

Prevalence of untreated surgical conditions in bateys (Sugar Workers' Towns) of the Eastern Dominican Republic: a retrospective cross-sectional study

Darren E. Eblövi, MD, MPH^{a,*}, Jhomainy M. Miller, MD^b, Kathryn L. Clitheroe, MPH^c, Se-Hwa Sun, BHSc^d, Peter J. Daly, MD^e

Introduction: The global burden of surgical disease is likely immense, but surgical care has been largely neglected in low- and middle-income countries, partly due to a lack of region-specific evidence describing the prevalence. In preparation for the opening of a charitable surgical center, the organization One World Surgery conducted a census, needs assessment, and a series of charitable outreach primary care clinics in several bateys (sugar workers' towns) in the eastern Dominican Republic. This study aims to use information collected by the organization to determine the prevalence of untreated surgical conditions in an underserved region of a high-middle-income country.

Methods: Population data from a series of bateys surrounding the city of San Pedro de Macoris on the country's eastern plains, a region with significant sugarcane, was determined from a census and needs assessment performed by community health workers between April and December 2019. This information was used to invite patients to charitable outreach primary care clinics led by volunteer US-based physicians between September 2019 and February 2020, during which the number of patients with untreated surgical conditions was calculated.

Results: Volunteer physicians recommended at least 1 surgery for 147 individuals among a population of 4070 (3.61%). Fifty-two percent of surgical patients were male and 36.7% were age 60 and above. The most common surgical diagnoses were cataract, pterygium, and hernias/hydroceles. The most needed specialties were ophthalmology (1.74%), general surgery (1.01%), and orthopedics (0.69%).

Conclusion: The population of bateys (sugar workers' towns) in the eastern Dominican Republic, a high-middle-income country, has a high prevalence of untreated surgical disease. This is likely due partly to the population of the bateys being underserved compared to the country overall, and partly to the country's increasing life expectancy. However, since most patients with untreated surgical conditions are of working age or below, it will be important with respect to national productivity for the Dominican Republic and other high-middle-income countries to increase surgical capacity along with other more traditionally prioritized health care initiatives.

Keywords: Global surgery, Underserved population, Medical missions, Charitable, Epidemiology

^aDepartment of Pediatrics, Northwestern University Feinberg School of Medicine, Chicago, IL, ^bDepartment of Medicine, Universidad Central del Este, San Pedro de Macoris, Dominican Republic, ^cOne World Surgery, Deerfield, IL, ^dOne World Surgery, San Pedro de Macoris, Dominican Republic and ^eDepartment of Family Medicine and Community Health, University of Minnesota Medical School, Minneapolis, MN

This manuscript has been peer reviewed.

Sponsorships or competing interests that may be relevant to content are disclosed at the end of this article.

*Corresponding author. Address: Feinberg School of Medicine, Northwestern University, 303 E Chicago Avenue, Chicago, IL 60611. Tel: 312-227-7410; fax: 312-227-9525. E-mail address: deblovi@luriechildrens.org (D. Eblövi).

Copyright © 2020 The Authors. Published by Wolters Kluwer Health, Inc. on behalf of IJS Publishing Group Ltd. This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

International Journal of Surgery: Global Health (2020) 3:e39

Received 31 August 2020; Accepted 29 September 2020

Published online 16 November 2020

<http://dx.doi.org/10.1097/GH9.000000000000039>

Historically, surgical care has not been adequately prioritized in healthcare systems of low- and middle-income countries^[1,2]. However, recent studies indicate surgical care can be more cost-effective than many other more commonly prioritized interventions^[3,4]. Although providing safe, timely, and affordable surgical care requires a larger initial investment in infrastructure, this investment provides universal long-term benefit to health care systems and has the potential to improve the productivity of low-income countries^[1].

Current estimates indicate the global burden of untreated surgical disease is immense, but little region-specific data exists, forcing policymakers to often rely on extrapolations from hospital registries and physician surveys that may not include all relevant populations. Data from the 2002 World Health Report and the 1996 Global Burden of Disease Study suggest that 11% of the world's disability-adjusted life years are due to conditions very likely to require surgery^[5]. Using an alternative method, researchers interviewed health care professionals worldwide and found that surgery would ideally be involved in 28%–32% of the burden of disease^[6]. Both studies suggest more region-specific

data are needed to make informed decisions about solving this significant problem.

