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Cost-effectiveness of paediatric surgery: an economic evaluation of World Paediatric Project surgical interventions in St. Vincent and the Grenadines (2002–2019)

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ABSTRACT

Objectives The purpose of this study is to examine the cost-effectiveness of six types of surgical interventions as part of a sustained paediatric surgical programme in St.Vincent and the Grenadines from 2002 to 2019.

Design In this economic model, six paediatric surgical interventions (ophthalmic, orthopaedic, plastic, general, urology, neurosurgery) were compared with no surgery in a deterministic cost-effectiveness model. We assessed health benefits as averted disability-adjusted life-years (DALYs). Costs were included from the programme perspective and measured using standard micro-costing methods. Incremental cost-effectiveness ratios (ICERs) were calculated for each type of surgical intervention. Interventions with ICERs of <50% of gross domestic product (GDP) per capita were considered cost-effective. Costs are reported in 2019 US$. Univariate sensitivity analyses were conducted to assess the effect of uncertainty.

Results The average cost per procedure was US$16 685 (range: US$9791.78–US$72 845.76). The cumulative discounted 18-year health impact was 5815 DALYs averted with a cost per DALY averted of US$2622. Most paediatric surgical interventions were cost-effective, yielding cost per DALY estimates less than 50% of GDP per capita of St. Vincent and the Grenadines. When undiscounted, only orthopaedic surgeries had cost per DALY more than 50% GDP per capita. When considering discounting, orthopaedic and urology surgeries exceeded the adopted threshold for cost-effectiveness.

Conclusions We found that short-term, recurrent surgical interventions could yield substantial economic benefits in this limited resource setting. This research indicates that investment in paediatric surgical interventions is cost-effective for the majority of specialties. These findings are of clinical significance given the large burden of disease attributable to surgically treatable diseases. This work demonstrates that scaling up dedicated surgical programmes for children is a cost-effective and essential component to improve paediatric health.

Strengths and limitations of this study

- ► This study focuses on six paediatric surgical interventions over 18 years, providing cost-effectiveness data for each.
- ► To increase the methodological rigour and encourage the reconciliation of the differences among divergent guidelines in the field of global surgery CEAs, we employed Shrime's checklist for global surgery in the design of our study.
- ► We assumed that surgical specialties could be generalised to a single average disability weight which is a strong assumption given that overgeneralisation could result in an inaccurate representation of the spectrum of disability associated with the surgical conditions.
- ► We note that the perspective of this analysis (ie, programme) did not allow for assessing the cost-effectiveness from government or societal perspectives; accounting for issues such as affordability, budget fairness and feasibility would have provided a more comprehensive assessment.

INTRODUCTION

WHO estimates that half of the world's population lacks access to essential health services and that more than 100 million people face poverty due to medical expenses.[1] In middle-income countries (MICs), surgical interventions are critical to families, where a significant portion of family income could be absorbed by preventive and medical care.[2]Many families have little choice in where and how they seek medical treatment, leaving them unable to find less expensive care choices. Medical missions help fill this gap by providing surgical interventions through teams in a duration of 1–2 weeks. A recent study on paediatric surgical interventions in Kenya and Canada determined that surgical missions significantly lessen the disease's global burden for genetic abnormalities.[3] A similar study focusing on the impact of plastic surgery interventions in Ecuador analysed the outcomes of more than

1000 reconstructive cases. This study concluded that surgical interventions that tackle common and treatable diseases lead to substantial clinical and economic benefits.[4] Another study based in Uganda focused on the cost-effectiveness of infrastructure improvement. They found that a dedicated paediatric operating room is cost-effective if hospital space and personnel pre-exist to staff the facility.[5] Thus, quantifying paediatric surgical missions' economic impact deserves attention from researchers and policy-makers alike. Previous studies have assessed the impact of specific paediatric surgical procedures in resource-limited settings, but existing research lacks conclusions on projects with multi-specialty scopes.[6 7] Therefore, we add to the scarce evidence related to the value of short-term, recurrent paediatric surgical missions by analysing 18 years of World Paediatric Project (WPP) paediatric surgical procedures in St. Vincent and the Grenadines. WPP is a nonprofit organisation with a mission to help critically ill children and build healthcare capacity. The scope and nature of WPP's surgical work are outlined in online supplemental material section 1. The purpose of this study is to examine the economic effect of recurrent, short-term surgical care as part of the WPP sustained paediatric surgical programme in St. Vincent and the Grenadines from 2002 to 2019. We approached the question, 'Are specialised paediatric surgical interventions cost-effective compared with no surgery?' from a programme perspective and measured by disability-adjusted life-years (DALYs). This study assessed the relevant costs and benefits of conducting paediatric plastic surgery, neurosurgery, ophthalmic surgery, general paediatric surgery, urology and paediatric orthopaedic surgery using cost-effectiveness analysis (CEA) as an analytical framework.

