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Funding Flows to Global Surgery: A Retrospective Analysis of Contributions from the United States

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Abstract

Objective: In recent years, funds for global health have risen dramatically. The funds available for global surgical delivery, capacity building, and research are unknown and presumed to be low. Meanwhile, conditions amenable to surgery are estimated to account for between 11% and 28% of the global burden of disease. We aimed to describe funds given to these efforts from the United States, the world's largest donor nation.

Design: Retrospective database review. United States Agency for International Development (USAID), National Institute of Health (NIH), Foundation Center, and registered U.S. charitable organizations databases were searched for financial data on any organization giving exclusively to surgical care in low-and-middle-income countries (LMICs). For USAID, NIH and Foundation Center all available data for all years were included. The five most recent years of financial data per charitable organization were included. All nominal dollars were adjusted for inflation by converting to 2014 U.S dollars

Setting: United States

Participants: USAID, NIH, Foundation Center, Charitable Organizations

Primary and Secondary outcome measures: Cumulative funds appropriated to global surgery

Results: Twenty two NIH funded projects (totaling \$31.3 million) were identified, primarily related to injury and trauma. Six relevant USAID projects were identified--all obstetric fistula care totaling \$438 million. A total of \$105 million was given to universities and charitable organizations by U.S. foundations for 12 different surgical specialties. Ninety-five U.S. charitable organizations representing 14 specialties totaled revenue of \$2.67 billion and expenditure of \$2.5 billion.

Conclusions and Relevance: Current funding flows to surgical care in LMICs are poorly understood, in part because they cannot be easily measured. U.S. funding predominantly comes from private charitable organizations, is often narrowly focused and does not always reflect local needs or support capacity building. Improving surgical care, and embedding it within national health systems in LMICs, will likely require greater financial investment. Tracking funds targeting surgery helps not only quantify and clarify current investments and funding gaps, but ensures resources materialize from promises, and promotes transparency within global health financing.

Strengths and limitations of this study:

- This was the first known attempt to track and quantify funds appropriated to surgical care in LMICs.
- Lack of streamline accounting processes and classification terms make it challenging to identify funds towards global surgery.
- There are inherent limitations in keyword searches of large databases, perhaps missing data points.

INTRODUCTION

Surgical care is an important component of a functioning health system for all countries. Conditions requiring surgical care – including maternal and neonatal conditions, digestive diseases, cancers, congenital abnormalities and injuries -- account for 11-30% of the global burden of disease [1-3]. Much of the morbidity and mortality from surgical conditions in low-and-middle-income countries (LMICs) could be averted through improved access to surgery [4]. Yet surgery has remained a low priority on the global health agenda as well as the national health agenda in most LMICs. As a result, population access to surgical care is poor, and surgical systems in LMICs remain severely under-resourced [5-8]. This neglect of surgery is despite evidence of its cost-effectiveness in low resource settings [9 10]. To improve surgical care and outcomes in the world's poorest regions, greater financial investment is likely required. However, little is known about current financing flows to surgery in LMICs, making it difficult to quantify funding shortfalls, or to determine how donors may be influencing the availability and distribution of surgical services.

Over the past 15 years, financial aid for global health has been on the rise [11-15]. In 2013, \$31.3 billion was provided to development assistance for health (DAH) [11]. The amount of DAH targeted to surgical care is unclear, because DAH databases do not specifically collect data on surgical services, and many funders only report investments using broad, aggregated classifications.

The United States is among the top five leading donors to global health[15]. In 2012, USAID (the United States Agency on International Development) spent \$5.5 billion on health, ranking it the highest funded program area[16]. In addition to funding directed through international development agencies, the U.S. also funds biomedical research and training in global health. For example, the National Institutes of Health (NIH), the U.S. federal agency of biomedical and health research, operated a budget of almost \$30 billion in 2013, nearly the global aggregated sum of DAH in 2013[11 17]. However, in the same year, the Fogarty International Center, the NIH's global health institute, received only \$65.7 million of that \$30 billion budget (0.22%) [17]. Given the sheer scale of U.S. global health funding, understanding U.S.-derived funding flows to surgery in LMICs can offer important insights into how DAH targets surgical care. We conducted a retrospective database review in an attempt to estimate how much DAH flows from the U.S. to surgical services in LMICs.

METHODS:

Conceptual Framework and Data Sources

We identified four major funding channels from which we can estimate resources allocated to surgical efforts in low resource settings. These include U.S. charitable organizations, foundations, USAID, and the NIH.

Charitable Organizations

The non-profit and volunteer sector, which charitable organizations fall under, is a significant economic sector; its growth has outpaced GDP growth by 20%[18]. In 2013 alone, charitable organizations accounted for 15.7% of overall donations to DAH [11]. Such organizations provide as much as 55% of surgical care in some LMICs [19]. In this study we included charitable organizations that provide exclusively surgical care and no other services in LMICs. We defined charitable organizations as non-profit, non-governmental organizations that serve public interest. The included organizations represent the spectrum of platforms for surgery described by Shrimel et al: short-term trips, specialized hospitals, and self-contained platforms [1]. Although these organizations may receive their funding from a variety of sources including private donations, grants, government contracts, and user fees, we are only able to track aggregated funds that are reported on federal tax form 990 (our data source).

Charitable organizations that provide exclusively surgical care were identified from the surgical volunteerism listings on numerous websites (Table 1). Next, each listed organization website was reviewed to insure adherence to inclusion criteria of providing exclusively surgical care in LMICs. Tax records (Form 990) provide information on the organization's revenue and expenses and were retrieved either from the organization website or from electronic sources listed in Table 1.

Table 1: Summary of Data Source and Research Methods

Funding Channel	Definition	Data Source	Methods to Identify Funds towards Global Surgery
Foundations	Non-governmental entity that is established as a	Foundation Center Online Directory	All database keyword search combinations of the following

	nonprofit corporation or a charitable trust, with a principal purpose of making grants to unrelated organizations, institutions, or individuals for scientific, educational, cultural, religious, or other charitable purpose		words: key word searches with combinations of “global,” “international,” “low resource,” “developing countries/nations” “research” and “surgery,” “obstetrics and gynecology,” “obstetric fistula,” “trauma,” “injury,” “congenital birth defects,” “cleft lip/palate,” “cataract,” “ophthalmology,” “burn,” “reconstructive,” “urology,” “orthopedics,” “club foot,” “neurosurgery,” “hydrocephalus,” “anesthesia,” “cardiac,” and “ENT”; manual review of results to assure it was solely related to surgical capacity building, delivery, research, and training.
Charitable Organizations	Non-profit, non-governmental organizations that serve public interest; many of which qualify for tax credits. These organizations may receive their funding from a variety of sources including private donations, grants, government contracts, and user fees.	Organization Identification: American College of Surgeons Operation Giving Back, the Society of Pediatric Anesthesiologists, OmniMed, Foundation Center Online Directory, U.S. State Department Private Volunteer Organizations registry Form 990: Guidestar, ProPublica, Economics Research Institute, Citizenaudit.org, National Center for Charitable Statistics at the Urban Institute, and the Foundation Center Online Directory	Verification of meeting definition criteria by checking each organization website that was listed on the data source websites.
USAID	United States Agency for International Development, U.S. government agency focusing on foreign assistance to developing countries	USAID website interactive project mapper	Manual review of each of the 524 projects listed on the online global health interactive project mapper.
NIH	National Institute of Health: U.S.- medical research agency from the department of health and human services	NIH online RePORTER	Selection of all fiscal years, selection of all LMICs from drop down menu, following keyword searches for all project descriptions search box: “surgery,” “obstetrics and gynecology,” “obstetric fistula,” “trauma,” “injury,” “congenital birth defects,” “cleft lip/palate,” “cataract,” “ophthalmology,” “burn,” “reconstructive,” “urology,” “orthopedics,” “club foot,” “neurosurgery,” “hydrocephalus,” “anesthesia,” “cardiac,” and “ENT”; manual review of all

			project to assure it was solely related to surgical capacity building, delivery, research, and training.
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U.S. Foundations

Health is the single largest focus issue of U.S. foundations, who provide billions of dollars annually in philanthropy [20]. A foundation is “a non-governmental entity that is established as a nonprofit corporation or a charitable trust, with a principal purpose of making grants to unrelated organizations, institutions, or individuals for scientific, educational, cultural, religious, or other charitable purposes”[21]. Foundations are different from the charitable organizations described above in that the latter are both funding channels and implementation agents. In contrast, foundations are simply the grantmakers; they do not implement a service. Foundations are further classified as independent, operating, community, corporate, as defined in Table 2. The Foundation Center Online Directory (FCOD) is a comprehensive digital library that archives grants made and received by foundations and non-profit organizations. The professional FCOD subscription was used, which has over three million grants covering the last ten years of their database.