One country in which region-specific data is limited is the Dominican Republic. With a gross national income of \$8,090 per capita, it is classified by the World Bank as a high-middle-income country, and the World Health Organization (WHO) ranks its health care system 51 of 191 countries evaluated^[7]. However, the Dominican Republic's Gini coefficient (the most accepted measurement of nationwide income inequality, named for Italian statistician Corrado Gini) is high at 45.7 (<https://www.indexmundi.com/facts/indicators/SI.POV.GINI/rankings>), indicating a subsequent potential for health disparity.

Bateys are communities that have developed around structures initially built by sugar companies in the early 20th century for temporary migrant laborers. A large number of bateys found among the sugarcane fields on the country's eastern plains are now home to full-time residents with varied employment that have poorer living conditions and less access to healthcare and other public services than the country's general population^[8].

With the goal of helping to meet the surgical needs of this underserved population, the organization One World Surgery is constructing a charitable surgery center on the outskirts of the city of San Pedro de Macoris, where both local and visiting foreign health care professionals can volunteer to provide free services. In advance of construction, the organization conducted a census and needs assessment followed by a series of primary care outreach clinics to provide care to the population and evaluate surgical need.

The aim of this study is to estimate the prevalence of all untreated surgical conditions in one underserved region of a high-middle-income country, that may contribute to the global body of data used to determine the need for improvement of surgical capacity worldwide.

Methods

As part of the census and needs assessment conducted between April 2019 and March 2020, 4 community health workers visited every home in each batey and recorded names and birthdates of each inhabitant living in the home. If no residents were present, they returned to the same home on a later date. In addition to the demographic information, surveyors recorded medical complaints of any household members. Before initiation, the community health workers were trained by volunteer physicians on questions to ask regarding medical complaints and how to describe them in detail. This information was then used to invite members of the batey communities to charitable primary care outreach clinics to allow for detailed clinician interviews and physical examinations. In addition to those that were invited, any walk-in patient presenting to the clinic was also evaluated and treated.

Outreach clinics were held between September 2019 and February 2020 in community centers, schools, or churches in the bateys. Clinic locations were selected to be within short walking distance of all community homes, and physicians made home visits for patients unable to walk. Volunteer physicians, currently licensed to practice in the United States and board certified in either internal medicine, family medicine, or pediatrics, treated and documented findings for all presenting patients. If necessary, private rooms were available for sensitive physical examinations. Translation for the US-based physicians was performed by volunteer Dominican medical students from the Universidad Central del Este in San Pedro de Macoris. The volunteer

physicians were asked to document whether they recommended the patient receive surgery for a current condition. If so, the physician documented the specific surgery he or she recommended or the diagnosis of the condition requiring surgery. Volunteers were provided with a list of the surgeries most performed in Honduras, the organization's other location. However, the physicians were not limited to any specific index of surgical conditions; they were encouraged to diagnose any condition or recommend any surgery they felt appropriate based on their clinical judgment.

The outreach clinics did not offer any diagnostic imaging; however, several patients presented with images or image reports they had previously obtained from the local health care system. In some cases, patients presented with surgical diagnoses previously made by physicians or surgeons from the local system but had not been able to obtain the recommended surgeries due to cost or other factors.

Population data was compiled from the census performed in the communities in which the outreach primary care clinics were held. Prevalence of all surgical conditions and within specific surgical specialties were calculated by dividing the number of patients diagnosed with the conditions by the observed combined population of the bateys visited. To ensure consistency between numerator and denominator, patients were excluded if they were residents of a community other than those in which the clinics were held.

Patients identified to have surgical conditions are followed by the organization's local employed physician and will be provided with surgical treatment once the surgery center is operational. For patients with more urgent surgical needs, the organization has been assisting them in accessing surgical care from the local health care system and from other nonprofit organizations.

Deidentified data collection through a retrospective review of the organization's medical records was approved by the ethical review board of Ann and Robert H. Lurie Children's Hospital of Northwestern University in Chicago, Illinois (protocol #2020-3943) with a waiver of informed consent. Whenever possible, the STROCCS criteria were followed^[9]. This study was registered on ResearchRegistry.com with #5970 (<https://www.researchregistry.com/browse-the-registry#home/registrationdetails/5f4cfbdd6f9bb80015b329f1/>).

