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Surgical care needs of low-resource populations: an estimate of the prevalence of surgically treatable conditions and avoidable deaths in 48 countries

Shailvi Gupta, Reinou S Groen, Patrick Kyamanywa, Emmanuel A Ameh, Mohamed Labib, Damian L Clarke, Peter Donkor, Miliard Derbew, Rachid Sani, Thaim B Kamara, Sunil Shrestha, Benedict C Nwomeh, Sherry M Wren, Raymond R Price, Adam L Kushner

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Poster 2

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Abstract

Background Surgical care needs in low-resource countries are increasingly recognised as an important aspect of global health, yet data for the size of the problem are insufficient. The Surgeons OverSeas Assessment of Surgical Need (SOSAS) is a population-based cluster survey previously used in Nepal, Rwanda, and Sierra Leone.

Methods Using previously published SOSAS data from three resource-poor countries (Nepal, Rwanda, and Sierra Leone), a weighted average of overall prevalence of surgically treatable conditions was estimated and the number of deaths that could have been avoided by providing access to surgical care was calculated for the broader community of low-resource countries. Such conditions included, but were not limited to, injuries (road traffic incidents, falls, burns, and gunshot or stab wounds), masses (solid or soft, reducible), deformities (congenital or acquired), abdominal distention, and obstructed delivery. Population and health expenditure per capita data were obtained from the World Bank. Low-resource countries were defined as those with a per capita health expenditure of US\$100 or less annually. The overall prevalence estimate from the previously published SOSAS data was extrapolated to each low-resource country. Using crude death rates for each country and the calculated proportion of avoidable deaths, a total number of deaths possibly averted in the previous year with access to appropriate surgical care was calculated.

Findings The overall prevalence of surgically treatable conditions was 11·16% (95% CI 11·15–11·17) and 25·6% (95% CI 25·4–25·7) of deaths were potentially avoidable by providing access to surgical care. Using these percentages for the 48 low-resource countries, an estimated 288·2 million people are living with a surgically treatable condition and 5·6 million deaths could be averted annually by the provision of surgical care. In the Nepal SOSAS study, the observed agreement between self-reported verbal responses and visual physical examination findings was 94·6%. Such high correlation helps to validate the SOSAS tool.

Interpretation Hundreds of millions of people with surgically treatable conditions live in low-resource countries, and about 25% of the mortality annually could be avoided with better access to surgical care. Strengthening surgical care must be considered when strengthening health systems and in setting future sustainable development goals.

Funding None.

Contributors

SG, ALK, RSG, and BCN conceived and designed the study. SG, RSG, SS, TBK, PK, and ALK collected the data. SG, RSG, and ALK interpreted the data. SG and ALK wrote the Abstract. All authors approve the final version of the Abstract for publication.

Declaration of interests

We declare no competing interests.

Injury assessment in three low-resource settings: a reference for worldwide estimates

Shailvi Gupta, Sherry M Wren, Thaim B Kamara, Sunil Shrestha, Patrick Kyamanywa, Evan G Wong, Reinou S Groen, Benedict C Nwomeh, Adam L Kushner, Raymond R Price

Abstract

Background Trauma has become a worldwide pandemic. Without dedicated public health interventions, fatal injuries will rise 40% and become the 4th leading cause of death by 2030, with the burden highest in low-income and middle-income countries (LMICs). The aim of this study was to estimate the prevalence of traumatic injuries and injury-related deaths in low-resource countries worldwide, using population-based data from the Surgeons OverSeas Assessment of Surgical Need (SOSAS), a validated survey tool.

Methods Using data from three resource-poor countries (Nepal, Rwanda, and Sierra Leone), a weighted average of injury prevalence and deaths due to injury was calculated and extrapolated to low-resource countries worldwide. Injuries were defined as wounds from road traffic injuries (bus, car, truck, pedestrian, and bicycle), gunshot or stab or slash wounds, falls, work or home incidents, and burns. The Nepal study included a visual physical examination that confirmed the validity of the self-reported data. Population and annual health expenditure per capita data were obtained from the World Bank. Low-resource countries were defined as those with an annual per capita health expenditure of US\$100 or less.