Table 2: Classification of Foundations

Type of Foundation	Description	Example
Independent Foundation	General category that usually includes foundations established by individuals and families	Bill and Melinda Gates Foundation
Operating Foundation	Foundations that are able to make grants and financial contributions to other non-profit organizations but primarily run their own program.	Lavelle Fund for the Blind is a non-profit organization that provides a broad range of services for people who are blind. This organization also has donated funds to other organizations that work with this same population.
Community Foundation	Foundations organized by public communities that raise money from the general public	The San Diego Foundation
Corporate Foundation	Foundations established by businesses but are legally separate entities from the main business	Bank of America Foundation

U.S. Government Agencies

USAID’s investment in global health is consistently ranked a top agency funding priority [22]. The NIH is the world’s largest supporter of biomedical research. In fact, one of the 27 institutes is the Fogarty International Center, which is dedicated to training scientists and enhancing research in LMICs. Together, these two agencies are the biggest U.S. government investors in global health. Both USAID and the NIH have online searchable databases chronicling their funded projects, including financial allotment. The NIH has project data from 1990. USAID’s project database begins in 1992.

Research Methods:

We constructed a separate database for each funding channel. USAID and NIH databases provided project-level information on actual disbursed funds. For foundations, grant details including amount, grant recipient, and specified use of funds were extracted. The grants were categorized for surgical specialty supported and the specified purpose of the funds (e.g. earmarked dollars). We extracted data on total revenue and the breakdown of total expenditure from the Forms 990. Due to data limitations, the most current five years of tax forms were collected for each organization. The charitable organizations were categorized by type of surgical service they provide. All nominal dollars were adjusted for inflation by converting to 2014 U.S dollars (USD) using the IMF World Economic Outlook database (downloaded in April 2014). Table 1 summarizes the data sources and detailed research methods.

RESULTS

U.S. Charitable Organizations

Tables 3a and 3b describe the total revenue and expenditure for 95 U.S. charitable organizations providing exclusively surgical care over the years 2007-2013, expressed in 2014 USD. The total revenue was \$2.14 billion, while total expenditure was \$2.53 billion 2014 USD. Total program expenditures were \$2.14 billion

2014 USD while total management costs were \$88.72 million. Notably, the data are skewed towards the years 2008-2012 due to limited data availability. Similarly, not all tax forms required itemized management expenses, so the \$88 million figure is a lower bound. The service expense/total expense measure is the proportion of funds spent on program services. The median range is 0.71 to 1. On an average aggregated level these organizations spend anywhere from 71% to 100% of their funding on executing their programs. Ophthalmology and cleft lip/palate care were the top two most funded specialties accounting for more than 75% of the total revenue while only accounting for 20% of the total organizations. Overall, 84% of the total expenses were on program services costs and the remaining 16% on other costs such as management, administration, and fundraising.

Table 3a: Summary of Total Revenue and Expenditure for 95 U.S. Charitable Organizations Committed Exclusively to Surgical Care in LMIC over 2007-2013 in 2014 U.S. Dollars.

Type of Surgery	Number of Organizations	Total Revenue (Sum)	% of Total	Total Expenses (Sum)	% of Total
Ophthalmology	11	\$1,256,253,010.50	47.21%	\$1,217,295,102.00	48.54%
Cleft Lip/Palate	8	\$819,720,317.98	30.39%	\$717,832,939.70	28.25%
Mix	14	\$283,748,366.10	10.63%	\$303,464,510.20	12.03%
Orthopedics	14	\$85,964,691.80	3.24%	\$80,620,765.84	2.69%
Cardiac	15	\$75,604,257.66	2.84%	\$71,826,159.55	2.86%
Pediatric	8	\$54,621,294.05	2.05%	\$48,121,042.56	1.99%
Reconstructive	10	\$48,305,681.69	1.80%	\$50,260,266.41	1.92%
Obstetric Fistula	8	\$24,651,950.52	0.93%	\$23,198,973.80	0.93%
Neurosurgery	2	\$11,915,392.06	0.45%	\$10,601,253.93	0.42%
Urology	1	\$4,893,374.11	0.19%	\$4,191,093.97	0.17%
ENT	1	\$3,493,169.92	0.13%	\$566,978.10	0.02%
Craniofacial	1	\$3,121,609.25	0.12%	\$3,844,568.83	0.15%
Burn	1	\$423,291.11	0.02%	\$348,710.23	0.01%
General	1	\$283,546.77	0.01%	\$236,555.18	0.01%
All	95	\$2,672,999,953.50	100.00%	\$2,532,408,921.00	100.00%

Table 3b: Breakdown of Expenditure for 95 U.S. Charitable Organizations Committed Exclusively to Surgical Care in LMIC over 2007-2013 in 2014 U.S. Dollars.

Type of Surgery	Total Program Service Expenses (Sum)	% of Total	Total Management Expenses (Sum)	% of Total	Service Expense/Total Expense (Median)
Ophthalmology	\$1,146,905,574.00	54.30%	\$25,232,021.67	27.72%	0.903736607
Cleft Lip/Palate	\$501,356,549.10	23.40%	\$27,124,232.84	29.91%	0.781596521
Mix	\$253,328,682.50	11.93%	\$18,558,637.91	20.37%	0.890432927
Orthopedics	\$74,106,734.52	2.65%	\$2,988,617.99	5.66%	0.851596868
Cardiac	\$59,824,911.09	2.83%	\$5,198,179.02	5.74%	0.857549949
Pediatric	\$38,866,267.74	1.84%	\$1,852,283.99	4.87%	0.837718153
Reconstructive	\$39,263,691.25	1.84%	\$4,459,333.64	2.05%	0.781690431
Obstetric Fistula	\$18,275,700.71	0.87%	\$1,935,357.54	2.14%	0.817607482
Neurosurgery	\$116,048.07	0.01%	\$11,283.36	0.01%	0.884690813
Urology	\$2,944,251.58	0.14%	\$843,406.30	0.94%	0.715213402
ENT	\$460,631.72	0.02%	\$106,003.33	0.12%	0.996284445
Craniofacial	\$3,361,305.62	0.16%	\$384,823.62	0.42%	0.871443206
Burn	\$279,259.59	0.01%	\$22,984.77	0.03%	0.967953626
General	\$236,554.13	0.01%	\$0.00	0.03%	1
All	\$2,139,326,162.00	100.00%	\$88,717,165.99	100.00%	

U.S. Foundations

The FCOD search yielded 1,250 grants awarded to 82 different organizations (2 universities and 80 charitable organizations) between 2003-2013. These grants were made by 470 foundations and totaled \$105.7 million. Reconstructive surgery, cleft surgery, and obstetric fistula repair were the specialties that received support from all 6 categories of foundations. Nearly half of community foundation grants (39.6%) were given to reconstructive surgery (\$992,730). The remainder was split among all other specialties. Ophthalmology (\$6 million) and cleft surgery (\$5.6 million) *each* received more than 40% of the corporate foundation funds with the remainder divided among all specialties. Cleft surgery accounted for 93% of grants made by uncategorized independent foundations. Similarly, 92% of all donations by operating foundations were given to ophthalmology organizations. Likewise, reconstructive surgery accounted for 84% of public charity funds. Obstetric emergency conditions (those requiring urgent surgical care, such as C-section) were exclusively funded by independent foundations.