Results

Twenty days of outreach clinics were held in 11 bateys that were previously surveyed by community health workers during the census, providing consultations for a total of 2308 patients. The combined population of these 11 communities was 4070 (1100 homes were surveyed in these bateys with an average of 3.7 inhabitants per home). Volunteer physicians recommended 160 surgeries for 147 individuals (3.61%); 13 patients were recommended to receive 2 distinct surgeries. Among the 147 individuals for whom surgery was recommended, 77 were male (52%), the median age was 51, with a standard deviation of 24.3. The age distribution of patients with untreated surgical conditions is found in **Figure 1**.

All surgical conditions identified and specific surgeries recommended are listed in **Table 1**. The most common surgical diagnoses were cataract (9.1 per 1000), pterygium (7.4 per 1000), umbilical hernia (3.4 per 1000), and inguinal hernia or hydrocele (2.7 per 1000). Ophthalmology was the most needed specialty (17.4 per 1000), followed by general surgery (10.1 per 1000) and orthopedics (6.9 per 1000) (**Table 2**).

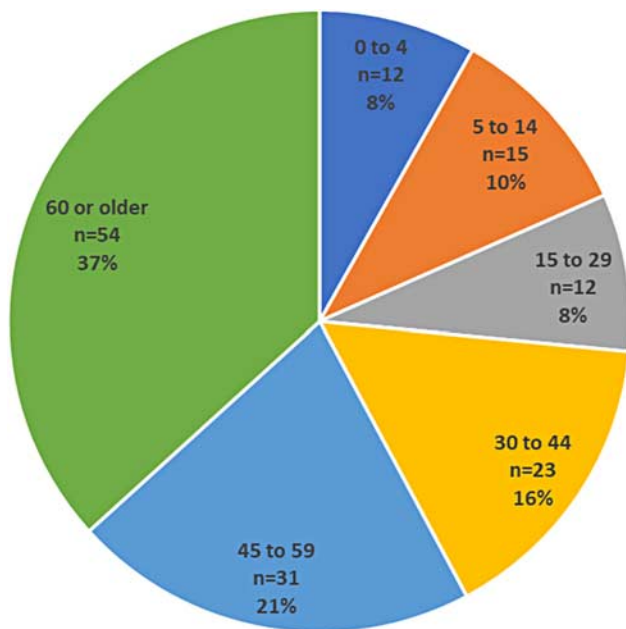


Figure 1. Age distribution of patients with untreated surgical conditions.

Table 1
Prevalence of surgical conditions or specific surgeries recommended (per 1000).

Condition or Surgery	Prevalence (Per 1000)
Cataract	9.09
Pterygium	7.37
Umbilical hernia	3.44
Inguinal hernia/hydrocele	2.70
Total knee arthroplasty	2.46
Hysterectomy (for leiomyoma or uterine prolapse)	1.97
Chronic venous insufficiency	1.47
Fracture malunion repair	1.47
Mass	1.47
Strabismus	0.98
Metatarsus adductus	0.74
Tonsillectomy and adenoidectomy	0.74
Debridement of chronic wound	0.49
Prostatectomy	0.49
Rotator cuff repair	0.49
Spinal decompression	0.49
Tympanoplasty	0.49
Acromioclavicular separation	0.25
Cholecystectomy	0.25
Cleft lip	0.25
Myringotomy tubes	0.25
Ovarian cystectomy	0.25
Polydactyly	0.25
Septoplasty	0.25
Tendon release	0.25
Total hip arthroplasty	0.25
Trigger finger	0.25
Urethral injury	0.25
Ventral hernia	0.25

Table 2

Prevalence of specialties of untreated surgical conditions.

Surgical Specialty	Prevalence (Per 1000)
Ophthalmology	17.4
General surgery	10.1
Orthopedics	6.90
Gynecology	2.22
Otolaryngology	1.73
Urology	0.74
Plastic surgery	0.25

