terms were "child*", "infant*", and "immuniz*". The most frequently mentioned surgery term was "surg*". Overall, 45% of NHPSPs discussed surgery, and 7% discussed children's surgery. The majority (93%) of countries did not mention selected essential and cost-effective children's procedures. When stratified by WHO region and World Bank income level, the West Pacific region led the inclusion of "pediatric surgery" in national health plans with 17% of its countries mentioning this term. Likewise, LICs led the inclusion of surg* and "pediatric surgery" with 63% and 11% of countries mentioning these terms, respectively. In both stratifications, pediatric surgery only equated to less than 1% of the total terms.

Conclusion: The low prevalence of children's surgical search terms in NHPSPs indicates that the influence of surgical care for this population remains low in the majority of countries. Increased awareness of children's surgical needs in national health plans might constitute a critical step to scale up surgical system in these countries.

Keywords: Pediatric Surgery, NSOAP, Health Policy, Universal Health Coverage

Strengths and limitations of the study

- This study uses national health plans as strong indicators to evaluate the priority given to pediatric surgical care in 124 countries.
- This study used a comprehensive set of proxy indicators to evaluate pediatric surgical care's impact on the national health plans.
- Underrepresentation of high-income countries was a limitation.
- Underrepresentation of countries whose health plans were written in languages different from English, Spanish, French, or Chinese was a limitation.

INTRODUCTION

Worldwide an estimated 1.7 billion children and adolescents, predominantly from low- and middle-income countries (LMICs) lack access to safe, affordable, and timely surgical and anesthesia care [1]. Although surgery has gained increased awareness in the global health agenda in recent years [2-4], surgery for children has received less attention. The burden of surgical disease among children in LMICs is high, with 15-20% of children in LMICs having surgically amenable conditions [5-11]. In addition, the consequences of untreated surgical conditions for children include life-long disabilities and social stigmatization [5 9 12-25]. National investments in surgical care for children are needed to improve children's health across all regions and income levels [6 7 19 21 26].

National Health Policies, Strategies, and Plans (NHPSPs) are country-level frameworks to design and operate complex health systems and are critical to aligning national strategies, policies, and goals for population health [27]. NHPSPs bring together stakeholders from across national and sub-national levels to develop a health system in line with national political, socio-economic, and historical complexities. NHPSPs are developed through cooperation with the World Health Organization (WHO) and facilitate the definition and support of national priorities [28]. In addition, NHPSPs are key elements for governmental negotiations regarding fiscal space and budget execution [29]. Therefore, these documents are excellent proxies to evaluate health priorities at a national level.

Designing country-level plans within an NHPSP framework is recommended to each WHO Member State[30]. Of the 194 Member States, 155 countries have updated an NHPSP in the last 5 years [27]. NHPSPs are strong measures of each country's priority to specific health conditions and can help assess if surgical care is incorporated into national plans. A number of countries have recognized a lack of policy-level strategy for improving surgical care. Eight countries have developed specific National Surgical, Obstetric, and Anesthesia Plans (NSOAPs) to address the gap in national strategic planning for improved access to surgical care [31-33]. Our study expands our understanding of the prioritization of children's surgical care in national health policy and strategies. As such, this study aimed to evaluate the level of priority given to surgical care for children within NHPSPs and provide recommendations on aligning these plans with the use of NSOAPs in LMICs.

METHODS

Search strategy and data collection

In the context of this manuscript, priority given to pediatric surgical care at a national level was defined as the inclusion of surgery-specific terms for children in the countries' NHPSPs. Inclusion criteria included publication in English, Spanish, French, or Chinese as these are part of the six WHO's official languages [34]. NHPSPs written in Russian and Arabic were not included due to a lack of resources to address these languages. From September to October 2019, five investigators searched NHPSPs available in the WHO's Country Planning Cycle Database [35]. The investigators assessed each country's NHPSPs mission, vision, goals, or strategies using 17 search terms related to child health and surgery-specific issues (Table 1). The selected terms were translated into Spanish by one of the coauthors, who is a native speaker. The terms in French were translated by the investigators and were validated by a native speaker health professional with expertise in global surgery (LMK) outside of the group of coauthors. The variations of the terms included for Spanish and French not always had an exact equivalent in English. In addition to variations in language, different variations of the terms were considered during the search. **Supplemental material 1** includes a complete list of terms in the three languages assessed in this study.

Each NHPSP PDF file was searched using the search function for each term and subsequently counted by frequency. The investigators carefully read the context in which the term appeared and only counted the relevant terms to this study. We selected the search terms based on a review of existing surgical and child health literature and international and national health policy reports. Specifically, search terms were chosen as common terms used in the current global surgery literature [2 7 12]. The search terms were grouped into child-specific and surgery-specific to evaluate pediatric surgery priority compared to other well-known priorities in child health and general surgery. We included the terms "circumcision", "open fracture fixation", and "inguinal hernia," as these are the three most commonly performed and cost-effective children's surgical procedures [21]. We followed three different analytic approaches for each search term. First, we counted the total number of mentions of each search term. Second, we counted the number of policies that have no mention of any search term. Third, we counted the number of policies with 5 or more mentions for each search term. The indicator of at least five mentions was established as a significant number following previous literature that evaluates the inclusion of surgery in African countries' health plans [36]. All data were stored in Microsoft Excel.

Data analysis

The NHPSPs were stratified according to the WHO regional divisions in the African region (AF), region of the Americas (AM), Eastern Mediterranean region (EM), South-East Asia region (SEA), European region (EU), and Western Pacific region (WP) to analyze geographic patterns countries. Likewise, the NHPSPs were stratified according to the World Bank's Fiscal Year 2019 income classification [37]. Descriptive and inference statistics were performed to analyze patterns of inclusion of search terms in NHPSPs across WHO regions and World Bank income levels. We used the analysis of variance (ANOVA) test and Tukey's Studentized Range test to compare the means of search terms across the mentioned categories. All analyses were performed using SAS (version 9.4; SAS Institute Inc).

Patient and Public Involvement

It was not appropriate or possible to involve patients or the public in the design, or conduct, or reporting, or dissemination plans of our research.

Ethical approval: This study does not involve human participants. Therefore, research approval was not applicable.

RESULTS

From 194 WHO Member States, 146 countries had NHPSPs available in the WHO's Country Planning Cycle Database. From the 146 NHPSPs assessed for eligibility, 22 NHPSPs were excluded because of being written in languages different from English, French, Spanish, and Chinese. The vast majority of these NHPSPs were written in languages not included as part of the six WHO's official languages. No NHPSP was written in Chinese. In total, 124 NHPSPs were included in this review (**Figure 1, Supplemental material 2**).

Table 1. Search terms in English, French, and Spanish with frequency of mentions and proportions of policies with no mentions, at least one mention and more than five mentions.