METHODS

Patient and public involvement statement

Patients and public representatives were not involved in the research design or analysis of this study. This study was conducted in partnership with the WPP, and results will be disseminated through the WPP website to the public.[8]

Model design

We retrospectively collected clinical data from the WPP's database comprising 914 surgical procedures for children living in St. Vincent and the Grenadines over eighteen years. Six paediatric surgical interventions (ophthalmic, orthopaedic, plastic, general, urology, neurosurgery) were compared with no surgery from a programme perspective in a deterministic cost-effectiveness model implemented in Microsoft Excel. We applied standard microcosting methods to assign procedure-level costs detailed in the online supplemental material section 2 and tables 1-3). We assessed health benefits as averted DALYs. Univariate sensitivity analyses were conducted to assess the effect of uncertainty. Costs and health outcomes data were used to estimate incremental cost-effectiveness ratios (ICERs) of conducting paediatric plastic surgery, neurosurgery, ophthalmic surgery, general paediatric surgery, urology and paediatric orthopaedic surgery. Programme costs and outputs were tabulated from services initiated between October 2002 and September 2019 in US dollars (US$), when the data set was closed. Cost-effectiveness is reported as estimates of discounted (3%) and undiscounted DALYs averted by each surgical specialty. Disability weights for paediatric specialties were obtained by averaging values from Global Burden of Disease (GBD) studies,[9] and others[3 10–13] as outlined by Saxton *et al*.[14] Calculated averages are provided in online supplemental material section 3 and table 4. The following program-level variables were selected as possible predictors of programme efficiency: personnel, management, equipment, supplies, drugs, hospital facility, surgical teams, consultations that resulted in surgery and the associated surgery provided, and children who received surgery. These predictors are outlined in online supplemental material section 2 and tables 1–3.

Clinical data

The clinical dataset on which cost estimations were generated for this study comprises 914 surgical procedures for children living in St. Vincent and the Grenadines between October 2002 and September 2019. All surgical procedures in the dataset were performed by visiting paediatric specialists in St. Vincent and the Grenadines, coordinated through WPP's International Teams Programme, and reported to WPP by completing its designated operative note form. The clinical dataset was obtained retrospectively from WPP's database and was provided in a de-identified format for the study. There are 650 paediatric patients represented in the dataset. The difference in the number of patients vs surgical procedures is due to both patients receiving more than one procedure in the same period and patients receiving procedures years apart, indicating the longitudinal aspect of WPP's clinical data. Based on WPP's criteria for qualification of paediatric specialist services for its programmes, all surgical procedures provided by a visiting surgeon to a patient were included in the dataset if the first surgical procedure that the patient received from WPP was when the patient was 0–21 years of age. Thirty-four surgical procedures were excluded from the data set. Details on the procedure exclusion criteria are outlined in online supplemental material section 4.

Estimating costs

The costs of paediatric surgical intervention include direct expenditure for medical care and indirect costs. In this study, the direct expenditures for medical care include equipment, supplies and medications purchased by WPP and an estimate of the portion of WPP's overhead, management and development costs attributable to surgeries in St. Vincent. These costs also include medical volunteers' travel to St. Vincent and the Grenadines (airfare, lodging, in-country transportation and travel insurance), and a portion of WPP St. Vincent staff salaries as well as the documented value of donated volunteer time, equipment, supplies and medications as reported by donor companies. Indirect costs arising from morbidity and mortality, such as time costs, are commonly included in economic evaluations.[15] In this study, we only focused on the direct costs related to the surgical intervention, as the WHO recommends excluding indirect costs from the primary analysis but including them in the secondary analysis if available.[16]

All surgical procedures considered in this study were performed free of charge to the patients. The patients also had access to necessary preoperative, postoperative and inpatient care at the same public hospital where healthcare is provided within a free healthcare system, apart from nominal fees for medications for patients over 16. Because patients are not charged for these services, no billing system tracks the actual cost of the surgical procedures that WPP directly facilitates. There is no billing system between WPP and the host hospital to enable the facility's surgical procedures. Therefore, WPP conducted comprehensive accounting of individual resources required to deliver paediatric surgical interventions and assigned each a value using standard micro-costing methods.[17] In summary, WPP estimated a total cost for each surgical procedure in the clinical dataset, representing (1) the costs incurred by WPP to facilitate the team of medical volunteers, (2) WPP's operational costs and (3) an estimate of the market value of the medical volunteers' donated services and the host hospital's facilities. Microcosting methods must be clearly described as resources that are likely to be identified and categorised in diverse ways by researchers with varying analytic perspectives.[18] Additional details on microcosting methods, including tables outlining costs, are included in online supplemental material section 2.