Discussion

Our findings indicate the patient population of sugar workers’ towns on the eastern plains of the Dominican Republic has a high prevalence of untreated surgical disease. For comparison, this observed prevalence of individuals with an untreated surgical condition (3.61%) was lower than that observed in nationwide population-based surveys conducted in Sierra Leone (25%), Uganda (10.6%), Rwanda (6.4%), and Nepal (10.0%)^[10-13]. However, compared with the Dominican Republic, with a physician density of 15.6 per 10,000 population, Sierra Leone (0.17), Uganda (0.58), Rwanda (0.50), and Nepal (2.1) all have far lower physician densities (<https://www.who.int/countries/sle/en/>, <https://www.who.int/countries/uga/en/>, <https://www.who.int/countries/rwa/en/>, <https://www.who.int/countries/npl/en/>). Similarly, the expenditure per capita on health care is also much higher in the Dominican Republic (\$580) than in Sierra Leone (\$224), Uganda (\$133), Rwanda (\$125), and Nepal (\$137) (<https://www.who.int/countries/sle/en/>, <https://www.who.int/countries/uga/en/>, <https://www.who.int/countries/rwa/en/>, <https://www.who.int/countries/npl/en/>).

These 4 studies were based primarily on the Surgeons OverSeas Assessment of Surgical Need (SOSAS) (http://www.adamkushnermd.com/files/SOSAS_survey2.pdf), a verbal survey administered mostly by students, interns, or lay community members, with the Nepalese study confirmed by visual exams performed by trained physicians. The studies state the survey most accurately identifies patients in need of a surgical consult, not necessarily patients that definitively require a surgical procedure^[10-13] (<https://www.who.int/countries/sle/en/>). The Ugandan study separated these 2 groups, and our result falls within the confidence interval of patients determined to “require surgical treatment” (3.2%–4.9%) as opposed to those who required “at least 1 surgical consultation”^{[11](p. 392)}. Therefore, our findings suggest even in a high-middle income country with a more developed health care system and workforce, there remain at least pockets of the population that are unable to access nonemergent surgical care.

The similarity in observed prevalence of untreated surgical disease in this region and that of a country with far fewer physicians and far lower health care expenditure may be partly attributable to the ages of the patients diagnosed with a surgically treatable condition. Compared with the ages of patients with surgical conditions in Rwanda, for example, those in our study are generally older. While 37% of the surgical patients in our study are at least 60 years of age, 80% of the surgical patients in Rwanda were younger than 45 years old. As the life expectancy at birth in the Dominican Republic is 74 (<https://www.who.int/countries/dom/en/>) versus 68 in Rwanda (<https://www.who.int/countries/rwa/en/>), and patients are

more likely to acquire a surgical condition as they age, the Dominican Republic will have a proportionally larger population of elderly individuals that require surgical care. This is especially evident in the number of patients in need of ophthalmological surgeries such as cataract and pterygium, conditions that disproportionately affect an elderly population^[14,15].

The higher overall age of our observed surgical patients demonstrates the importance of improving surgical capacity for countries in all stages of health care development. As a country improves its ability to prevent newborn and maternal mortality, to increase vaccination rates and otherwise prevent and treat communicable disease, it will face the novel challenge of providing its ageing population with safe, timely, and affordable surgical care. However, our finding that the majority (63%) of surgical candidates are younger than 60 years old suggests that the unmet surgical need likely impacts the country's employment and productivity.

Our study has several limitations. Most important is whether our observation of the population was complete; factors exist that could have caused either an overestimate or underestimate of the true prevalence of surgical disease. For example, since the combined population of the communities was found to be 4070, but only 2308 of these presented to the clinic, it is possible that members of the community with an untreated surgical condition were not examined, leading to an underestimate. However, since individuals with any medical complaints were those invited to the clinic, we anticipate the majority of those who did not present were healthy. In contrast, it is also possible that members of the communities were missed by the census, which would decrease the denominator and lead to an overestimate of the prevalence of surgical disease. We do not see this as a significant factor, however, as the prevailing culture of the bateys is always to have one member of the household at home.

Another limitation involves the method of diagnosing surgical conditions: all diagnoses were made by primary care physicians as opposed to surgeons and were not necessarily confirmed with diagnostic imaging; both of which could lead to overestimation. However, many conditions such as hernias and cataracts do not require imaging to confirm, and volunteer physicians were instructed to determine, to the best of their clinical ability, if the patient would currently benefit from a surgical procedure and not simply evaluation by a surgeon. Therefore, we believe most of these diagnoses are indeed accurate and unlikely to overestimate prevalence.

Unlike the studies performed with the SOSAS (http://www.adamkushnermd.com/files/SOSAS_survey2.pdf), this study was not designed to include emergency surgeries or lifetime surgical prevalence, as information was not collected about recent deaths or surgeries previously received by study patients. For future research, it will also be informative to investigate reasons for delayed care seeking, especially with regards to ethnicity and legal residency status.