Search Terms English	Search Terms French	Search Terms Spanish	Total Mentions n (%) *3783 (100)*	Number of policies with **no** mentions of term n (%) *124 (100)*	Number of policies with **at least 1** mention of term n (%) *124 (100)*	Number of policies with **5 or more** mentions of term n (%) *124 (100)*
Surgery-specific						
surg*[a]	chirurgi*	cirug* / ciruj* /quirurgic*	269 (7.1)	68 (54.8)	56 (45.2)	14 (11.3)
injury	blessure*	lesion*	155 (4.1)	80 (64.5)	44 (35.5)	9 (7,3)
trauma	traumat*	trauma*	102 (2.7)	88 (71.0)	36 (29.0)	6 (5,8)
operation	operation / intervention	operacion*	75 (2.0)	90 (72.6)	18 (14.5)	5 (4.8)
operative	opératoire	operativo*	32 (0.8)	109 (87.9)	14 (11.3)	3 (2.4)
operating	opératoire / opérant	N/A	28 (0.7)	80 (64.5)	12 (9.7)	2 (1.6)
open fracture fixation	fixation de fracture ouverte / ostéosynthèse de fracture ouverte	fijacion de fractura abierta	3 (0.1)	121 (97.6)	3 (2.4)	0 (0.0)
inguinal hernia	hernie inguinale	hernia inguinal	0 (0.0)	124 (100.0)	0 (0.0)	0 (0.0)
pediatric surgery	chirurgie pédiatrique	cirujía pediátrica	9 (0.2)[f]	115 (92.7)	9 (7.3)	0 (0.0)
Children-specific						
child*[b]	enfant* / naissance	niñ*	2142 (56.6)	16 (12.9)	108 (87.1)	85 (68.5)
immuniz*[c]	immunis* / vaccin*	vacuna* inmuniz*	280 (7.4)	50 (40.3)	74 (59.7)	19 (15.3)
infant	bébé / infant*	infant*	285 (7.5)	48 (38.7)	76 (61.3)	21 (16.9)
malnutrition	malnutrition	desnutricion	242 (6.4)	67 (54.0)	57 (46.0)	17 (13.7)
stunt*[d]	retard de croissance	retraso en el crecimiento	67 (1.8)	89 (71.8)	35 (28.2)	4 (3.2)
pedia*[e]	pédiatr*	pedia*	44 (1.2)	101 (81.5)	23 (18.5)	1 (0.8)
wasting	dépérissement	anemia	33 (0.9)	106 (85.5)	18 (14.5)	1 (0.8)
circumcision	circoncision / posthectomie	Circuncisión	17 (0.4)	115 (92.7)	9 (7.3)	0 (0.0)

For simplicity in the remaining text of this paper only English terms will be used to describe the statistics revealed by both English and French and Spanish search terms.
[a] *surg** includes surgery, surgeries, surgical, neurosurgery, and surgeon. [b] child* includes child, children, childbearing, childbirth, and childhood. [c] *immuniz** includes immunization, and immunized. [d] *stunt** includes stunting. [e] *pedia** includes pediatric and pediatrics. [f] Mentions of "pediatric surgery" were found in NHPSPs from Uganda, Democratic Republic of Congo, Congo, Chile, Tajikistan, Cambodia, China, Cook Islands, and Vietnam.

Table 2. Comparison of means (ANOVA) of frequency of search terms across WHO regions and World Bank income level. Statistically significant different means were bolded (Tukey's Studentized Range).

	WHO REGION													WORLD BANK INCOME LEVEL								
Search terms	**Africa** Mean	(SE)	**Americas** Mean	(SE)	**E Mediter** Mean	(SE)	**Europe** Mean	(SE)	**SE Asia** Mean	(SE)	**W Pacific** Mean	(SE)	**p**	**HIC** Mean	(SE)	**UMIC** Mean	(SE)	**LMIC** Mean	(SE)	**LIC** Mean	(SE)	**p**
Surgery-specific																						
surg*	**4.4**	(1.3)	**0.7**	(0.3)	1.8	(1.1)	**0.2**	(0.2)	2.9	(1.5)	1.5	(0.6)	0.0198	**0.5**	(0.2)	2.0	(0.6)	1.7	(0.7)	**4.6**	(1.7)	0.0276
injury	**3.2**	(0.8)	**0.5**	(0.2)	**0.3**	(0.1)	**0.1**	(0.1)	1.3	(1.0)	**0.3**	(0.2)	0.0002	0.9	(0.7)	0.6	(0.1)	1.4	(0.5)	2.5	(0.9)	0.1057
trauma	**1.9**	(0.5)	0.6	(0.2)	**0.1**	(0.1)	**0.2**	(0.1)	0.8	(0.5)	**0.2**	(0.1)	0.0009	0.2	(0.1)	0.7	(0.2)	1.1	(0.5)	1.2	(0.3)	0.23
operation	**0.2**	(0.1)	**0.2**	(0.1)	**0.1**	(0.1)	**0.1**	(0.1)	**0.0**	(0.0)	**2.7**	(1.0)	<.0001	0.0	(0.0)	1.0	(0.4)	0.9	(0.6)	0.1	(0.1)	0.2197
operative	0.7	(0.2)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.3	(0.2)	0.026	0.2	(0.2)	0.2	(0.1)	0.4	(0.2)	0.3	(0.2)	0.7019
operating	**0.2**	(0.1)	**0.0**	(0.0)	**0.0**	(0.0)	**0.1**	(0.1)	**0.0**	(0.0)	**1.1**	(0.3)	<.0001	0.3	(0.2)	0.4	(0.2)	0.2	(0.1)	0.2	(0.2)	0.8311
open fracture fixation	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.1	(0.1)	0.1	(0.1)	0.0869	0.0	(0.0)	0.1	(0.0)	0.0	(0.0)	0.0	(0.0)	0.433
inguinal hernia	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	n/a	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	n/a
pediatric surgery	0.1	(0.0)	0.0	(0.0)	0.0	(0.0)	0.1	(0.1)	0.0	(0.0)	0.2	(0.1)	0.3611	0.0	(0.0)	0.1	(0.0)	0.1	(0.0)	0.1	(0.1)	0.7154
Children-specific																						
child*	**36.7**	(5.0)	**7.1**	(1.6)	**7.3**	(2.0)	**7.9**	(2.7)	**12.6**	(3.1)	**10.6**	(2.4)	<.0001	**6.7**	(1.2)	**10.7**	(2.5)	**17.7**	(3.5)	**36.6**	(6.2)	<.0001
immuniz*	3.4	(0.8)	1.1	(0.2)	1.2	(0.3)	1.6	(0.8)	3.6	(1.6)	2.1	(0.7)	0.0984	**1.3**	(0.4)	**1.4**	(0.4)	2.5	(0.6)	**4.0**	(1.1)	0.0164
infant	3.3	(0.8)	1.5	(0.4)	1.9	(0.8)	1.5	(0.6)	2.5	(1.5)	2.2	(0.4)	0.2736	1.8	(0.5)	2.2	(0.6)	2.0	(0.5)	3.3	(0.7)	0.394
malnutrition	**4.6**	(0.9)	**0.8**	(0.3)	**1.3**	(0.5)	**0.4**	(0.3)	1.1	(0.5)	**0.7**	(0.3)	<.0001	**0.3**	(0.3)	**0.9**	(0.2)	**1.4**	(0.3)	**5.8**	(1.2)	<.0001
stunt*	**1.3**	(0.3)	**0.1**	(0.1)	0.3	(0.1)	**0.0**	(0.0)	0.6	(0.3)	**0.3**	(0.1)	0.0002	**0.2**	(0.1)	**0.2**	(0.1)	0.7	(0.2)	**1.2**	(0.4)	0.0026
pedia*	0.4	(0.2)	0.5	(0.2)	0.2	(0.2)	0.1	(0.1)	0.3	(0.3)	0.5	(0.3)	0.76	0.3	(0.2)	0.5	(0.2)	0.2	(0.1)	0.5	(0.2)	0.648
wasting	0.4	(0.2)	0.5	(0.2)	0.2	(0.1)	0.1	(0.1)	0.4	(0.2)	0.0	(0.0)	0.3519	0.2	(0.1)	0.3	(0.1)	0.1	(0.1)	0.6	(0.3)	0.1525
circumcision	0.4	(0.2)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0219	0.0	(0.0)	0.2	(0.1)	0.1	(0.0)	0.3	(0.2)	0.2382