Estimating benefits of paediatric surgical interventions

To quantitatively measure the impact of surgical care, the outcome was calculated as DALYs averted. In the context of this research, the DALY captures the impact of paediatric surgical intervention by measuring the shortfall from a healthy life. Five DALYs, for example, can be interpreted as 5 years of healthy life lost. Therefore, paediatric surgical intervention benefits can be described in terms of the DALYs averted by the surgical procedure. Although an imperfect measure criticised for not considering contextual variables,[19] the DALY is widely promoted by the World Bank and WHO.[20,21] Selecting DALYs averted as a measure of surgical care's impact provides results comparable to other burdens of disease studies and will help determine where paediatric surgical care fits within other global health priorities.[20]

In economic analyses, the predominant argument is that it is necessary to adjust the data because we value costs and benefits differently depending on when they occur.[17] For this reason, costs and benefits are discounted using a widely accepted standard discount rate of 3%.[17] However, this argument is controversial because it may overvalue the future costs and health benefits of interventions.[22] Therefore, we present DALYs in two ways: (1) DALYs without discounting and (2) DALYs with discounting. In both cases, we applied no age weighting. Disability weights are critical to the DALY calculation because a weighting factor is applied that reflects the severity of a disease on a scale from zero (perfect health) to one (death). Due to many surgical conditions and interventions, assigning disability weights and surgical care values is challenging.[20] Also, the impairment associated with each condition depends on social and cultural variables.[20] Ideally, disability weights specific to St. Vincent and the Grenadines, as well as WPP programmes, would be available. Given that these are unavailable, we adopted an alternative approach to calculating disability weights by taking a simple average for each specialty across multiple procedures. Disability weights for paediatric specialties were obtained by averaging values from GBD studies[10,23] and others,[3,11–13] as outlined by Saxton *et al.*[14] Average disability weights for paediatric surgical specialties ranged from 0.076 for orthopaedics to 0.562 for neurosurgery. The DALY calculation is provided in online supplemental material section 5. Developing a more rigorous methodological approach that uses the average value for disability weights and the value of surgical care could facilitate a more detailed analysis of surgical services.[20] At a minimum, further research could use a weighted average that considers the percentage of the total within each class of surgery associated with each of these procedures. This would require information on the percentage distribution of procedure type within each specialty unavailable in our data set.

Estimating cost-effectiveness

We divided the total costs by the total DALYs averted (discounted or undiscounted, respectively) to determine each surgical specialty's ICER. We also present the ICER for all interventions together. To determine whether the surgical intervention is cost-effective, the ICER is assessed against a general value. A commonly employed threshold to gauge the magnitude of the monetary estimates presented compares ICERs to 1–3 times gross domestic product (GDP) per capita.[16,24] In resource-constrained settings, this approach has significant shortcomings, including obscuring meaningful comparisons, easy attainment of thresholds, a reliance on untested assumptions, and inadequate appraisal of affordability.[25] Therefore, we adopted a more recent approach to determining cost-effectiveness by considering interventions with ICERs of <50% of St.Vincent and the Grenadines 2019 (GDP per capita; 0.5×US$7457.24=US$3736.91) to be cost-effective rather than the 1–3 GDP rule.[26,27] The use of half GDP per capita to estimate the cost-effectiveness has appeared in a paper assessing the cost-effectiveness of diagnostic HIV infection in South Africa.[28] In addition, the half of GDP per capita approach was referenced in the Disease Control Priorities three as an example in resource-limited settings.[29]

Table 1 Descriptive statistics of procedures

Characteristics		
No of procedures	914	
Mean age in years	7.94	
Age yrs (range)	0–24.25	
	Count	**Percentage**
Female	434	48
Male	470	51
Unknown	10	1
Medical specialty		
Plastic surgery	193	21
Neurosurgery	46	5
Ophthalmic surgery	255	28
Ped general surgery	141	15
Urology	54	6
Orthopaedic	225	25

RESULTS

Procedures

Of the 914 procedures (table 1), 48% were performed on females and 51% on males. The average age of patients during procedures was 7.94 years, with an SD of 5.96. The youngest recorded patient was less than 1 month at the time of their procedure, and the oldest was 24.25 years. WPP performed 46 neurosurgery procedures, 255 ophthalmology procedures, 225 orthopaedic surgeries, 141 general paediatric surgeries, 193 plastic surgeries and 54 urology procedures. Common procedures included strabismus correction, hydrocephalus shunting, hernia repair, spinal fusion and cleft palate repair.