Findings The overall prevalence of lifetime injury for these three countries was 18·03% (95% CI 18·02–18·04); 11·64% (95% CI 11·53–11·75) of deaths annually were due to injury. An estimated prevalence of lifetime injuries for the total population in 48 low-resource countries is 465·7 million people; about 2·6 million fatal injuries occur in these countries annually.

Interpretation The limitations of this observational study with self-reported data include possible recall and desirability bias. About 466 million people at a community level (18%) sustain at least one injury during their lifetime and 2·6 million people die annually from trauma in the world's poorest countries. Trauma care capacity should be considered a global health priority; the importance of integrating a coordinated trauma system into any health system should not be underestimated.

Funding None.

Contributors

SG, ALK, and RSG conceived and designed the study. SG, RSG, SS, TBK, PK, and ALK collected the data. SG, RSG, and ALK interpreted the data. SG wrote the abstract. All Authors approved the final version of the Abstract for publication.

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Poster 3

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Demographics of patients affected by surgical disease in rural hospitals in two sub-Saharan African countries: a retrospective analysis

Caris E Grimes, Michael L Billingsley, Anna J Dare, Nigel Day, Imogen Mabey, Sara Naraghi, Peter M George, Michael Murowa, Thaim B Kamara, Nyengo C Mkandawire, Andy Leather, Christopher B D Lavy

Abstract

Background Awareness is growing of both the importance of surgical disease as a major cause of death and disability in low-income and middle-income countries (LMICs) and the cost-effectiveness of fairly simple surgical interventions. We hypothesised that surgical disease predominantly affects young adults and is therefore significant in both the macroeconomic effect of untreated disease and the microeconomic effects on patients and families in low-resource settings.

Methods We retrospectively reviewed all admission data from two rural government district hospitals, Bo District Hospital in Sierra Leone and Thyolo District Hospital in Malawi. Both hospitals serve a rural population of roughly 600 000. We analysed data from 3 months in the wet season and 3 months in the dry season for each hospital by careful analysis of all hospital logbook data. For the purposes of this study, a surgical diagnosis was defined as a diagnosis in which the patient should be managed by a surgically trained provider. We analysed all surgical admissions with respect to patient demographics (age and sex), diagnoses, and the procedures undertaken.

Findings In Thyolo, 835 (12.9%) of 6481 hospital admissions were surgical admissions. In Bo, 427 (19.8%) of 2152 hospital admissions were surgical admissions. In Thyolo, if all patients who had undergone a procedure in theatre were admitted overnight, the total number of admissions would have been 6931, with 1344 (19.4%) hospital admissions being surgical and 1282 (18.5%) hospital patients requiring a surgical procedure. In Bo, 133 patients underwent a surgical procedure. This corresponded to 6.18% of all hospital admissions; although notably many of the obstetric admissions were referred to a nearby Médecins Sans Frontières (MSF) hospital for treatment. Analysis of the admission data showed that younger than 16-year-olds accounted for 10.5% of surgical admissions in Bo, and 17.9% of surgical admissions in Thyolo. 16–35-year-olds accounted for 57.3% of all surgical admissions in Bo and 53.5% of all surgical admissions in Thyolo. Men accounted for 53.7% of surgical admissions in Bo and 46.0% of surgical admissions in Thyolo. Analysis of the procedure data showed that younger than 16-year-olds accounted for 7.0% of procedures in Bo and 4.5% of procedures in Thyolo, with 16–35-year-olds accounting for 65.6% of all procedures in Bo and 84.4% of all procedures in Thyolo. Men underwent 63% of all surgical procedures in Bo, but only 7.7% of surgical procedures in Thyolo. This discrepancy is explained by the high rate of maternal surgery in Thyolo, which was not present in Bo because this service was provided at the nearby MSF hospital.

Interpretation Most people affected by disease requiring surgery are young adults. It would be expected that failure to provide surgical care could have long-term adverse effects on both individual and national wealth.