For simplicity in the remaining text of this paper only English terms will be used to describe the statistics revealed by both English and French and Spanish search terms.
[a] *surg** includes surgery, surgeries, surgical, neurosurgery, and surgeon. [b] child* includes child, children, childbearing, childbirth, and childhood. [c] *immuniz** includes immunization, and immunized. [d] *stunt** includes stunting. [e] *pedia** includes pediatric and pediatrics.

The term with the most mentions was "child*" with 2,142 mentions, followed by the terms "infant" and "immuniz*" with 285 (8%) and 280 (7%) mentions, respectively (**Table 1)**. The terms "surg*" and "pediatric surgery" were mentioned at least once in 45% and 7% of NHPSPs, respectively. Sixty-eight (55%) NHPSPs did not mention "surg*". Only 11% of NHPSPs mentioned "surg*" more than five times and no NHPSP mentioned "pediatric surgery" more than five times. In comparison, over 50% of NHPSPs mentioned other common child-specific issues such as "immuniz*" (60% of NHPSPs), "infant" (39%), or "malnutrition" (54%). Nine countries, including Congo, Uganda, Democratic Republic of Congo, Chile, Tajikistan, Cambodia, China, Cook Islands, and Vietnam mentioned "pediatric surgery" in their NHPSPs. Terms mentioning essential and cost-effective children's procedures, including "circumcision" (7%), "open fracture fixation" (2%), and "inguinal hernia" (0%), were the least likely to be mentioned. When stratified by WHO region and World Bank income level, the average frequency of inclusion of surg* (4.4 and 4.6) and child* (36.7 and 36.6) was higher for Africa and LCIs, compared to the other regions and income groups (**Table 2**). Comparisons for "pediatric surgery" and the essential and cost-effective children's procedures were not statistically significant.

All (100%) countries from Africa, East Mediterranean, and South East Asia regions mentioned child* at least once and over 60% of countries from South East Asia and African mentioned surg*. In contrast, only 17% of countries from the West Pacific Region (the highest percentage among all regions) mentioned "pediatric surgery" (**Figure 2**). The Eastern Mediterranean region and the South East Asia region had no mentions of "pediatric surgery" in their NHPSPs. The cost-effective pediatric surgical procedures were only mentioned in the West Pacific, South East Asia, and Africa regions. The West Pacific region (44%) and the African region (33%) had the most frequent mentions of "pediatric surgery" and combined make up to 77% of mentions for this search term. However, when compared to other terms, "pediatric surgery" only equated to 0.8% and 0.1% of total search term mentions, respectively (**Supplemental material 3 & 4**).

Over 80% of countries from each income level group mentioned child* in their national health plans. LICs lead the inclusion of surg* and "pediatric surgery" with 63% and 11% of countries mentioning these terms, respectively (**Figure 3**). The cost-effective pediatric surgical procedures were not mentioned by HICs and under 15% of countries from the other regions mentioned these terms. LICs had the highest frequency of mentions for "surg*" (45%), which equates to 8% of the total mentions for this economic group. NHPSPs from LICs (33%) and LMICs (33%) concentrated the majority of mentions for "pediatric surgery" and combined make up to 66% of mentions for this term. However,

when compared to other terms, "pediatric surgery" only equates to 0.2% and 0.3% of total search term mentions, respectively (**Supplemental material 5**).

DISCUSSION

Inclusion of children's surgical care coverage in NHPSPs and NSOAPs is improving the health of children and alignment of surgical care with UHC frameworks [38-40]. Our study provides evidence that the financing of surgical care for children and penetration of UHC policies for surgical coverage for children in NHPSPs is quite limited, with under 18% and 15% of countries addressing pediatric surgical care across income levels and regions. Furthermore, The majority (93%) of countries did not mention selected essential and cost-effective children's procedures. Given that children's surgical care requires a unique set of workforce and infrastructure, this gap in the inclusion of surgical needs for children is an opportunity to define children's surgical care as a part of national essential benefit packages.

Surgical care was more frequently discussed within NHPSPs in the Africa region in comparison to other regions. Fewer countries from the European region addressed surgical-specific and pediatric surgery terms. This finding could reflect the number of countries, particularly in the WHO Africa region, that have created NSOAPs [32]. More countries from the Western Pacific region mentioned "pediatric surgery," despite a lack of NSOAPs in that region. Furthermore, the Western Pacific region used language including "operation" more frequently than other regions, a finding that could indicate a lack of international consensus on NSOAP language. The Western Pacific region has had a long-standing collaborative partnership in surgical training and provision of specialist surgical services in the region with the Royal Australasian College of Surgeons. Over the first 15 years of the partnership, operations done by trainees increased from 10% to 77%, and nurse anesthetists were trained and deployed in each hospital [41]. In addition, collaborations between nations have recently resulted in 13 of the 14 countries collectively measuring the first four Lancet Commission global surgery indicators [42]. This type of collaborative partnerships could serve as key examples of integrating surgical care on national levels.