Costs

Results are presented in 2019 US dollars (US$). The total cost of all 914 procedures conducted by the WPP in St. Vincent and the Grenadines was US$15 250 189.97, with an average cost per procedure of US$16 685 (table 2).

Table 2 Cost distribution (USUS$)

Characteristics	Value	Mean
No of procedures	914	
Total cost (US$)	US$15 250 189.97	16 685
Range (US$) (min-max)	US$9791.78–US$72 845.76	
Total gifts in kind (US$)	US$11 370 965.82	
Cost per medical specialty (US$)		
Neurosurgery	US$1 059 737.84	23 037.78
Ophthalmology	US$3 035 583.29	11 904.25
Orthopaedic	US$5 376 974.24	23 897.66
Ped general	US$2 287 408.19	16 222.75
Plastic surgery	US$2 673 862.54	13 854.21
Urology	US$16 623.87	15 122.66

Table 3 Estimates of averted DALYs

Surgical intervention	Total cases	DALYs (undiscounted)	DALYs (discounted)
Ophthalmic surgery	255	4818	1817
Orthopaedic	225	1374	544
Plastic surgery	193	2778	1075
Ped general surgery	141	4079	1544
Urology	54	272	106
Neurosurgery	46	1979	729
Total	914	15 300	5815

DALYs, disability-adjusted life years.

The lowest cost for a procedure was US$9791.78, with the highest being US$72 845.76. By total cost, the most expensive medical specialty was orthopaedic surgeries, which consisted of 35.3% (US$5 376 974.24) of the total cost for all the procedures. An orthopaedic procedure's average cost was US$23 897.66; these procedures were used to help relieve diagnoses of clubfeet, scoliosis and various other orthopaedic conditions. The medical specialty with the highest average cost per procedure was neurosurgery; however, this discipline saw the second-lowest total cost and the lowest number of procedures.

Estimated effects: DALYs averted

Table 3 provides estimates of discounted (3%) and undiscounted DALYs averted by each surgical specialty. There were 5815 total discounted DALYs averted by the six programmes. The top three (with 3% discounting) were ophthalmic surgery (US$1817), general paediatric surgery (US$1544) and plastic surgery (US$1075). Table 3 further shows that the surgical interventions together led to US$15 300 undiscounted DALYs averted, with ophthalmic surgery averting the most DALYs and urology averting the least.

Cost-effectiveness of paediatric surgeries

Table 4 presents the ICERs for each surgical specialty and all specialties together, with or without discounting both costs and DALYs. All financial data were standardised to 2019 using the World Bank's consumer price index conversion factors.[27] The undiscounted cost per DALY averted ranged from approximately US$551 for neurosurgery to US$4031 for orthopaedic surgery. The cost per DALY averted with discounting ranged from US$1453 for neurosurgery to US$9892 for orthopaedic surgery. Together, the cost per DALY averted is US$1027 without discounting and US$2622 with discounting. Most of the paediatric surgical conditions assessed are cost-effective with and without discounting, yielding cost per DALY estimates that are less than <50% of St.Vincent and the Grenadines 2019 GDP 2019 GDP per capita—only undiscounted orthopaedic surgeries had cost per DALY of more than 50% GDP per capita. With discounting,

Table 4 Incremental cost-effectiveness ratios						
	Undiscounted			Discounted		
Specialty	Total cost (2019 USD)	DALY	Cost per DALY averted	Total cost (2019 USD)	DALY	Cost per DALY averted
Cranofacial/plastic surgery	2 754 078.42	2778.00	991.39	2 673 862.54	1074.73	2487.94
Neurosurgery	1 091 529.97	1979.00	551.56	1 059 737.84	729.29	1453.10
Opthalmic surgery	3 126 650.79	4818.00	648.95	3 035 583.29	1817.20	1670.47
Ped general surgery	2 356 030.44	4079.00	577.60	2 287 408.19	1544.00	1481.48
Urology	841 122.59	272.00	3092.36	816 623.87	106.46	7670.64
Orthopaedic	5 538 283.47	1374.00	4030.77	5,376,974.24	543.58	9891.77
All cases	15 707 695.67	15 300.00	1026.65	15 250 189.97	5815.27	2622.44

DALYs, disability-adjusted life-years.

urology and orthopaedic surgeries exceeded the cost-effectiveness threshold.