Funding The Sir Ratanji Dalal Scholarship from the Royal College of Surgeons of England.

Contributors

CEG conceived and designed the study, with help from CBDL and AL. ND, SN, IM, and AJD assisted with the data collection and revision of the manuscript. MLB assisted with the data analysis. NCM and TBK assisted with the background and interpretation of the data. All authors have seen and approved the final version of the Abstract for publication.

Declaration of interests

We declare no competing interests.

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Rectal bleeding and endoscopy need in Sierra Leone: results of a nationwide, community-based survey

Barclay T Stewart, Reinou S Groen, Thaim B Kamara, Steve Kwon, T Peter Kingham, Adam L Kushner

Abstract

Background Low-income and middle-income countries (LMICs) face a large burden of gastrointestinal diseases that benefit from prompt endoscopic diagnosis and treatment. This study aimed to estimate the prevalence of gross rectal bleeding among adults in Sierra Leone.

Methods A cluster randomised, cross-sectional household survey using the SOSAS tool was undertaken in Sierra Leone. 75 clusters of 25 households with two randomly selected respondents in each were sampled to estimate the prevalence of and disability from rectal bleeding. Barriers to care were also assessed.

Findings 3645 individuals responded to the survey, 15 with rectal bleeding. Nine responders (64%) had been bleeding for more than a year. The prevalence of rectal bleeding was 412 per 100 000 people. In view of these findings, an estimated 24 604 individuals with rectal bleeding are in need of evaluation in Sierra Leone. Eight (53%) of the 15 people with rectal bleeding sought care from a traditional healer. If medical care was not sought, the most common reason was absence of financial resources (ten people; 77%), followed by no capable facility availability (two; 15%), and inability to leave work or family for the time needed (one; 8%). Seven (54%) of those with rectal bleeding reported some form of disability, including five (39%) that had bleeding that prevented usual work.

Interpretation The high prevalence of rectal bleeding identified in Sierra Leone represents a major unmet health-care need. This study did not examine the cause of bleeding. However, the high prevalence, chronicity, and disability among respondents with bleeding suggest a substantial burden of disease. Additionally, because microscopic haematochezia was not assessed, these data represent a bare-minimum estimate of rectal bleeding in need of evaluation and treatment. In view of the substantial burden of conditions that can be diagnosed, treated, or palliated with timely endoscopic therapy, it is appropriate to consider endoscopy among efforts to develop health system capacity in LMICs.

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Contributors

RSG, TBK, TPK, and ALK conceived and designed the study. RSG, TBK, TPK, and ALK collected the data. BTS, SK, TPK, and ALK interpreted the data. BTS and SK wrote the Abstract. All authors approved the final version of the Abstract for publication.

Declaration of interests

We declare no competing interests.

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Poster 5

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Surgical need in an ageing population: a cluster-based household survey in Nepal

Barclay T Stewart, Even Wong, Shailvi Gupta, Santosh Bastola, Sunil Shrestha, Adam L Kushner, Benedict C Nwomeh

Abstract

Background With an ageing global population comes major non-communicable disease burden, especially in low-income and middle-income countries. An unknown proportion of this burden is treatable or palliated with surgery. This study aimed to estimate the surgical needs of individuals aged 50 years or older in Nepal.

Methods A two-stage, 30 randomised cluster by 30 households, community-based survey was performed in Nepal with the validated Surgeons OverSeas Assessment of Surgical Need (SOSAS). Respondents aged older than 50 years were included. After verbal informed consent was obtained, SOSAS collected household demographics, completed a verbal autopsy, and randomly selected household members for verbal head-to-toe examinations for surgical conditions. The Nepal Health Research Council in Kathmandu and the Nationwide Children's Hospital in Columbus, OH, USA, granted ethical approval.