Table 4 shows the total amount of funding received by different specialties. The “other” category includes neurosurgery, urology, anesthesia, mixed specialty surgical teams, and unspecified specialty. Cleft surgery (\$34 million) and ophthalmology (\$40.9 million) account for 70% of the total donated funds.

Surgical delivery (\$35 million) and unspecified donations (\$26.1 million) account for nearly 60% of all funds given. Infrastructure (\$1.7 million) encompasses equipment, supplies, and surgical center /operating room establishment. Surgical training (\$7.1 million) refers to training local surgical providers.

Research (\$14.6 million) includes funds for evaluating surgical conditions and postoperative outcomes. Notably, \$11 million of the \$14.6 is a single grant on postoperative outcomes of trichiasis surgery in Africa. Other items in this category include conferences. Low cost technology and innovation (\$13.2 million) include developing tools to reduce or prevent fatal post-partum hemorrhage, producing a pulse oximetry probe for mothers undergoing C-section, and creating low cost orthopedic prosthesis. Advocacy (\$42,223) refers to patient outreach, in this case for women suffering from obstetric fistulas.

Operations management (\$8 million) is the operational costs of running an organization, including the costs associated with fundraising.

Table 4: Total Amount of Funding from Foundations Distributed by Surgical Specialty 2003-2013.

Surgical Specialty	Total Funding	% of Total
Ophthalmology	\$40,932,280.64	38.70%
Cleft	\$34,052,712.59	32.20%
Obstetric Emergency	\$12,815,112.89	12.12%
Reconstructive	\$7,461,168.91	7.05%
Obstetric Fistula	\$5,535,578.79	5.23%
Cardiac	\$1,546,149.91	1.46%
Orthopedic	\$1,134,262.60	1.07%
Burn	\$854,992.59	0.81%
Other	\$522,695.56	0.49%
General	\$330,933.61	0.31%
Mix	\$234,182.96	0.22%
Anesthesia	\$208,676.39	0.20%
Pediatric	\$117,121.43	0.11%
Neurosurgery	\$23,527.52	0.02%
All	\$105,769,396.40	100.00%

USAID

Six projects (executed between 2006-2013) were identified as related to surgical conditions, all concerning obstetric fistulas. With the exception of Bangladesh, all projects were in Sub-Saharan Africa. The total funds allocated were \$438 million.

NIH

Twenty-two different research projects were funded between 1991-2014, totaling \$31.3 million. Only four projects were *not* related to trauma (3 general surgery and 1 ophthalmology). Despite trauma accounting for nearly 80% of projects, it only accounted for 50% of total funds awarded. General surgery comprised 12% of projects but amassed nearly one third of funding (31.6%). Ophthalmology, the most funded specialty in the private sector, only accounted for 18.4% of NIH funding.

Africa (30.5%) and Latin America (32%) account for nearly two-thirds of these funded projects. The remaining one-third is devoted to the regions of Eastern Europe (10.9%), the Middle East (8.6%), Southeast Asia (8.6%), and global (unspecified region, 9.4%). Two projects comprised this global region. One was the development of a low cost negative pressure wound therapy system for LMICs. The second was the many years of the National Eye Institute's (NEI) contribution to the WHO's Prevention of Blindness program. Although the Fogarty International Center was the main grant administrator and funder, six other institutes and offices also made significant contributions – the Office of the Director, National Eye Institute, National Heart Lung and Blood Institute, National Institute of Alcohol Abuse and Alcoholism, National Institute of Biomedical Engineering and Bioimaging, and the National Institute of Child Health and Human Development.

DISCUSSION:

The aim of this study was to describe funding flows to global surgery via private charitable and public channels from the United States. We found that while detailed information regarding funding flows to surgical care is limited, two patterns emerged from the available data. First, the private charitable sector contributed significantly more funds than did the government sector. Second, there are clear donor preferences for surgical specialties and services.

The U.S. non-profit private sector is an important funder of global surgery—thus it is a powerful stakeholder to be engaged in advocacy for greater funding towards global surgery. From the foundation perspective, those classified as family/individual foundations account for nearly three-quarters of total funds donated, while corporate foundations support an eighth of funds. This skewed distribution, in which family and individual foundations are dominant, may explain why certain surgical specialties receive the most funding—these foundations are not publicly accountable, but are governed by individuals or families who are free to decide their priorities. A key guiding principle of the Bill & Melinda Gates Foundation, for example, is that it is “driven by the interests and passions of the Gates family”[23]. Our study found that together, ophthalmology and cleft surgery account for nearly three-fourths of funding among surgical specialties. Moreover, elective surgery is favored over emergency care. Surgical delivery and operations management were the top two specified reasons for fund allocation. In contrast, local capacity building, such as infrastructure and surgical training, was among the least funded areas of surgery. Notably, a significant portion of funds was also unspecified. It is not possible to determine where these funds were spent, but it is possible some may have been used for capacity building.

A similar pattern exists with U.S. charitable organizations, which account for the largest funding stream for global surgery. Disbursements from these organizations also favor elective procedures and surgical care delivery. Most frequently, these services are provided through short-term, narrowly focused interventions. There is less assistance given to emergency surgical care and training local staff. Ophthalmology accounts for over half of the funding from U.S. charitable organizations (54%), while cleft/lip palate (23%) and mixed services (12%) make up the next biggest proportion. Every other specialty receives less than 3% of total charitable organization funding.

Funding for surgical care in LMICs amongst U.S. foundations and charitable organizations appears poorly aligned with the burden of surgical conditions in LMICs, focusing mainly on vertical programs in ophthalmology and cleft care. Educating donors and charitable organizations about the most pressing global surgery needs and emphasizing comprehensive sustainable care may facilitate closer alignment of funding with local needs.

Likewise, USAID appears to be focused on obstetric fistula work and the NIH is heavily skewed towards trauma. Both contribute very small proportions of their budgets to surgical conditions in LMIC.

There are several study limitations. First, though the U.S. provides global health funding via other avenues like UN agencies and PEPFAR, the proportion of that funding for surgery could not be determined. Therefore, these channels were excluded. Similarly, some broad NIH grants like the Medical Education Partnership Initiative (MEPI) and the Fogarty Training grants were excluded due to inability to ascertain exact proportions spent on

1
2
3 surgical education and training. Additionally, USAID supports projects focusing on health system strengthening
4 (HSS) and health workforce issues. The exact quantities of these project funds that specifically go towards
5 surgery could not be determined, so they were omitted. However, in 2014, only 3% (\$250 million) of all USAID
6 DAH was for HSS, and very little of that was targeted at strengthening surgical services [24].
7

8 One potentially useful future strategy to try estimating funding flows to surgery would be the application of a
9 modified form of the “Muskoka methodology”[25]. In trying to assess how much funding goes to women’s and
10 children’s health (WCH), the same challenge occurred in that these funds were not precisely tracked, although it
11 was clear that plenty of funding given to other tracked areas were directly benefiting WCH. The Muskoka
12 methodology was developed in response. It imputes the proportion of categorized funding that directly benefits
13 WCH by 1) directly asking multilateral organizations to estimate percentage of funds benefiting WCH and 2)
14 for bilateral aid, using existing demographics and its relation to disease burden and mortality. The latter
15 approach may still pose some challenges, as not all the existing linkages necessary for the imputations are
16 available for surgery as they are for WCH.

17 A second limitation is that the foundation data are limited to only the organizations listed in FCOD. Any
18 foundation that funds global surgery not listed were not included in these results. The timeframe is also limited
19 due to data availability (begins in 2003 and finishes with a few documented funds for 2013).
20

21 Third, the U.S. charitable organizations’ data only includes those that provided exclusively surgical care and no
22 other service. There are many other charitable organizations (e.g. Partners in Health) that in some countries
23 provide a significant amount of surgical services in addition to other forms of medical care and developmental
24 aid. However, their financial documents do not indicate the portion of their funds allocated to surgery as
25 opposed to other activities, thus they were excluded. Nonetheless, it is important to acknowledge that many such
26 organizations exist and provide invaluable efforts to advancing global surgery. Furthermore, we excluded
27 organizations for which financial data were not available. Perhaps such organizations were not officially
28 registered as charitable entities and thus were not required to provide forms 990. Likewise, only funds
29 accounted for on the federal tax form 990 are tracked and included in this study. Any additional funds received
30 but not included on the 990 are not accounted for.