Interventions with ICERs of <50% of St.Vincent and the Grenadines 2019 (GDP per capita; 0.5×US$7473.83=US$3736.91) were considered to be cost-effective

Sensitivity analysis

The base case ICER for the various paediatric surgical interventions were US$1453.10 for neurosurgery; US$1670.47 for ophthalmic surgery; US$9891.77 for orthopaedic surgery; US$1481.48 for general paediatric surgery; US$2487.94 for plastic surgery and US$7670.64 for urological surgery. A one-way sensitivity analysis was conducted to address uncertainty. The ICER variations are summarised as a table and tornado diagrams in online supplemental material section 6, table 5 and figures 6.1-6.6. The ICER's most influential drivers are the lower-bound disability weights in paediatric surgeries and discounting at 5% with no age weighting.

Building on local infrastructure

WPP coordinates paediatric surgical missions to St. Vincent and the Grenadines because the country's population is too small to generate the caseload necessary to attract and retain dedicated paediatric specialised surgeons. While partnering with the Ministry of Health to administer a surgical fellowship is beyond the scope of WPP's mission, the organisation does partner with local surgeons to provide equipment and operate in emergencies when paediatric specialists are not available. WPP teams also invite surgeons from other Eastern Caribbean regions to take part in surgical missions. Recognising the limitations of developing genuinely sustainable local paediatric surgical practices in small-population settings, the WPP model has evolved to serve as a critical complement to the local healthcare system's surgical services, with the surgical training and development for local providers as an additional targeted benefit provided to the country.

DISCUSSION

According to the World Bank, St. Vincent and the Grenadines moved from a lower-MIC to upper-MIC in 2003.[30] However, given very small population sizes and geographical isolation, these Eastern Caribbean countries are incredibly resource-constrained from the standpoint of health resources, even if the national Gross national income (GNI) reflects a higher classification. For example, St. Vincent and the Grenadines lacks advanced diagnostic imaging, paediatric surgical subspecialists, and paediatric intensive care, all of which one would expect to see in a non-resource constrained health system. This analysis establishes the cost-effectiveness of most WPP surgical interventions in St. Vincent and the Grenadines compared with no surgical intervention. The results demonstrate that short-term, recurrent paediatric surgical interventions can yield substantial economic benefits in this limited resource setting. Other studies have found that paediatric surgical interventions are highly cost-effective in other resource-constrained settings, including Africa, Asia, Latin America and the Caribbean.[3 11 14 21 31–33] However, like Hughes *et al* our study focuses on the cost-effectiveness of surgeries undertaken by charitable organisations.[4] A recent systematic review of charitable surgical platforms found that short-term temporary surgical missions should be limited to areas and conditions for which no other surgical delivery platform is available.[34] Our results indicate that WPP generates economic benefits that outweigh the programme and other costs associated with such interventions in St. Vincent and the Grenadines. In the case of WPP, surgical teams that deliver the interventions are mainly based in the US. The costs associated with such teams could be relatively higher than for teams based at the location of interventions. That could explain the somewhat higher ICER in our study, compared with those from other studies elsewhere of under approximately US$2020 (2015 US$) per DALY averted for 29 studies reported in Saxton.[14] In order to determine cost-effectiveness, our ICERs were evaluated against a predefined decision rule. We adopted half of GDP per capita as a rule of thumb to estimate the cost-effectiveness based on significant shortcomings in the 1–3 GDP per capita approach.[25 26] According to recent research by Ochalek, applying a 3× GDP per capita approach to assess the cost-effectiveness of interventions results in an underestimate of health opportunity costs for 100% of upper-MICs such as St.Vincent and the Grenadines, and 1× GDP per capita underestimates health opportunity costs for 87% for these countries. Adoption of a 1–3 GDP per capita approach can result in decisions that, according to Ochalek, 'displaces more health than (the interventions) generate.'[35] Using a 0.5× GDP per capita approach minimises this bias and more accurately reflects health opportunity costs in that these costs are only underestimated in 31% of upper-MICs.[35] That notwithstanding, majority of the ICERs in St. Vincent and the Grenadines still represent good value for money, even after accounting for changes in disability weights and discount rates.