When stratified by income level, LICs were most likely to mention surgery-specific search terms in addition to children-specific search terms compared to HICs, a finding consistent with the increasing number of LICs that are developing NSOAPs. Overall, however, the low frequency of children-specific surgical procedures could be reflective of a lack of global consensus on defining essential

surgical procedures for children. This finding suggests an opportunity to define surgical procedures for children such that future NHPSPs and NSOAPs can target prevalent surgical conditions and cost-effective care to improve the health of children in national UHC goals. This has partially been done with the latest edition of the *Disease Control Priorities 3*, mainly for congenital conditions [38].

Although surgical conditions are a high burden for children in many LMICs, a list of cost-effective, essential surgical procedures for children still needs to be defined for the inclusion of children's surgical care in NHPSPs and NSOAPs. Furthermore, because children's surgical care is subspecialized in nature, organized referral systems, specialized centers, and specialized workforce are required simultaneously for optimal outcomes. The Global Initiative for Children's Surgery (GICS), a collaborative organization with over 150 providers worldwide, developed guidelines in the Optimal Resources for Children's Surgery (OReCS) document to support the provision of care at every healthcare level based on infrastructure, service delivery, training, and research [21 26 43 44]. The OReCS document outlines a multi-faceted strategy for integrating procedure-specific surgical care for children into NSOAPs. The OReCS document serves as a specific guide to scale-up surgical care in an organized manner by addressing all levels of healthcare in the country, including referral systems and workforce expansion. The utility of the OReCS document in conjunction with national child health policy plans, NHPSPs, and NSOAPs could serve as a starting point for integrating child-specific surgical care into existing or developing national health plans.

Nigeria can serve as an example of successfully integrating the OReCS document with NSOAPs and NHPSPs through the lens of UHC (**Figure 4**). Nigeria's robust development of a national surgical plan is integrated into the national health plan and includes the provision and strengthening of children and adolescents' surgical care within the existing healthcare systems. This model highlights the utility of using national plans that can address multiple sectors of surgical delivery in a coordinated manner. Going forward, the success of Nigeria's integration of children's surgical care within national health plans can serve as a template for other countries to follow.

Surgically amenable conditions will increasingly impact children around the world, as over a quarter of the global population is under fifteen years of age, and approximately 50% of the population in LICs are under the age of 15 [39 40]. Inclusion of children's surgical policies in NHPSPs and WHO regional health plans might constitute a critical step in the efforts to meet the United Nation's Strategic Development Goals (SDG)-3 goals of achieving 80% coverage of essential healthcare services while protecting 100% of patients from impoverishing and catastrophic health expenditures [45].

Limitations

Our study limitations include being unable to locate NHPSPs for all countries on the WHO Country Planning Cycle Database. Of the 48 countries not included, 73% were from HICs or UMICs, which may have biased the results as HICs and UMICs were less likely to report surgical-specific and child-specific search terms than LICs or LMICs. Additionally, our study excluded 22 NHPSPs written in languages other than English, Spanish, and French. Of the 22 studies, 91% were from HICs or UMICs. We also used limited search terms to assess the inclusion of children's surgery in the NHPSP reviews, potentially underestimating the number of plans with surgical care embedded. Although this occurrence may be small as we searched for the major terms of surg* and ped*, there is a possibility of missing key terms. Deeper analyses of NHPSPs through additional search terms and other qualitative approaches may provide a more robust and thorough search through the plans. Finally, NHPSPs represent only one part of UHC schemes. Further study on the national budget and health policy literature and documents is important in defining the penetration of UHC schemes on surgical care provision for children at national health system levels.

Conclusion

Our results suggest that pediatric surgical care has a very low impact on the majority of national health plans. NHPSPs are developed to guide national health priorities. Therefore, we have a golden opportunity to incorporate children's surgical care as part of these health plans and, in this way, contribute to the scale-up of surgical care systems for children at a national and global scale. From our findings, we propose the following key policy recommendations for the Member States:

1. Countries should use the Global Initiative for Children's Surgery's Optimal Resources for Children's Surgery (OReCS) guidelines to assess the current state of surgical care for children across multiple health system perspectives and facilitate collaboration with a broad range of health policy and children's surgery stakeholders.
2. Individual countries should define an essential package of children's surgical care across all specialties based on country-level surgical needs for children using language consistent across the Member States.
3. The inclusion of children's surgical needs in WHO NHPSPs and NSOAPs should be prioritized in order to address country-level surgical needs for children.

Autor contributorship:

Conceptualization: ERS, HR, KL, CCC, YL, JR, NT, RG; Methodology: ERS, HR, KL, CCC, YL, JR, NT, RG; Data collection: CCC, YL, JR, NT, RG; Formal analysis and investigation: CCC; Writing - original draft preparation: ERS, KL, CCC, YL; Writing - review and editing: ERS, KL, CCC, PT, EAA, SWB, LS, JM, HR; Supervision: ERS.

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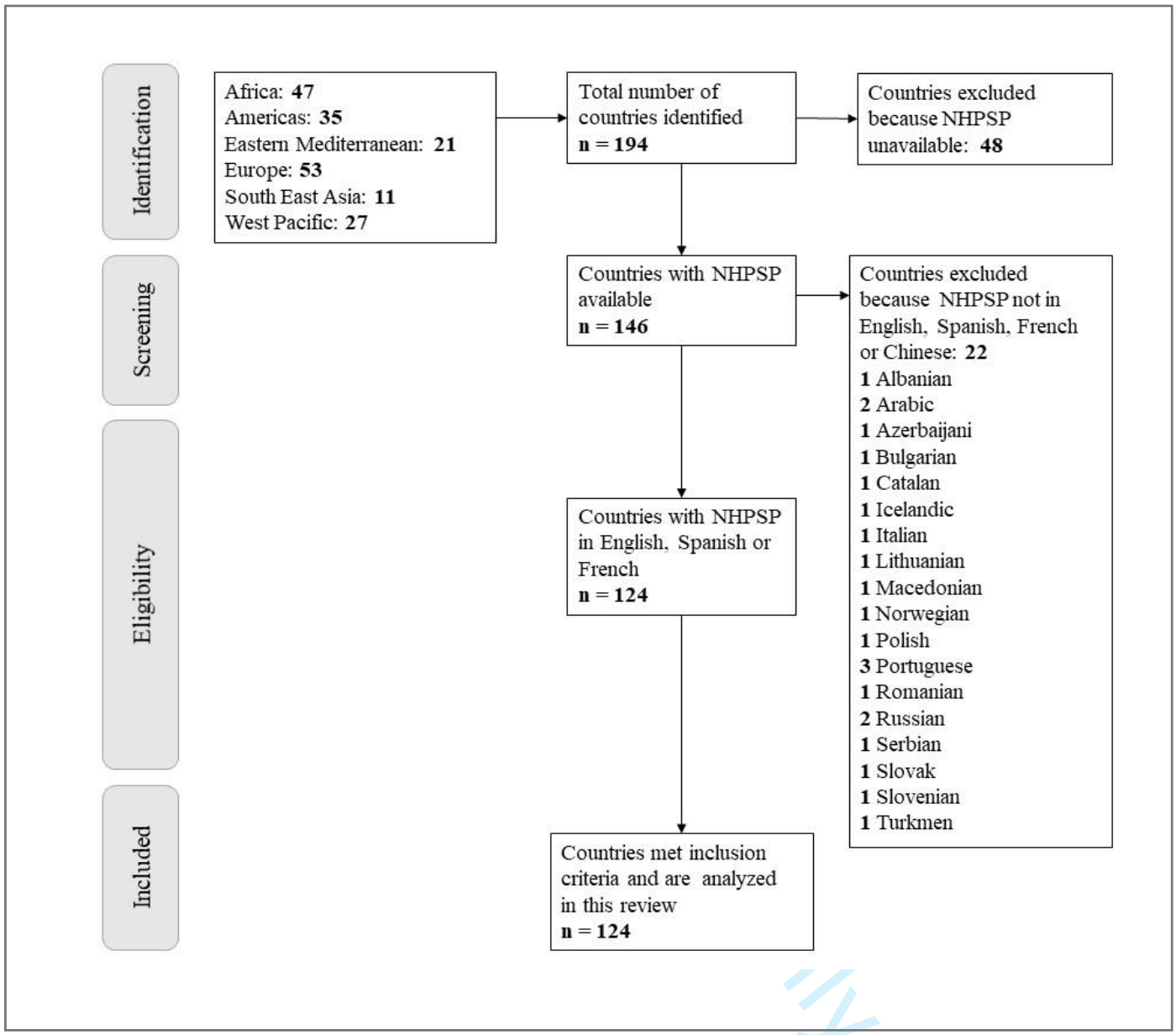
FIGURE LEGEND