31 Fourth, in order to obtain aggregate funds across channels, it is vital to address double counting. However, in
32 this paper we do not aggregate across channels, thus we did not adjust for double counting. Due to the nature of
33 our data the main areas vulnerable to double counting would be funds that foundations contributed to charitable
34 organization. Specifically, we know that some of the funds accounted for in the \$105 million contribution from
35 foundations are also included in charitable organizations’ revenues of \$2.67 billion.
36

37 Lastly, there are inherent limitations related to keyword searches, particularly in the absence of a standardized
38 means for classifying and describing surgical care. It is possible that funds allocated to global surgery were not
39 picked up with the keywords employed in our search.

40 It is beyond the scope of this research to determine precisely how much DAH should target surgical care. Since
41 the cost-effectiveness, cultural appropriateness, and availability of interventions vary across different contexts it
42 does not follow that funding should not perfectly match disease burden. Still, cost-effective surgical
43 interventions seem to be receiving strikingly little attention from donors.
44

45 Our study has two conclusions. First, as evidenced by the limited data sources, better tracking of all external
46 financing sources in global health is required, including disaggregation of expenditure within budgets. This
47 tracking is not aimed at encouraging vertical programming and funding, but is required for quantification of
48 funding gaps for clinical services such as surgery; to ensure that resources materialize from promises; and to
49 encourage accountability and transparency. Second, we have shown that within the data limitations, U.S.
50 funding does not wholly align with what is currently understood about surgical need in LMICs.

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53

54 **Competing interests:** We have read and understood BMJ policy on declaration of interests and declare that we
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Author Contribution: LG, MGS, AJD, JGM all contributed to the design of the study. LG did the data collection and analysis. All authors contributed to data interpretation. All authors contributed to writing and editing the manuscript. All authors have seen and approved the final version of the manuscript for publication.

For peer review only

REFERENCES:

1. Shrime MG, Sleemi A, Ravilla TD. Charitable Platforms in Global Surgery: A Systematic Review of their Effectiveness, Cost-Effectiveness, Sustainability, and Role Training. *World journal of surgery* 2014 doi: 10.1007/s00268-014-2516-0[published Online First: Epub Date]].
2. Debas H GR, McCord C, Thind A. *Surgery*. 2nd ed. New York: Oxford University Press, 2006.
3. Shrime M.G. BSW, Alkire B.C., Mock C. . Thirty percent of the global burden of disease is surgical. . *Lancet Global Health* 2015
4. Bickler S. The Global Burden of Surgical Conditions. In: Kruk M, ed. DCP3, 2015.
5. Choo S, Perry H, Hesse AA, et al. Assessment of capacity for surgery, obstetrics and anaesthesia in 17 Ghanaian hospitals using a WHO assessment tool. *Tropical medicine & international health : TM & IH* 2010;**15**(9):1109-15 doi: 10.1111/j.1365-3156.2010.02589.x[published Online First: Epub Date]].
6. Knowlton LM, Chackungal S, Dahn B, LeBrun D, Nickerson J, McQueen K. Liberian surgical and anesthesia infrastructure: a survey of county hospitals. *World journal of surgery* 2013;**37**(4):721-9 doi: 10.1007/s00268-013-1903-2[published Online First: Epub Date]].
7. Linden AF, Sekidde FS, Galukande M, Knowlton LM, Chackungal S, McQueen KA. Challenges of surgery in developing countries: a survey of surgical and anesthesia capacity in Uganda's public hospitals. *World journal of surgery* 2012;**36**(5):1056-65 doi: 10.1007/s00268-012-1482-7[published Online First: Epub Date]].
8. Notrica MR, Evans FM, Knowlton LM, Kelly McQueen KA. Rwandan surgical and anesthesia infrastructure: a survey of district hospitals. *World journal of surgery* 2011;**35**(8):1770-80 doi: 10.1007/s00268-011-1125-4[published Online First: Epub Date]].
9. Chao TE, Sharma K, Mandigo M, et al. Cost-effectiveness of surgery and its policy implications for global health: a systematic review and analysis. *The Lancet Global Health* 2014;**2**(6):e334-e45 doi: 10.1016/s2214-109x(14)70213-x[published Online First: Epub Date]].
10. Grimes CE, Henry JA, Maraka J, Mkandawire NC, Cotton M. Cost-effectiveness of surgery in low- and middle-income countries: a systematic review. *World journal of surgery* 2014;**38**(1):252-63 doi: 10.1007/s00268-013-2243-y[published Online First: Epub Date]].
11. Dieleman JL, Graves CM, Templin T, et al. Global health development assistance remained steady in 2013 but did not align with recipients' disease burden. *Health affairs* 2014;**33**(5):878-86 doi: 10.1377/hlthaff.2013.1432[published Online First: Epub Date]].
12. Cometto G, Ooms G, Starrs A, Zeitz P. A global fund for the health MDGs? *The Lancet*; **373**(9674):1500-02 doi: [http://dx.doi.org/10.1016/S0140-6736\(09\)60835-7](http://dx.doi.org/10.1016/S0140-6736(09)60835-7) [published Online First: Epub Date]].
13. Kates J, Morrison JS, Lief E. Global health funding: a glass half full? *The Lancet* 2006;**368**(9531):187-88 doi: 10.1016/s0140-6736(06)69018-1[published Online First: Epub Date]].
14. Piva P, Dodd R. Where did all the aid go? An in-depth analysis of increased health aid flows over the past 10 years. *Bulletin of the World Health Organization*

- 2009;**87**(12):930-9 doi: 10.2471/BLT.08.058677[published Online First: Epub Date]].
15. Ravishankar N, Gubbins P, Cooley RJ, et al. Financing of global health: tracking development assistance for health from 1990 to 2007. *Lancet* 2009;**373**(9681):2113-24 doi: 10.1016/s0140-6736(09)60881-3[published Online First: Epub Date]].
16. USAID. Where Does the Money Go? Secondary Where Does the Money Go? <http://www.usaid.gov/results-and-data/budget-spending/where-does-money-go>.
17. NIH Budget 2013. Secondary NIH Budget 2013. [http://officeofbudget.od.nih.gov/pdfs/FY13/FY 2013 Full-Year CR Operating Plan Posting.pdf](http://officeofbudget.od.nih.gov/pdfs/FY13/FY2013%20Full-Year%20CR%20Operating%20Plan%20Posting.pdf).
18. Casey KM. The global impact of surgical volunteerism. *The Surgical clinics of North America* 2007;**87**(4):949-60, ix doi: 10.1016/j.suc.2007.07.018[published Online First: Epub Date]].
19. Bolkan HVS, J.; Samai, M.; Bash-Taqi, D.; Kamara, T.B; Salvesen, O; Ystgaard, B; Wibe, A. Met and unmet needs for surgery in Sierra Leone: a comprehensive, retrospective, countrywide survey from all healthcare facilities performing surgeries in 2012. *Surgery* 2015
20. Key Facts on US Foundations: Foundation Center, 2013:7.
21. What is a Foundation. Secondary What is a Foundation. <http://grantspace.org/tools/Knowledge-Base/Funding-Resources/Foundations/what-is-a-foundation>.
22. About USAID. Secondary About USAID. <http://www.usaid.gov/what-we-do/global-health>.
23. What has the Gates Foundation done for global health? *Lancet* 2009;**373**(9675):1577 doi: 10.1016/s0140-6736(09)60885-0[published Online First: Epub Date]].
24. IHME Developmental Assistance for Health 2014 database., 2014.
25. Methodology for Calculating Baselines and Commitments: G8 Member Spending on Maternal, Newborn and Child Health. Secondary Methodology for Calculating Baselines and Commitments: G8 Member Spending on Maternal, Newborn and Child Health 2010. <http://www.g8.utoronto.ca/summit/2010muskoka/methodology.html>.