Conclusion

There is a currently a high prevalence of untreated surgical disease in the bateys (sugar workers' towns) on the eastern plains of the Dominican Republic. Although many of these patients with untreated surgical conditions are elderly, the majority are of working age, and therefore an increase in surgical capacity

will likely play an important role in reducing the loss of disability-adjusted life years and contribute to the productivity of the nation.

Ethical approval

Ann & Robert H. Lurie Children's Hospital of Chicago, protocol #2020-3943.

Sources of funding

This study was supported in part by a Faculty Catalyzer Grant (fund number 925791) from the Center for Primary Care Innovation of Northwestern University.

Author contribution

D.E.E. contributed to the study design, data collection, data analysis, and writing. J.M.M. contributed to the data collection and writing. K.L.C. contributed to the study design and writing. S.-H.S. contributed to the data collection. P.J.D. contributed to the study design.

Conflicts of interest disclosure

The authors declare that they have no financial conflict of interest with regard to the content of this report.

Research registration unique identifying number (UIN)

Research Registry #5970.

Guarantors

Darren E. Eblovi, Jhomairy M. Miller, Se-Hwa Sun.

References

- [1] Meara JG, Leather AJ, Hagander L, *et al.* Global Surgery 2030: evidence and solutions for achieving health, welfare, and economic development. *Lancet* 2015;386:569–624.
- [2] Farmer PE, Kim JY. Surgery and global health: a view from beyond the OR. *World J Surg* 2008;32:533–6.
- [3] Grimes CE, Henry JA, Maraka J, *et al.* Cost-effectiveness of surgery in low- and middle-income countries: a systematic review. *World J Surg* 2014;38:252–63.
- [4] Chao TE, Sharma K, Mandigo M, *et al.* Cost-effectiveness of surgery and its policy implications for global health: a systematic review and analysis. *Lancet Global Health* 2014;2:e334–45.
- [5] Debas HT, Gosselin R, McCord C, *et al.* Surgery. In: Jamison DT, Breman JG, Measham AR, Alleyne G, Claeson M, Evans DB, Jha P, Mills A, Musgrove P, editors. *Disease Control Priorities in Developing Countries*, 2nd edition. New York: Oxford University Press; 2006.
- [6] Shrimel MG, Bickler SW, Alkire BC, *et al.* Global burden of surgical disease: an estimation from the provider perspective. *Lancet Global Health* 2015;3(S2):S8–9.
- [7] Tandon A, Murray CJ, Lauer JA, *et al.* Measuring Overall Health System Performance for 191 Countries. GPE Discussion Paper Series: No. 30. World Health Organization.
- [8] Keys HM, Noland GS, De Rochars MB, *et al.* Perceived discrimination in bateyes of the Dominican Republic: results from the Everyday

- Discrimination Scale and implications for public health programs. *BMC Public Health* 2019;19:1513–25.
- [9] Agha R, Abdall-Razak A, Crossley E, *et al.* for the STROCCS Group. The STROCCS 2019 Guideline: Strengthening the reporting of cohort studies in surgery. *Int J Surg* 2019;72:156–65.
- [10] Groen RS, Samai M, Stewart K, *et al.* Untreated surgical conditions in Sierra Leone: a cluster randomized, cross-sectional, countrywide survey. *Lancet*. 2012;380:1082–87.
- [11] Tran TM, Fuller AT, Butler EK, *et al.* Burden of surgical conditions in Uganda: a cross sectional nationwide household survey. *Ann Surg* 2017;266:389–99.
- [12] Petroze RT, Groen RS, Niyonkuru F, *et al.* Estimating operative disease prevalence in a low-income country: results of a nationwide population survey in Rwanda. *Surgery* 2013;153:457–64.
- [13] Gupta S, Shrestha S, Ranjit A, *et al.* Conditions, preventable deaths, procedures, and validation of a countrywide survey of surgical care in Nepal. *British J Surg*. 2015;102:700–7.
- [14] Lee CM, Afshari NA. The global state of cataract blindness. *Curr Opin Ophthalmol* 2017;28:98–103.
- [15] Saw S, Tan D. Pterygium: prevalence, demography, and risk factors. *Ophthalmol Epidemiol* 1999;6:219–29.