Findings The survey sampled 1350 households, totalling 2695 individuals (97% response rate); 49% were aged 50–59 years, 33% were 60–69 years, and 17% were 70 years and older. Of these, 273 surgical conditions were reported by 507 individuals. A growth or mass (including hernias and goiters) was the most commonly reported potentially surgical condition (25%), injuries and fractures were also common and had the greatest disability. Acquired deformities (13%), incontinence (11%), non-injury wounds (9%), and pelvic organ prolapse were also prevalent. Together, head and neck (24%) and back and extremity conditions (32%) were responsible for more than half of the conditions potentially treatable with surgery. These were followed by genitourinary (28%), abdominal (14%) and chest and breast conditions (2%). Extrapolated nationwide, roughly 1.25 million elderly individuals have a surgically treatable condition (32 150 per 100 000 people). There were 108 deaths in the year before to the survey. 20 (19%) were potentially preventable with surgery. Half of the deaths were due to a growth or mass, 20% to injury, 20% to abdominal pain or distension, and 10% to a non-injury wound. The age-standardised death rate of those with a potentially surgical condition was 24 per 1000 persons for individuals in their 6th decade, 60 per 1000 for those in their 7th, and 44 per 1000 for those in their 8th. One in five deaths were potentially treatable or palliated by surgery. Literacy and distance to secondary and tertiary health facilities were associated with not receiving care for surgical conditions ($p < 0.05$).

Interpretation Surgical need is largely unmet among elderly individuals in Nepal. Literacy and distance from a capable health facility are the greatest barriers to care. Although verbal examination findings were used as proxies for surgical conditions, the survey tool has been previously validated. Also, there is potential for recall bias with overestimation of tragic deaths and underestimation of unknown or forgotten surgical causes of death and disease. However, this is the most comprehensive evaluation of surgical need in a developing country among the elderly. As the global population ages, there is an increasing need to improve access to surgical services and strengthen health systems to care for this group.

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Contributors

SG, SB, SS, ALK, and BN conceived and designed the study. EW, SG, SB, and SS collected the data. BTS, EW, ALK, and BN interpreted the data. BTS and EW wrote the Abstract. All authors approved the final version of the Abstract for publication.

Declaration of interests

We declare no competing interests.

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Poster 6

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An estimate of hernia prevalence in Nepal from a countrywide community survey

Barclay T Stewart, John Prathak, Shailvi Gupta, Sunil Shrestha, Reinou S Groen, Benedict C Nwomeh, Adam L Kushner, Thomas McIntyre

Abstract

Background Herniorrhaphy is one of the most frequently performed general surgical operations worldwide; however, most low-income and middle-income countries (LMICs) are unable to provide this essential surgery resulting in substantial morbidity and mortality. This study aimed to estimate the prevalence of, barriers to care for, and disability from untreated hernias in Nepal.

Methods A cluster randomised, cross-sectional household survey was performed in Nepal using the validated Surgeons OverSeas Assessment of Surgical (SOSAS) tool. Sample size was based on a pilot study that reported a 5% prevalence of unmet surgical need. 15 clusters consisting of 30 households each were sampled proportional to population. In each, two randomly selected family members underwent a verbal head-to-toe physical examination and answered questions about barriers to care and disability.

Findings The survey sampled 1350 households, totalling 2695 individuals (97% response rate). 1434 (53%) of responders were men and 1.5% (95% CI 1.8–4.0) had a mass or swelling in the groin at time of survey. The age-standardised rate for inguinal hernias in men ranged from 1144 per 100 000 persons between age 5 and 49 years and 2941 per 100 000 persons aged 50 years and older. 29 respondents were not able to have surgery due to lack of surgical services (nine; 31%), fear or mistrust of the surgical system (nine; 31%), and inability to afford care (six; 21%). 10 respondents (20%) were unable to work as previous or perform self-care due to their hernia.

Interpretation Despite the lower than expected prevalence of inguinal hernias, more than 300 000 people in Nepal are currently in need of herniorrhaphy. In view that essential surgery is a necessary component in health systems, the prevalence of inguinal hernias and the cost-effectiveness of herniorrhaphy, this disease is an important target for LMICs planning surgical capacity improvements.