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Funding Allocation to Surgery in Low and Middle Income Countries: A Retrospective Analysis of Contributions from the United States

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Abstract

Objective: The funds available for global surgical delivery, capacity building, and research are unknown and presumed to be low. Meanwhile, conditions amenable to surgery are estimated to account for nearly 30% of the global burden of disease. We describe funds given to these efforts from the United States, the world's largest donor nation.

Design: Retrospective database review. United States Agency for International Development (USAID), National Institute of Health (NIH), Foundation Center, and registered U.S. charitable organizations were searched for financial data on any organization giving exclusively to surgical care in low-and-middle-income countries (LMICs). For USAID, NIH and Foundation Center all available data for all years were included. The five recent years of financial data per charitable organization were included. All nominal dollars were adjusted for inflation by converting to 2014 U.S dollars.

Setting: United States

Participants: USAID, NIH, Foundation Center, Charitable Organizations

Primary and Secondary outcome measures: Cumulative funds appropriated to global surgery

Results: Twenty-two NIH funded projects (totaling \$31.3 million) were identified, primarily related to injury and trauma. Six relevant USAID projects were identified--all obstetric fistula care totaling \$438 million. A total of \$105 million was given to universities and charitable organizations by U.S. foundations for 12 different surgical specialties. Ninety-five U.S. charitable organizations representing 14 specialties totaled revenue of \$2.67 billion and expenditure of \$2.5 billion.

Conclusions and Relevance: Current funding flows to surgical care in LMICs are poorly understood. U.S. funding predominantly comes from private charitable organizations, is often narrowly focused and does not always reflect local needs or support capacity building. Improving surgical care, and embedding it within national health systems in LMICs, will likely require greater financial investment. Tracking funds targeting surgery helps to quantify and clarify current investments and funding gaps, ensures resources materialize from promises, and promotes transparency within global health financing.

Strengths and limitations of this study:

- This was the first known attempt to track and quantify funds appropriated to surgical care in LMICs.
- Lack of streamline accounting processes and classification terms make it challenging to identify funds towards global surgery.
- There are inherent limitations in keyword searches of large databases, perhaps missing data points.

INTRODUCTION

Surgical care is an important component of a functioning health system for all countries. Conditions requiring surgical care – including maternal and neonatal conditions, digestive diseases, cancers, congenital abnormalities and injuries -- account for 11-30% of the global burden of disease [1-3]. Much of the morbidity and mortality from surgical conditions in low-and-middle-income countries (LMICs) could be averted through improved access to surgery [4]. About 5 billion people lack access to safe, affordable, timely surgical care; and, in LMIC this problem is magnified where nine out of ten people cannot access basic surgical care.[5] Yet surgery has remained a low priority on the global health agenda as well as the national health agenda in most LMICs. For example, a systematic review of National Health Strategic Plans in 43 African countries found that 19% had no mention of surgery and 65% mentioned it 5 or fewer times[6]. As a result, population access to surgical care is poor, and surgical systems in LMICs remain severely under-resourced [7-10]. This neglect of surgery is despite evidence of its cost-effectiveness in low resource settings [11 12]. To improve surgical care and outcomes in the world's poorest regions, greater financial investment is likely required. However, little is known about current financing flows to surgery in LMICs, making it difficult to quantify funding shortfalls, or to determine how donors may be influencing the availability and distribution of surgical services.

Over the past 15 years, financial aid for global health has been on the rise [13-17]. In 2013, \$31.3 billion was provided to development assistance for health (DAH) [13]. The amount of DAH targeted to surgical care is unclear, because DAH databases do not specifically collect data on surgical services, and many funders only report investments using broad, aggregated classifications.

The United States is among the top five leading donors to global health[17]. In 2012, USAID (the United States Agency for International Development) spent \$5.5 billion on health, ranking it the highest funded program area[18]. In addition to funding directed through international development agencies, the U.S. also funds biomedical research and training in global health. For example, the National Institutes of Health (NIH), the U.S. federal agency of biomedical and health research, operated a budget of almost \$30 billion in 2013, nearly the global aggregated sum of DAH in 2013[13 19]. However, in the same year, the Fogarty International Center, the NIH's global health institute, received only \$65.7 million of that \$30 billion budget (0.22%) [19]. Given the sheer scale of U.S. global health funding, understanding U.S.-derived funding flows to surgery in LMICs can offer important insights into how DAH targets surgical care. We conducted a retrospective database review in an attempt to estimate how much DAH flows from the U.S. to surgical services in LMICs.

METHODS:

We identified four major funding channels from which we can estimate resources allocated to surgical efforts in low resource settings. These include U.S. charitable organizations, foundations, USAID, and the NIH.

Charitable Organizations

We defined charitable organizations as non-profit, non-governmental organizations that serve the public interest. The included organizations represent the spectrum of platforms for surgery described by Shrima et al: short-term trips, specialized hospitals, and self-contained platforms [1]. The non-profit and volunteer sector, which charitable organizations fall under, is a significant economic sector; its growth has outpaced GDP growth by 20%[20]. In 2013 alone, charitable organizations accounted for 15.7% of overall donations to DAH [13]. Such organizations provide as much as 55% of surgical care in some LMICs [21]. In this study we included charitable organizations that provide exclusively surgical care and no other services in LMICs. Organizations providing surgical care in addition to other services were excluded. Although these organizations may receive their funding from a variety of sources including private donations, grants, government contracts, and user fees, we are only able to track aggregated funds that are reported on federal tax form 990 (our data source).

Charitable organizations that provide exclusively surgical care were identified from the surgical volunteerism listings on numerous websites (Table 1). Next, each listed organization website was reviewed to ensure adherence to inclusion criteria of providing exclusively surgical care in LMICs. Tax records (Form 990) provide information on the organization's revenue and expenses and were retrieved either from the organization website or from electronic sources listed in Table 1.

Table 1: Summary of Data Source and Research Methods

Funding Channel	Definition	Data Source	Methods to Identify Funds towards Global Surgery
Foundations	Non-governmental entity that is established as a nonprofit corporation or a charitable trust, with a principal purpose of making grants to unrelated organizations, institutions, or individuals for scientific, educational, cultural, religious, or other charitable purpose	Foundation Center Online Directory	All database keyword search combinations of the following words: key word searches with combinations of “global,” “international,” “low resource,” “developing countries/nations” “research” and “surgery,” “obstetrics and gynecology,” “obstetric fistula,” “trauma,” “injury,” “congenital birth defects,” “cleft lip/palate,” “cataract,” “ophthalmology,” “burn,” “reconstructive,” “urology,” “orthopedics,” “club foot,” “neurosurgery,” “hydrocephalus,” “anesthesia,” “cardiac,” and “ENT”; manual review of results to assure it was solely related to surgical capacity building, delivery, research, and training.
Charitable Organizations	Non-profit, non-governmental organizations that serve public interest; many of which qualify for tax credits. These organizations may receive their funding from a variety of sources including private donations, grants, government contracts, and user fees.	Organization Identification: American College of Surgeons Operation Giving Back, the Society of Pediatric Anesthesiologists, OmniMed, Foundation Center Online Directory, U.S. State Department Private Volunteer Organizations registry Form 990: Guidestar, ProPublica, Economics Research Institute, Citizenaudit.org, National Center for Charitable Statistics at the Urban Institute, and the Foundation Center Online Directory	Verification of meeting definition criteria by checking each organization website that was listed on the data source websites.
USAID	United States Agency for International Development, U.S. government agency focusing on foreign assistance to developing countries	USAID website interactive project mapper	Manual review of each of the 524 projects listed on the online global health interactive project mapper.
NIH	National Institutes of Health: U.S.- medical research agency from the department of health and human services	NIH online RePORTER	Selection of all fiscal years, selection of all LMICs from drop down menu, following keyword searches for all projects descriptions search box: “surgery,” “obstetrics and gynecology,” “obstetric fistula,” “trauma,” “injury,” “congenital birth defects,” “cleft lip/palate,” “cataract,” “ophthalmology,” “burn,”

			“reconstructive,” “urology,” “orthopedics,” “club foot,” “neurosurgery,” “hydrocephalus,” “anesthesia,” “cardiac,” and “ENT”; manual review of all project to assure it was solely related to surgical capacity building, delivery, research, and training.
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U.S. Foundations

Health is the single largest focus issue of U.S. foundations, who provide billions of dollars annually in philanthropy [22]. A foundation is “a non-governmental entity that is established as a nonprofit corporation or a charitable trust, with a principal purpose of making grants to unrelated organizations, institutions, or individuals for scientific, educational, cultural, religious, or other charitable purposes”[23]. Foundations are different from the charitable organizations described above in that the latter are both funding channels and implementation agents. In contrast, foundations are simply the grantmakers; they do not implement a service. Foundations are further classified as independent, operating, community, corporate, as defined in Table 2. The Foundation Center Online Directory (FCOD) is a comprehensive digital library that archives grants made and received by foundations and non-profit organizations. The professional FCOD subscription was used, which has over three million grants covering the last ten years of their database.