Figure 1. Flowchart of data search process.

Figure 2. Percentage of countries from each WHO's region that mention the search terms in their NHPSPs at least once . Weighted percent was used to facilitate comparison across regions.

Figure 3. Percentage of countries from each World Bank Income level that mention the search terms in their NHPSPs at least once. Weighted percent was used to facilitate comparison across income levels.

Figure 4. Example of Nigeria: Inclusion of children's surgical care within national health plans.


Identification
Screening
Eligibility
Included
Africa: 47
Americas: 35
Eastern Mediterranean: 21
Europe: 53
South East Asia: 11
West Pacific: 27
Total number of countries identified
n = 194
Countries excluded because NHPSP unavailable: 48
Countries with NHPSP available
n = 146
Countries excluded because NHPSP not in English, Spanish, French or Chinese: 22
1 Albanian
2 Arabic
1 Azerbaijani
1 Bulgarian
1 Catalan
1 Icelandic
1 Italian
1 Lithuanian
1 Macedonian
1 Norwegian
1 Polish
3 Portuguese
1 Romanian
2 Russian
1 Serbian
1 Slovak
1 Slovenian
1 Turkmen
Countries with NHPSP in English, Spanish or French
n = 124
Countries met inclusion criteria and are analyzed in this review
n = 124

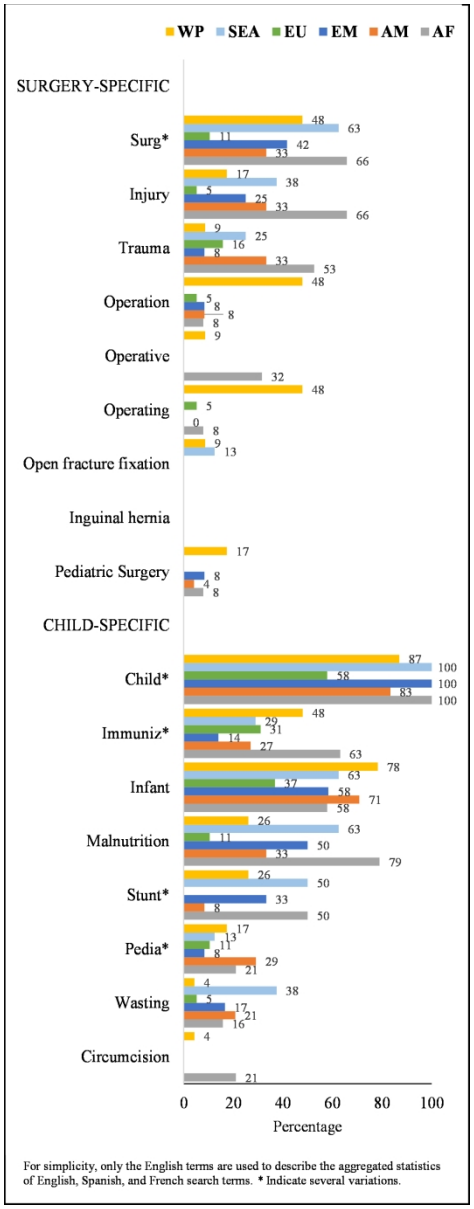


Figure 2. Percentage of countries from each WHO's region that mention the search terms in their NHPSPs at least once. Weighted percent was used to facilitate comparison across regions.

104x267mm (300 x 300 DPI)

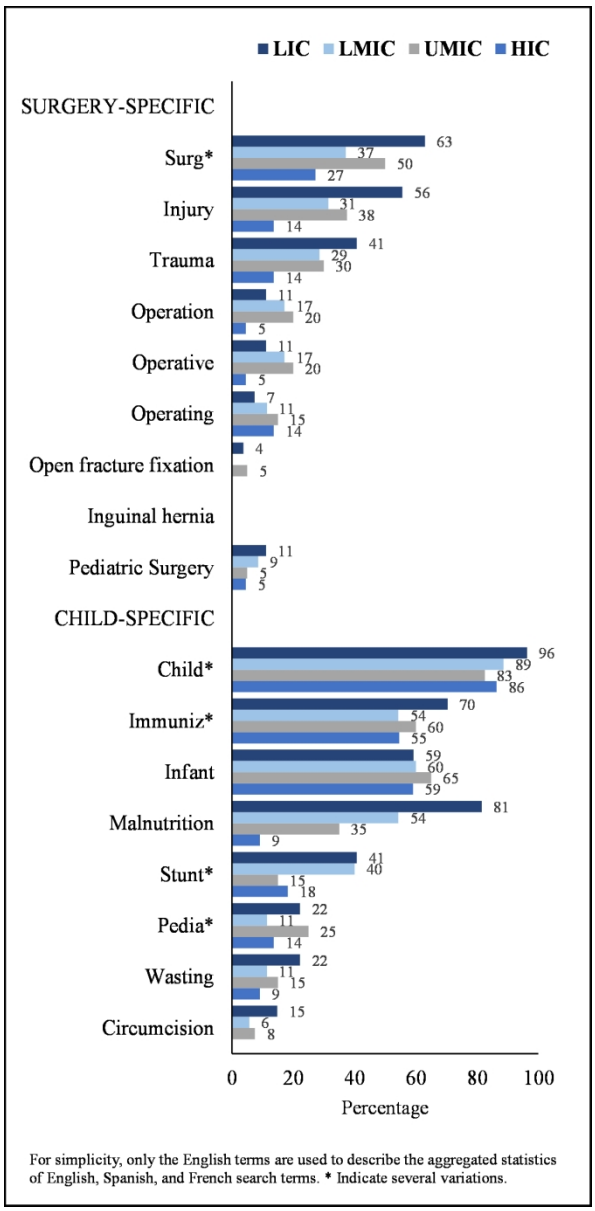


Figure 3. Percentage of countries from each World Bank Income level that mention the search terms in their NHPSPs at least once. Weighted percent was used to facilitate comparison across income levels.