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Contributors

JP, SG, SS, RSG, BCN, and ALK conceived and designed the study. JP, SG, SS, RSG, BCN, and ALK collected the data. BTS, ALK, and TM interpreted the data. JP, BTS, SG, SS, ALK, and TM wrote the Abstract. All authors approved the final version of the Abstract for publication.

Declaration of interests

We declare no competing interests.

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Burden of road traffic injuries in Nepal: results of a countrywide population-based survey

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Abstract

Background Road traffic injury has emerged as a leading cause of mortality, contributing to 2·1% of deaths globally and is predicted to be the third highest contributor to the global burden of mortality by 2020. This major public health problem disproportionately affects low-income and middle-income countries, where such incidents are too often underreported. Our study aims to explore the epidemiology of road traffic injuries in Nepal at a population level via a countrywide study.

Methods The Surgeons OverSeas Assessment of Surgical Need (SOSAS) tool, a cluster randomised, cross-sectional nationwide survey, was conducted in Nepal between May 25, and June 12, 2014. Two-stage cluster sampling was performed: 15 of 75 districts were chosen randomly proportional to population; within each district, after stratification for urban and rural, and three clusters were randomly chosen. Questions were structured anatomically and designed around a representative spectrum of surgical conditions. Road traffic injury-related results were reported.

Findings 1350 households and 2695 individuals were surveyed with a response rate of 97%. 75 road traffic injuries were reported in 72 individuals (2·67% [95% CI 2·10–3·35] of the study population), with a mean age of 33·2 years (SD 1·85). The most commonly affected age group was 30–44 years, with females showing significantly lower odds of sustaining a road traffic injury than men (crude odds ratio 0·29 [95% CI 0·16–0·52]). Road traffic injuries composed 19·8% of the injuries reported. Motorcycle crashes were the most common road traffic injuries (48·0%), followed by car, truck, or bus crashes (26·7%), and pedestrian or bicycle crashes (25·3%). The extremity was the most common anatomic site injured (74·7%). Of the 80 deaths reported in the previous year, 7·5% (n=6) were due to road traffic injuries.

Interpretation This study provides the epidemiology of road traffic injuries at a population-based level in the first countrywide surgical needs assessment in Nepal. WHO reported that mortality due to road traffic injuries in Nepal in 2011 was 1·7%, whereas our study reported 7·5%, consistent with the concept of underreporting of deaths in police and hospital level data noted in previous literature. Road traffic injuries continue to be a significant problem in Nepal, probably greater than previously reported; future efforts should focus on addressing this growing epidemic through preventive and mitigating strategies.

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Contributors

SGup, BCN, and ALK conceived and designed the study. SN, SGup, and SGur collected the data. SGup, SGur, EGW, MS, ALK, and BCN interpreted the data. SGup and SN wrote the Abstract. All authors approved the final version of the Abstract for publication.

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Poster 8

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Validation of a community-based survey assessing non-obstetric surgical conditions in Burera District, Rwanda

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Abstract

Background Community-based surveillance methods to monitor epidemiological progress in surgery have not yet been employed for surgical capacity building. The aim of this study was to create and assess the validity of a questionnaire that collected data for untreated surgically correctable diseases throughout Burera District, northern Rwanda, to accurately plan for surgical services.

Methods A structured interview to assess for the presence or absence of ten index surgically treatable conditions (breast mass, cleft lip/palate, club foot, hernia or hydrocele [adult and paediatric]), hydrocephalus, hypospadias, injuries or wounds, neck mass, undescended testes, and vaginal fistula) was created. The interview was built based on previously validated questionnaires, forward and back translated into the local language and underwent focus group augmentation and pilot testing. In March and May, 2012, data collectors conducted the structured interviews with a household representative in 30 villages throughout Burera District, selected using a two-stage cluster sampling design. Rwandan physicians revisited the surveyed households to perform physical examinations on all household members, used as the gold standard to validate the structured interview. Ethical approval was obtained from Boston Children's Hospital (Boston, MA, USA) and the Rwandan National Ethics Committee (Kigali, Rwanda). Informed consent was obtained from all households.