Table 2: Classification of Foundations

Type of Foundation	Description	Example
Independent Foundation	General category that usually includes foundations established by individuals and families	Bill and Melinda Gates Foundation
Operating Foundation	Foundations that are able to make grants and financial contributions to other non-profit organizations but primarily run their own program.	Lavelle Fund for the Blind is a non-profit organization that provides a broad range of services for people who are blind. This organization also has donated funds to other organizations that work with this same population.
Community Foundation	Foundations organized by public communities that raise money from the general public	The San Diego Foundation
Corporate Foundation	Foundations established by businesses but are legally separate entities from the main business	Bank of America Foundation

U.S. Government Agencies

USAID’s investment in global health is consistently ranked a top agency funding priority [24]. The NIH is the world’s largest supporter of biomedical research. In fact, one of the 27 institutes is the Fogarty International Center, which is dedicated to training scientists and enhancing research in LMICs. Together, these two agencies are the biggest U.S. government investors in global health. Both USAID and the NIH have online searchable databases chronicling their funded projects, including financial allotment. The NIH has project data from 1990. USAID’s project database begins in 1992.

Research Methods

We constructed a separate database for each funding channel. USAID and NIH databases provided project-level information on actual disbursed funds. For foundations, grant details including amount, grant recipient, and specified use of funds were extracted. The grants were categorized for surgical specialty supported and the specified purpose of the funds (e.g. earmarked dollars). We extracted data on total revenue and the breakdown of total expenditure from the Forms 990. Due to data limitations, the most current five years of tax forms were collected for each organization. The charitable organizations were categorized by type of surgical service they provide. All nominal dollars were adjusted for inflation by converting to 2014 U.S dollars (USD) using the IMF World Economic Outlook database (downloaded in April 2014). Table 1 summarizes the data sources and detailed research methods.

RESULTS

U.S. Charitable Organizations

Tables 3a and 3b describe the total revenue and expenditure for 95 U.S. charitable organizations providing exclusively surgical care over the years 2007-2013, expressed in 2014 USD. The total revenue was \$2.14 billion, while total expenditure was \$2.53 billion 2014 USD. Total program expenditures were \$2.14 billion 2014 USD while total management costs were \$88.72 million. Notably, the data are skewed towards the years 2008-2012 due to limited data availability. Similarly, not all tax forms required itemized management expenses, so the \$88 million figure is a lower bound. The service expense/total expense measure is the proportion of funds spent on program services. The median range is 0.71 to 1. On an average aggregated level these organizations spend anywhere from 71% to 100% of their funding on executing their programs. Ophthalmology and cleft lip/palate care were the top two most funded specialties accounting for more than 75% of the total revenue while only accounting for 20% of the total organizations. Overall, 84% of the total expenses were on program services costs and the remaining 16% on other costs such as management, administration, and fundraising.

Table 3a: Summary of Total Revenue and Expenditure for 95 U.S. Charitable Organizations Committed Exclusively to Surgical Care in LMIC over 2007-2013 in 2014 U.S. Dollars.

Type of Surgery	Number of Organizations	Total Revenue (Sum)	% of Total	Total Expenses (Sum)	% of Total
Ophthalmology	11	\$1,256,253,010.50	47.21%	\$1,217,295,102.00	48.54%
Cleft Lip/Palate	8	\$819,720,317.98	30.39%	\$717,832,939.70	28.25%
Mix	14	\$283,748,366.10	10.63%	\$303,464,510.20	12.03%
Orthopedics	14	\$85,964,691.80	3.24%	\$80,620,765.84	2.69%
Cardiac	15	\$75,604,257.66	2.84%	\$71,826,159.55	2.86%
Pediatric	8	\$54,621,294.05	2.05%	\$48,121,042.56	1.99%
Reconstructive	10	\$48,305,681.69	1.80%	\$50,260,266.41	1.92%
Obstetric Fistula	8	\$24,651,950.52	0.93%	\$23,198,973.80	0.93%
Neurosurgery	2	\$11,915,392.06	0.45%	\$10,601,253.93	0.42%
Urology	1	\$4,893,374.11	0.19%	\$4,191,093.97	0.17%
ENT	1	\$3,493,169.92	0.13%	\$566,978.10	0.02%
Craniofacial	1	\$3,121,609.25	0.12%	\$3,844,568.83	0.15%
Burn	1	\$423,291.11	0.02%	\$348,710.23	0.01%
General	1	\$283,546.77	0.01%	\$236,555.18	0.01%
All	95	\$2,672,999,953.50	100.00%	\$2,532,408,921.00	100.00%

Table 3b: Breakdown of Expenditure for 95 U.S. Charitable Organizations Committed Exclusively to Surgical Care in LMIC over 2007-2013 in 2014 U.S. Dollars.

Type of Surgery	Total Program Service Expenses (Sum)	% of Total	Total Management Expenses (Sum)	% of Total	Service Expense/Total Expense (Median)
Ophthalmology	\$1,146,905,574.00	54.30%	\$25,232,021.67	27.72%	0.903736607
Cleft Lip/Palate	\$501,356,549.10	23.40%	\$27,124,232.84	29.91%	0.781596521
Mix	\$253,328,682.50	11.93%	\$18,558,637.91	20.37%	0.890432927
Orthopedics	\$74,106,734.52	2.65%	\$2,988,617.99	5.66%	0.851596868
Cardiac	\$59,824,911.09	2.83%	\$5,198,179.02	5.74%	0.857549949
Pediatric	\$38,866,267.74	1.84%	\$1,852,283.99	4.87%	0.837718153
Reconstructive	\$39,263,691.25	1.84%	\$4,459,333.64	2.05%	0.781690431
Obstetric Fistula	\$18,275,700.71	0.87%	\$1,935,357.54	2.14%	0.817607482
Neurosurgery	\$116,048.07	0.01%	\$11,283.36	0.01%	0.884690813
Urology	\$2,944,251.58	0.14%	\$843,406.30	0.94%	0.715213402
ENT	\$460,631.72	0.02%	\$106,003.33	0.12%	0.996284445
Craniofacial	\$3,361,305.62	0.16%	\$384,823.62	0.42%	0.871443206
Burn	\$279,259.59	0.01%	\$22,984.77	0.03%	0.967953626

General	\$236,554.13	0.01%	\$0.00	0.03%	1
All	\$2,139,326,162.00	100.00%	\$88,717,165.99	100.00%	

U.S. Foundations

The FCOD search yielded 1,250 grants awarded to 82 different organizations (2 universities and 80 charitable organizations) between 2003-2013. These grants were made by 470 foundations and totaled \$105.7 million. Reconstructive surgery, cleft surgery, and obstetric fistula repair were the specialties that received support from all 6 categories of foundations. Nearly half of community foundation grants (39.6%) were given to reconstructive surgery (\$992,730). The remainder was split among all other specialties. Ophthalmology (\$6 million) and cleft surgery (\$5.6 million) *each* received more than 40% of the corporate foundation funds with the remainder divided among all specialties. Cleft surgery accounted for 93% of grants made by uncategorized independent foundations. Similarly, 92% of all donations by operating foundations were given to ophthalmology organizations. Likewise, reconstructive surgery accounted for 84% of public charity funds. Obstetric emergency conditions (those requiring urgent surgical care, such as C-section) were exclusively funded by independent foundations.