103x211mm (300 x 300 DPI)

Recommendations include:

INFRASTRUCTURE

Creation of one federal children's hospital.

Availability of a package of essential children's surgery at all healthcare levels, including the provision of specialized equipment and supplies.

WORKFORCE

Provision of specialized human resources for children's surgery.

SERVICE DELIVERY

Integrate and create efficient referral system for children's surgery.

Increase capacity of tertiary levels of care for advanced surgical care for children.

Availability of critical care and pre-hospital services.

Supplemental material 1: Complete list of search terms and associated variations found in NHPSPs, stratified by language English, French, and Spanish.

ENGLISH		FRENCH		SPANISH	
Search Terms	**Variations found**	**Search Terms**	**Variations found**	**Search Terms**	**Variations found**
Surgery-specific					
surg*	surgery, surgeries, surgical, neurosurgery, and surgeon	chirurgi*	chirurgie, chirurgien, chirurgicale, chirurgicaux, chirurgiens, neurochirurgien, médicochirurgicaux, chirurgical	cirug* / ciruj*/ quirurgic*	cirugía, cirujano, cirujanos, quirúrgico
injury		blessure*	blessure, blessures	lesion*	lesión, lesiones
trauma		traumat*	traumatismes, traumatique, traumatology	trauma*	trauma, traumatismo
operation		operation / intervention		operacion*	operación, operaciones
operative		opératoire		operativo*	operativo, operativos
operating		opératoire / opérant		N/A	
open fracture fixation / fracture		fixation de fracture ouverte / ostéosynthèse de fracture ouverte / fracture		fijación de fractura abierta / fractura	
inguinal hernia / hernia		hernie inguinale / hernie		hernia inguinal / hernia	
pediatric surgery		chirurgie pédiatrique		cirugía pediátrica	
Children-specific					
child*	child, children, childbearing, childbirth, childhood	enfant* / naissance	enfant, enfants, enfance,	niñ*	niño,niños, niña, niñas, niñez
immuniz*	immunization, immunized	immunis* / vaccin*	Immunisation, vacciné	vacuna* inmuniz*	vacuna, vacunación, vacunaciones, inmunización, inmunizaciones
infant		bébé / infant*	infantile	infant*	infante, infantes, infantil
malnutrition		malnutrition		desnutrición	
stunt*	stunting	retard de croissance		retraso en el crecimiento	
pedia*	pediatric, pediatrics	pédiatr*	pédiatrique, pédiatriques, pédiatres, pédiatrie,	pedia*	pediátrico, pediatría, pediátrica, pediatras,
wasting		dépérissement		anemia	
circumcision		circoncision / posthectomie		circuncisión	

Supplemental material 2: Country health plans stratified by WHO's region and World Bank's income classification level.

	Total	Excluded because NHPSP unavailable	Excluded because not in English, Spanish, or French	Total available for search
	n (%)	n (%)	n (%)	n (%)
	194 (100.0)	*48 (100.0)*	*22 (100.0)*	*124 (100.0)*
WHO region				
Africa	47 (24.2)	7 (14.6)	2 (9.1)	38 (30.6)
Americas	35 (18.0)	10 (20.8)	1 (4.5)	24 (19.4)
Eastern Mediterranean	21 (10.8)	7 (15.6)	2 (9.1)	12 (9.7)
Europe	53 (27.3)	17 (35.4)	17 (77.3)	19 (15.3)
South East Asia	11 (5.7)	3 (6.3)	0 (0.0)	8 (6.5)
West Pacific	27 (13.9)	4 (8.3)	0 (0.0)	23 (18.5)
World Bank Income Classification Level				
HIC	56 (28.9)	25 (52.1)	9 (40.9)	22 (17.7)
UMIC	61 (31.4)	10 (20.8)	11 (50.0)	40 (32.2)
LMIC	44 (22.7)	7 (14.6)	2 (9.1)	35 (28.5)
LIC	33 (17.0)	6 (12.5)	0 (0.0)	27 (21.8)