There are vast disparities in the methodology used to establish the cost-effectiveness of global surgery.[15 36] To increase the methodologic rigour and to encourage the reconciliation of the differences among divergent guidelines in the field of global surgery CEAs, we employed Shrime's checklist for global surgery in the design of our study (online supplemental material section 7 and table 6).[15] Of course, there are limitations to this type of research, including dependence on a range of assumptions. It is essential to denote the assumptions under which the primary analysis was performed. We assumed that every child who received surgery was cured without complications. This assumption was based on the observed rates of complications in the past 5 years. A frequent criticism of medical mission trips is the lack of follow-up that occurs post-operatively, as the travelling surgeons leave shortly after their cases and cannot follow these patients long-term to take care of complications. WPP has prioritised ongoing programme monitoring and evaluation as a key component of programme operations by using a custom-designed database to track all patients up to the age of 21. This database is also a key reporting source for ongoing programme monitoring and quality improvement, disease trend analysis and strategic decision making about new programme development. This quantitative data are coupled with qualitative information acquired through surveys, questionnaires, and ongoing dialogue with patients, partners and other stakeholders. Patient follow-up is generally managed through existing relationships with paediatricians or specialists.

In most cases, referrals come from the patients' physicians, and those practitioners generally manage immediate postoperative follow-up care. In-country staff also follow-up on postoperative imaging/lab requests and ongoing consultation with WPP treating physician regarding patient follow-up and any specific issues that arise throughout the year. WPP volunteers also provide telehealth services to ensure adequate follow-up and positive outcomes. Longer term, many patients will return for consultation with WPP volunteer physicians during future surgical missions or be referred to advanced care in the US. In nearly all cases, WPP is aware of a patient's death. In most cases of serious postoperative complications, WPP is also aware. This assumption was based on the observed rates of complications in the past 5 years. A significant limitation to highlight is the selection of disability weights used in this analysis. We assumed that surgical specialties could be generalised to a single average disability weight which is a strong assumption given that overgeneralisation could result in an inaccurate representation of the spectrum of disability associated with the surgical conditions. This approach does alleviate some methodological limitations by providing consistency in categorisation by surgical specialty; it is not a perfect solution. Ideally, disability weights specific to St. Vincent and the Grenadines, as well as WPP programmes, would be available.

Given that these are unavailable, we adopted an alternative approach to calculating disability weights by taking a simple average for each specialty across multiple procedures. The references for disability weights are provided in online supplemental material section 8. At a minimum, further research could use a weighted average that considers the percentage of the total within each class of surgery associated with each of these procedures. This would require information on the percentage distribution of procedure type within each specialty unavailable in our data set. To explore how sensitive our ICERs are to the choice of disability weights, we varied the weights (using minimum and maximum for the categories) in the sensitivity analysis. Finally, we assumed that patients are de facto travelling to the US to get surgery under US surgical costs. Calculating paediatric surgical interventions' costs requires that information be available on all significant direct expenditures and indirect costs. No such comprehensive data are available. We attempt to derive a roughly comparable cost to what similar services would cost in the US. More rigorous, detail-informed methodologies are warranted, therefore, cost estimates should be viewed as a starting point for the sensitivity analysis. The WPP used a microcosting framework led by a physician experienced in the healthcare revenue cycle to obtain the best possible cost data. The team measured this data's credibility using procedure documentation from surgical teams and facilities and consulted with medical practices to validate these estimates against averages of the physician and hospital systems reported values of services provided. Most of the potential variation in costs comes from the estimates of our medical volunteers' donated services which were self-reported and may bias the results by being overestimated.

Next, we focus on the limitations of the methodological approach; this analysis may underestimate paediatric surgical intervention benefits since the CEA's analytical structure is only designed to reflect the DALY. A DALY-based approach estimates future disability diverted after a surgical intervention but fails to capture the years lived with an untreated disability before the intervention occurred.[37] Finally, we note that this analysis's perspective (ie, programme) did not allow for assessing the cost-effectiveness from government or societal perspectives, though accounting for issues such as affordability, budget fairness, and feasibility would have provided a more comprehensive assessment.[38]

In conclusion, we reviewed the data and calculated the averted DALYs and cost-effectiveness for paediatric surgical procedures performed by WPP. We found that short-term, recurrent surgical interventions can yield substantial economic benefits in this limited resource setting. Results indicate that large health gains have been achieved, by alleviating the health burden that faces the patients WPP treats, in interventions that represent good value for money. These results support the need to scale up surgical services for children as an essential component of addressing the total GBD.

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