Table 4 shows the total amount of funding received by different specialties. The “other” category includes neurosurgery, urology, anesthesia, mixed specialty surgical teams, and unspecified specialty. Cleft surgery (\$34 million) and ophthalmology (\$40.9 million) account for 70% of the total donated funds.

Surgical delivery (\$35 million) and unspecified donations (\$26.1 million) account for nearly 60% of all funds given. Infrastructure (\$1.7 million) encompasses equipment, supplies, and surgical center /operating room establishment. Surgical training (\$7.1 million) refers to training local surgical providers.

Research (\$14.6 million) includes funds for evaluating surgical conditions and postoperative outcomes. Notably, \$11 million of the \$14.6 is a single grant on postoperative outcomes of trichiasis surgery in Africa. Other items in this category include conferences. Low cost technology and innovation (\$13.2 million) include developing tools to reduce or prevent fatal post-partum hemorrhage, producing a pulse oximetry probe for mothers undergoing C-section, and creating low cost orthopedic prosthesis. Advocacy (\$42,223) refers to patient outreach, in this case for women suffering from obstetric fistulas.

Operations management (\$8 million) is the operational costs of running an organization, including the costs associated with fundraising.

Table 4: Total Amount of Funding from Foundations Distributed by Surgical Specialty 2003-2013.

Surgical Specialty	Total Funding	% of Total
Ophthalmology	\$40,932,280.64	38.70%
Cleft	\$34,052,712.59	32.20%
Obstetric Emergency	\$12,815,112.89	12.12%
Reconstructive	\$7,461,168.91	7.05%
Obstetric Fistula	\$5,535,578.79	5.23%
Cardiac	\$1,546,149.91	1.46%
Orthopedic	\$1,134,262.60	1.07%
Burn	\$854,992.59	0.81%
Other	\$522,695.56	0.49%
General	\$330,933.61	0.31%
Mix	\$234,182.96	0.22%
Anesthesia	\$208,676.39	0.20%
Pediatric	\$117,121.43	0.11%
Neurosurgery	\$23,527.52	0.02%
All	\$105,769,396.40	100.00%

USAID

Six projects (executed between 2006-2013) were identified as related to surgical conditions, all concerning obstetric fistulas. With the exception of Bangladesh, all projects were in Sub-Saharan Africa. The total funds allocated were \$438 million.

NIH

Twenty-two different research projects were funded between 1991-2014, totaling \$31.3 million. Only four projects were *not* related to trauma (3 general surgery and 1 ophthalmology). Despite trauma accounting for nearly 80% of projects, it only accounted for 50% of total funds awarded. General surgery comprised 12% of projects but amassed nearly one third of funding (31.6%). Ophthalmology, the most funded specialty in the private sector, only accounted for 18.4% of NIH funding.

Africa (30.5%) and Latin America (32%) account for nearly two-thirds of these funded projects. The remaining one-third is devoted to the regions of Eastern Europe (10.9%), the Middle East (8.6%), Southeast Asia (8.6%), and global (unspecified region, 9.4%). Two projects comprised this global region. One was the development of a low cost negative pressure wound therapy system for LMICs. The second was the many years of the National Eye Institute's (NEI) contribution to the WHO's Prevention of Blindness program. Although the Fogarty International Center was the main grant administrator and funder, six other institutes and offices also made significant contributions – the Office of the Director, National Eye Institute, National Heart Lung and Blood Institute, National Institute of Alcohol Abuse and Alcoholism, National Institute of Biomedical Engineering and Bioimaging, and the National Institute of Child Health and Human Development.

DISCUSSION:

The aim of this study was to describe funding flows to global surgery via private charitable and public channels from the United States. We found that while detailed information regarding funding flows to surgical care is limited, two patterns emerged from the available data. First, the private charitable sector contributed significantly more funds than did the government sector. Second, there are clear donor preferences for surgical specialties and services.

The U.S. non-profit private sector is an important funder of global surgery—thus it is a powerful stakeholder to be engaged in advocacy for greater funding towards global surgery. From the foundation perspective, those classified as family/individual foundations account for nearly three-quarters of total funds donated, while corporate foundations support an eighth of funds. This skewed distribution, in which family and individual foundations are dominant, may explain why certain surgical specialties receive the most funding—these foundations are not publicly accountable, but are governed by individuals or families who are free to decide their priorities. A key guiding principle of the Bill & Melinda Gates Foundation, for example, is that it is “driven by the interests and passions of the Gates family”[25]. Our study found that together, ophthalmology and cleft surgery account for nearly three-fourths of funding among surgical specialties. Moreover, elective surgery is favored over emergency care. Surgical delivery and operations management were the top two specified reasons for fund allocation. In contrast, local capacity building, such as infrastructure and surgical training, was among the least funded areas of surgery. Notably, a significant portion of funds was also unspecified. It is not possible to determine where these funds were spent, but it is possible some may have been used for capacity building.

A similar pattern exists with U.S. charitable organizations, which account for the largest funding stream for global surgery. Disbursements from these organizations also favor elective procedures and surgical care delivery. Most frequently, these services are provided through short-term, narrowly focused interventions. There is less assistance given to emergency surgical care and training local staff. Ophthalmology accounts for over half of the funding from U.S. charitable organizations (54%), while cleft/lip palate (23%) and mixed services (12%) make up the next biggest proportion. Every other specialty receives less than 3% of total charitable organization funding.

Funding for surgical care in LMICs amongst U.S. foundations and charitable organizations appears poorly aligned with the burden of surgical conditions in LMICs, focusing mainly on vertical programs in ophthalmology and cleft care. Educating donors and charitable organizations about the most pressing global surgery needs and emphasizing comprehensive sustainable care may facilitate closer alignment of funding with local needs.

Likewise, USAID appears to be focused on obstetric fistula work and the NIH is heavily skewed towards trauma. Both contribute very small proportions of their budgets to surgical conditions in LMIC.

There are several study limitations. First, though the U.S. provides global health funding via other avenues like UN agencies and PEPFAR, the proportion of that funding for surgery could not be determined. Therefore, these channels were excluded. Similarly, some broad NIH grants like the Medical Education Partnership Initiative (MEPI) and the Fogarty Training grants were excluded due to inability to ascertain exact proportions spent on surgical education and training. Additionally, USAID supports projects focusing on health system strengthening (HSS) and health workforce issues. The exact quantities of these project funds that specifically go towards surgery could not be determined, so they were omitted. However, in 2014, only 3% (\$250 million) of all USAID DAH was for HSS, and very little of that was targeted at strengthening surgical services [26].

One potentially useful future strategy to try estimating funding flows to surgery would be the application of a modified form of the “Muskoka methodology”[27]. In trying to assess how much funding goes to women’s and children’s health (WCH), the same challenge occurred in that these funds were not precisely tracked, although it was clear that plenty of funding given to other tracked areas were directly benefiting WCH. The Muskoka methodology was developed in response. It imputes the proportion of categorized funding that directly benefits WCH by 1) directly asking multilateral organizations to estimate percentage of funds benefiting WCH and 2) for bilateral aid, using existing demographics and its relation to disease burden and mortality. The latter approach may still pose some challenges, as not all the existing linkages necessary for the imputations are available for surgery as they are for WCH.

A second limitation is that the foundation data are limited to only the organizations listed in FCOD. Any foundation that funds global surgery not listed were not included in these results. The timeframe is also limited due to data availability (begins in 2003 and finishes with a few documented funds for 2013).

Third, the U.S. charitable organizations’ data only includes those that provided exclusively surgical care and no other service. There are many other charitable organizations (e.g. Partners in Health) that in some countries provide a significant amount of surgical services in addition to other forms of medical care and developmental aid. However, their financial documents do not indicate the portion of their funds allocated to surgery as opposed to other activities, thus they were excluded. Nonetheless, it is important to acknowledge that many such organizations exist and provide invaluable efforts to advancing global surgery. Furthermore, we excluded organizations for which financial data were not available. Perhaps such organizations were not officially registered as charitable entities and thus were not required to provide forms 990. Likewise, only funds accounted for on the federal tax form 990 are tracked and included in this study. Any additional funds received but not included on the 990 are not accounted for.