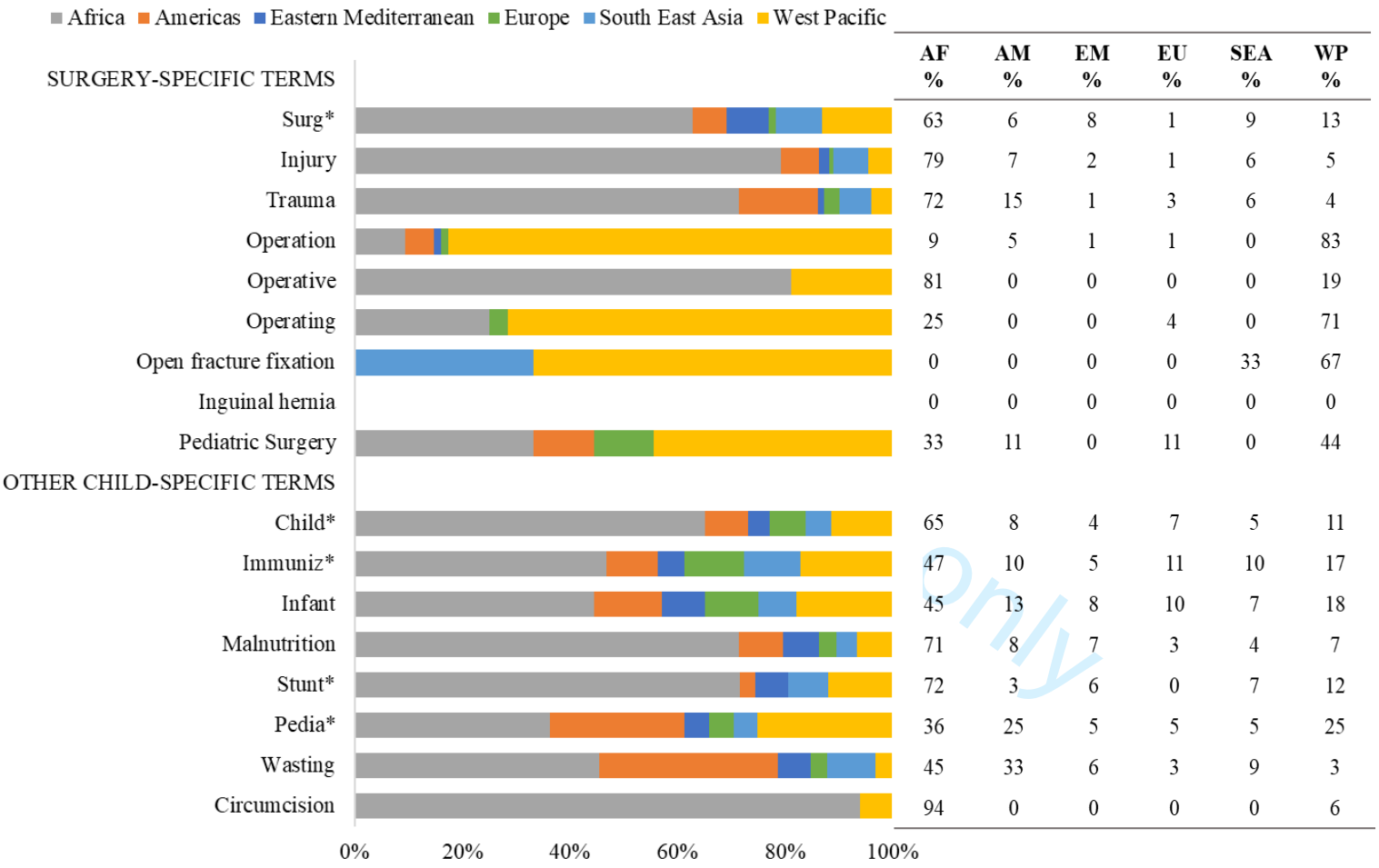
HIC=High Income Countries, UMIC=Upper-Middle-Income Countries, LMIC=Lower-Middle-Income Countries, LIC=Low Income Countries.

Supplemental material 3: Search Terms in English, French, and Spanish with number of citations stratified by WHO regions and World Bank income classification level.

	WHO Region						World Bank Income Classification Level				TOTAL
	AF **n (%)** *2330 (100.0)*	**AM** **n (%)** *325 (100.0)*	**EM** **n (%)** *175 (100.0)*	**EU** **n (%)** *224 (100.0)*	**SEA** **n (%)** *209 (100.0)*	**WP** **n (%)** *520 (100.0)*	**HIC** **n (%)** *286 (100.0)*	**UMIC** **n (%)** *838 (100.0)*	**LMIC** **n (%)** *1065 (100.0)*	**LIC** **n (%)** *1594 (100.0)*	**n (%)** *3783 (100.0)*
Surgery-specific											
Surg*	169 (7.3)	17 (5.2)	21 (12.0)	4 (1.8)	23 (11.0)	35 (6.7)	11 (3.8)	80 (9.5)	58 (5.4)	120 (7.5)	269 (7.1)
Injury	123 (5.3)	11 (3.4)	3 (1.7)	1 (0.4)	10 (4.8)	7 (1.3)	20 (7.0)	23 (2.7)	48 (4.5)	64 (4.0)	155 (4.1)
Trauma	73 (3.1)	15 (4.6)	1 (0.6)	3 (1.3)	6 (2.9)	4 (0.8)	5 (1.7)	27 (3.2)	40 (3.8)	30 (1.9)	102 (2.7)
Operation	7 (0.3)	4 (1.2)	1 (0.6)	1 (0.4)	0 (0.0)	62 (11.9)	1 (0.3)	39 (4.7)	32 (3.0)	3 (0.2)	75 (2.0)
Operative	26 (1.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	6 (1.2)	4 (1.4)	6 (0.7)	13 (1.2)	9 (0.6)	32 (0.8)
Operating	7 (0.3)	0 (0.0)	0 (0.0)	1 (0.4)	0 (0.0)	20 (3.8)	5 (1.7)	12 (1.4)	5 (0.5)	6 (0.4)	28 (0.7)
Open Frac. Fix.	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.5)	2 (0.4)	0 (0.0)	2 (0.2)	0 (0.0)	1 (0.1)	3 (0.1)
Inguinal Hernia	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
'Pediatric Surgery'	3 (0.1)	1 (0.3)	0 (0.0)	1 (0.4)	0 (0.0)	4 (0.8)	1 (0.3)	2 (0.2)	3 (0.3)	3 (0.2)	9 (0.2)
Children-specific											
Child*	1396 (59.9)	170 (52.3)	88 (50.3)	143 (63.8)	101 (48.3)	244 (46.9)	145 (50.7)	426 (50.8)	620 (58.2)	951 (59.7)	2142 (56.6)
Immuniz*	131 (5.6)	27 (8.3)	14 (8.0)	31 (13.8)	29 (13.9)	48 (9.2)	30 (10.5)	57 (6.8)	88 (8.3)	105 (6.6)	280 (7.4)
Infant	127 (5.5)	36 (11.1)	23 (13.1)	28 (12.5)	20 (9.6)	51 (9.8)	41 (14.3)	89 (10.6)	70 (6.6)	85 (5.3)	285 (7.5)
Malnutrition	173 (7.4)	20 (6.2)	16 (9.1)	8 (3.6)	9 (4.3)	16 (3.1)	7 (2.4)	35 (4.2)	49 (4.6)	151 (9.5)	242 (6.4)
Stunt*	48 (2.1)	2 (0.6)	4 (2.3)	0 (0.0)	5 (2.4)	8 (1.5)	5 (1.7)	6 (0.7)	26 (2.4)	30 (1.9)	67 (1.8)
Pedia*	16 (0.7)	11 (3.4)	2 (1.1)	2 (0.9)	2 (1.0)	11 (2.1)	7 (2.4)	17 (2.0)	7 (0.7)	13 (0.8)	44 (1.2)
Wasting	15 (0.6)	11 (3.4)	2 (1.1)	1 (0.4)	3 (1.4)	1 (0.2)	4 (1.4)	10 (1.2)	4 (0.4)	15 (0.9)	33 (0.9)
Circumcision	16 (0.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.2)	0(0.0)	7 (0.8)	2 (0.2)	8 (0.5)	17 (0.4)

AF=African region, AM=American region, EM= Eastern Mediterranean region, EU=European region, SEA=South East Asia region, WP=West Pacific region.
HIC=High Income Countries, UMIC=Upper-Middle-Income Countries, LMIC=Lower-Middle-Income Countries, LIC=Low Income Countries.
For simplicity, only the English terms are used to describe the aggregated statistics of English, Spanish, and French search terms.
[a] *surg** includes surgery, surgeries, surgical, neurosurgery, and surgeon. [b] child* includes child, children, childbearing, childbirth, and childhood. [c] *immuniz** includes immunization, and immunized. [d] *stunt** includes stunting. [e] *pedia** includes pediatric and pediatrics.