Fourth, in order to obtain aggregate funds across channels, it is vital to address double counting. However, in this paper we do not aggregate across channels, thus we did not adjust for double counting. Due to the nature of our data the main areas vulnerable to double counting would be funds that foundations contributed to charitable organization. Specifically, we know that some of the funds accounted for in the \$105 million contribution from foundations are also included in charitable organizations’ revenues of \$2.67 billion.

Lastly, there are inherent limitations related to keyword searches, particularly in the absence of a standardized means for classifying and describing surgical care. It is possible that funds allocated to global surgery were not picked up with the keywords employed in our search.

It is beyond the scope of this research to determine precisely how much DAH should target surgical care. Since the cost-effectiveness, cultural appropriateness, and availability of interventions vary across different contexts it does not follow that funding should not perfectly match disease burden. Still, cost-effective surgical interventions seem to be receiving strikingly little attention from donors.

Our study has two conclusions. First, as evidenced by the limited data sources, better tracking of all external financing sources in global health is required, including disaggregation of expenditure within budgets. This tracking is not aimed at encouraging vertical programming and funding, but is required for quantification of funding gaps for clinical services such as surgery; to ensure that resources materialize from promises; and to encourage accountability and transparency. Second, we have shown that within the data limitations, U.S. funding does not wholly align with what is currently understood about surgical need in LMICs. Specifically, we found that most funding is targeted towards elective and often specialized procedures and provision of clinical services, often by foreign teams, rather than emergency and basic surgery along with local capacity building.

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REFERENCES:

1. Shrime MG, Sleemi A, Ravilla TD. Charitable Platforms in Global Surgery: A Systematic Review of their Effectiveness, Cost-Effectiveness, Sustainability, and Role Training. *World journal of surgery* 2014 doi: 10.1007/s00268-014-2516-0[published Online First: Epub Date]].
2. Debas H GR, McCord C, Thind A. *Surgery*. 2nd ed. New York: Oxford University Press, 2006.
3. Shrime M.G. BSW, Alkire B.C., Mock C. . Thirty percent of the global burden of disease is surgical. *Lancet Global Health* 2015
4. Bickler S. The Global Burden of Surgical Conditions. In: Kruk M, ed. DCP3, 2015.
5. Meara JG, Leather AJ, Hagander L, et al. Global Surgery 2030: Evidence and solutions for achieving health, welfare, and economic development. *Surgery* 2015 doi: 10.1016/j.surg.2015.04.011[published Online First: Epub Date]].
6. Citron I, Chokocho L, Lavy C. Prioritisation of surgery in the National Health Strategic Plans of Africa: a systematic review. *Lancet* 2015;**385** Suppl 2:S53 doi: 10.1016/s0140-6736(15)60848-0[published Online First: Epub Date]].
7. Choo S, Perry H, Hesse AA, et al. Assessment of capacity for surgery, obstetrics and anaesthesia in 17 Ghanaian hospitals using a WHO assessment tool. *Tropical medicine & international health : TM & IH* 2010;**15**(9):1109-15 doi: 10.1111/j.1365-3156.2010.02589.x[published Online First: Epub Date]].
8. Knowlton LM, Chackungal S, Dahn B, LeBrun D, Nickerson J, McQueen K. Liberian surgical and anesthesia infrastructure: a survey of county hospitals. *World journal of surgery* 2013;**37**(4):721-9 doi: 10.1007/s00268-013-1903-2[published Online First: Epub Date]].
9. Linden AF, Sekidde FS, Galukande M, Knowlton LM, Chackungal S, McQueen KA. Challenges of surgery in developing countries: a survey of surgical and anesthesia capacity in Uganda's public hospitals. *World journal of surgery* 2012;**36**(5):1056-65 doi: 10.1007/s00268-012-1482-7[published Online First: Epub Date]].
10. Notrica MR, Evans FM, Knowlton LM, Kelly McQueen KA. Rwandan surgical and anesthesia infrastructure: a survey of district hospitals. *World journal of surgery* 2011;**35**(8):1770-80 doi: 10.1007/s00268-011-1125-4[published Online First: Epub Date]].
11. Chao TE, Sharma K, Mandigo M, et al. Cost-effectiveness of surgery and its policy implications for global health: a systematic review and analysis. *The Lancet Global Health* 2014;**2**(6):e334-e45 doi: 10.1016/s2214-109x(14)70213-x[published Online First: Epub Date]].
12. Grimes CE, Henry JA, Maraka J, Mkandawire NC, Cotton M. Cost-effectiveness of surgery in low- and middle-income countries: a systematic review. *World journal of surgery* 2014;**38**(1):252-63 doi: 10.1007/s00268-013-2243-y[published Online First: Epub Date]].
13. Dieleman JL, Graves CM, Templin T, et al. Global health development assistance remained steady in 2013 but did not align with recipients' disease burden. *Health affairs* 2014;**33**(5):878-86 doi: 10.1377/hlthaff.2013.1432[published Online First: Epub Date]].
14. Cometto G, Ooms G, Starrs A, Zeitz P. A global fund for the health MDGs? *The Lancet*; **373**(9674):1500-02 doi: [http://dx.doi.org/10.1016/S0140-6736\(09\)60835-7](http://dx.doi.org/10.1016/S0140-6736(09)60835-7) [published Online First: Epub Date]].

15. Kates J, Morrison JS, Lief E. Global health funding: a glass half full? *The Lancet* 2006;**368**(9531):187-88 doi: 10.1016/s0140-6736(06)69018-1[published Online First: Epub Date]].
16. Piva P, Dodd R. Where did all the aid go? An in-depth analysis of increased health aid flows over the past 10 years. *Bulletin of the World Health Organization* 2009;**87**(12):930-9 doi: 10.2471/BLT.08.058677[published Online First: Epub Date]].
17. Ravishankar N, Gubbins P, Cooley RJ, et al. Financing of global health: tracking development assistance for health from 1990 to 2007. *Lancet* 2009;**373**(9681):2113-24 doi: 10.1016/s0140-6736(09)60881-3[published Online First: Epub Date]].
18. USAID. Where Does the Money Go? Secondary Where Does the Money Go? <http://www.usaid.gov/results-and-data/budget-spending/where-does-money-go>.
19. NIH Budget 2013. Secondary NIH Budget 2013. <http://officeofbudget.od.nih.gov/pdfs/FY13/FY 2013 Full-Year CR Operating Plan Posting.pdf>.
20. Casey KM. The global impact of surgical volunteerism. *The Surgical clinics of North America* 2007;**87**(4):949-60, ix doi: 10.1016/j.suc.2007.07.018[published Online First: Epub Date]].
21. Bolkan HVS, J.; Samai, M.; Bash-Taqi, D.; Kamara, T.B; Salvesen, O; Ystgaard, B; Wibe, A. Met and unmet needs for surgery in Sierra Leone: a comprehensive, retrospective, countrywide survey from all healthcare facilities performing surgeries in 2012. *Surgery* 2015
22. Key Facts on US Foundations: Foundation Center, 2013:7.
23. What is a Foundation. Secondary What is a Foundation. <http://grantspace.org/tools/Knowledge-Base/Funding-Resources/Foundations/what-is-a-foundation>.
24. About USAID. Secondary About USAID. <http://www.usaid.gov/what-we-do/global-health>.
25. What has the Gates Foundation done for global health? *Lancet* 2009;**373**(9675):1577 doi: 10.1016/s0140-6736(09)60885-0[published Online First: Epub Date]].
26. IHME Developmental Assistance for Health 2014 database., 2014.
27. Methodology for Calculating Baselines and Commitments: G8 Member Spending on Maternal, Newborn and Child Health. Secondary Methodology for Calculating Baselines and Commitments: G8 Member Spending on Maternal, Newborn and Child Health 2010. <http://www.g8.utoronto.ca/summit/2010muskoka/methodology.html>.

Correction

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