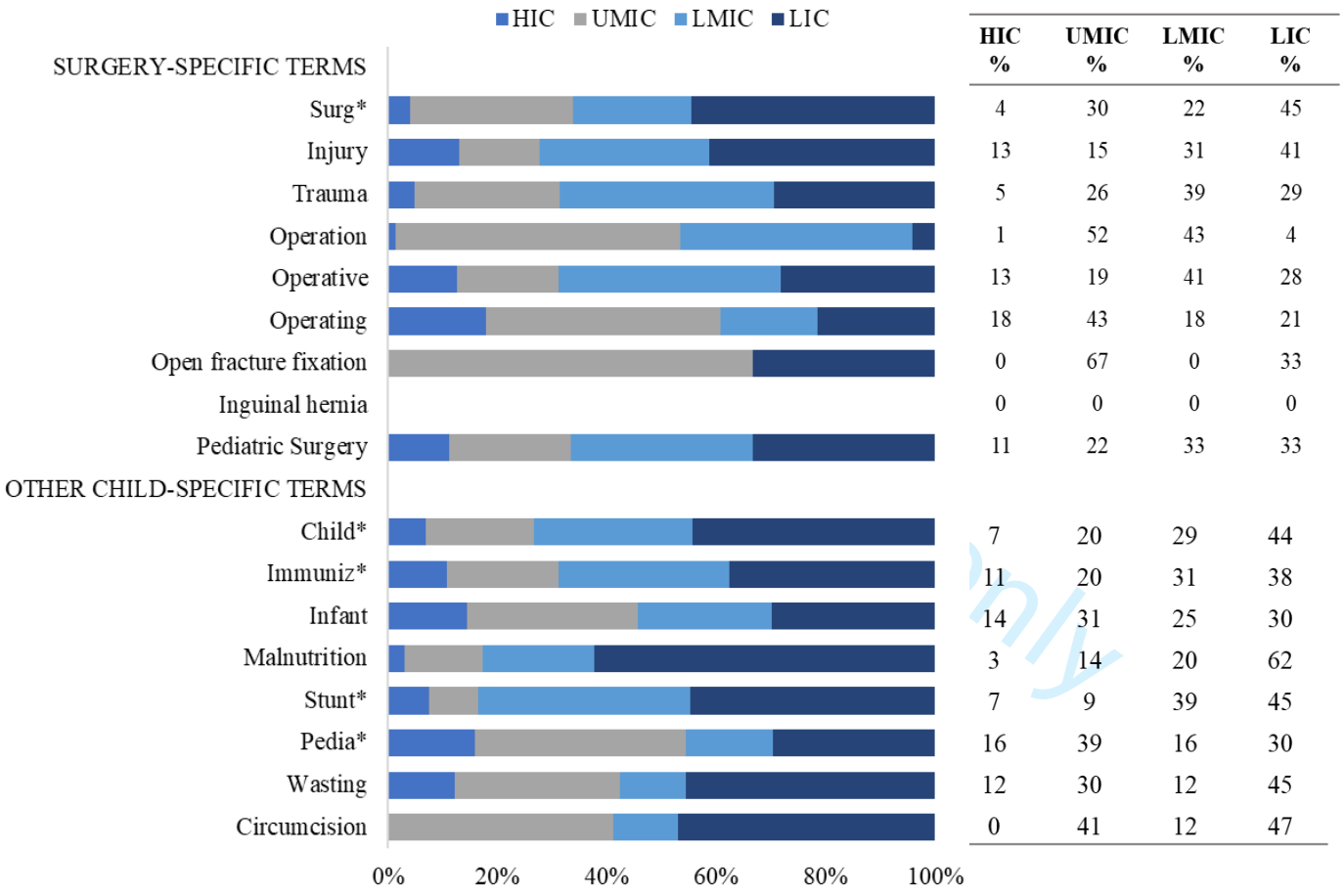
Supplemental material 4: Percentages of search terms in English, French, and Spanish with number of citations stratified by WHO regions.



	AF %	AM %	EM %	EU %	SEA %	WP %
SURGERY-SPECIFIC TERMS						
Surg*	63	6	8	1	9	13
Injury	79	7	2	1	6	5
Trauma	72	15	1	3	6	4
Operation	9	5	1	1	0	83
Operative	81	0	0	0	0	19
Operating	25	0	0	4	0	71
Open fracture fixation	0	0	0	0	33	67
Inguinal hernia	0	0	0	0	0	0
Pediatric Surgery	33	11	0	11	0	44
OTHER CHILD-SPECIFIC TERMS						
Child*	65	8	4	7	5	11
Immuniz*	47	10	5	11	10	17
Infant	45	13	8	10	7	18
Malnutrition	71	8	7	3	4	7
Stunt*	72	3	6	0	7	12
Pedia*	36	25	5	5	5	25
Wasting	45	33	6	3	9	3
Circumcision	94	0	0	0	0	6

For simplicity, only the English terms are used to describe the aggregated statistics of English, Spanish, and French search terms.
*surg** includes surgery, surgeries, surgical, neurosurgery, and surgeon. child* includes child, children, childbearing, childbirth, and childhood.
*immuniz** includes immunization, and immunized. *stunt** includes stunting. *pedia** includes pediatric and pediatrics.

Supplemental material 5: Percentages of search terms in English, French, and Spanish with number of citations stratified by World Bank income classification level.



	HIC %	UMIC %	LMIC %	LIC %
SURGERY-SPECIFIC TERMS				
Surg*	4	30	22	45
Injury	13	15	31	41
Trauma	5	26	39	29
Operation	1	52	43	4
Operative	13	19	41	28
Operating	18	43	18	21
Open fracture fixation	0	67	0	33
Inguinal hernia	0	0	0	0
Pediatric Surgery	11	22	33	33
OTHER CHILD-SPECIFIC TERMS				
Child*	7	20	29	44
Immuniz*	11	20	31	38
Infant	14	31	25	30
Malnutrition	3	14	20	62
Stunt*	7	9	39	45
Pedia*	16	39	16	30
Wasting	12	30	12	45
Circumcision	0	41	12	47

HIC=High Income Countries, UMIC=Upper-Middle-Income Countries, LMIC=Lower-Middle-Income Countries, LIC=Low Income Countries. For simplicity, only the English terms are used to describe the aggregated statistics of English, Spanish, and French search terms. *surg** includes surgery, surgeries, surgical, neurosurgery, and surgeon. child* includes child, children, childbearing, childbirth, and childhood. *immuniz** includes immunization, and immunized. *stunt** includes stunting. *pedia** includes pediatric and pediatrics.