Findings 2990 individuals were surveyed, a 97% response rate. 2094 (70%) individuals were available for physical examination. The calculated overall sensitivity of the structured interview tool was 44.5% (95% CI 38.9–50.2) and the specificity was 97.7% (96.9–98.3%; appendix). The positive predictive value was 70% (95% CI 60.5–73.5), whereas the negative predictive value was 91.3% (90.0–92.5). The conditions with the highest sensitivity and specificity, respectively, were hydrocephalus (100% and 100%), clubfoot (100% and 99.8%), injuries or wounds (54.7% and 98.9%), and hypospadias (50% and 100%). Injuries or wounds and hernias or hydroceles were the conditions most frequently identified on examination that were not reported during the interview (appendix).

Interpretation To the best of our knowledge, this study provides the first attempt to validate a community-based surgical surveillance tool. The finding of low sensitivity limits the use of the tool, which will require further revision, and calls into question previously published unvalidated community surgical survey data. To improve validation of community-based surveys, community education efforts on common surgically treatable conditions are needed in conjunction with increased access to surgical care. Accurate community-based surveys are crucial to integrated health system planning that includes surgical care as a core component.

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Contributors

AFL, EK, GM, GN, GK, EN, FN, JM, TM, JGM, and RR conceived and designed the study. AFL, EK, GN, GK, FN, and JM collected the data. AFL, RM, BLH-G, GM, GN, GK, EN, JGM, and RR interpreted the data. AFL, RM, BLHG, JGM, and RR wrote the Abstract. All authors approved the final version of the Abstract for publication.

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Poster 9

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Epidemiology of untreated non-obstetric surgical disease in Burera District, Rwanda: a cross-sectional survey

Allison F Linden, Rebecca Maine, Bethany L Hedt-Gauthier, Emmanuel Kamanzi, Gita Mody, Georges Ntakiyiruta, Grace Kansayisa, Edmond Ntaganda, Francine Niyonkuru, Joel Mubiligi, Tharcisse Mpunga, John G Meara, Robert Riviello

Abstract

Background In low-income and middle-income countries, surgical epidemiology is largely undefined at the population level, with operative logs and hospital records serving as a proxy. This study assesses the distribution of surgical conditions that contribute the largest burden of surgical disease in Burera District, in northern Rwanda. We hypothesise that our results would yield higher rates of surgical disease than current estimates (from 2006) for similar low-income countries, which are 295 per 100 000 people.

Methods In March and May, 2012, we performed a cross-sectional study in Burera District, randomly sampling 30 villages with probability proportionate to size and randomly sampling 23 households within the selected villages. Six Rwandan surgical postgraduates and physicians conducted physical examinations on all eligible participants in sampled households. Participants were assessed for injuries or wounds, hernias, hydroceles, breast mass, neck mass, obstetric fistula, undescended testes, hypospadias, hydrocephalus, cleft lip or palate, and club foot. Ethical approval was obtained from Boston Children's Hospital (Boston, MA, USA) and the Rwandan National Ethics Committee (Kigali, Rwanda). Informed consent was obtained from all participants.

Findings Of the 2165 examined individuals, the overall prevalence of any surgical condition was 12% (95% CI 9·2–14·9) or 12 009 per 100 000 people. Injuries or wounds accounted for 55% of the prevalence and hernias or hydroceles accounted for 40%, followed by neck mass (4·2%), undescended testes (1·9%), breast mass (1·2%), club foot (1%), hypospadias (0·6%), hydrocephalus (0·6%), cleft lip or palate (0%), and obstetric fistula (0%). When comparing study participant characteristics, no statistical difference in overall prevalence was noted when examining sex, wealth, education, and travel time to the nearest hospital. Total rates of surgically treatable disease yielded a statistically significant difference compared with current estimates ($p < 0\cdot001$).

Interpretation Rates of surgically treatable disease are significantly higher than previous estimates in comparable low-income countries. The prevalence of surgically treatable disease is evenly distributed across demographic parameters. From these results, we conclude that strengthening the Rwandan health system's surgical capacity, particularly in rural areas, could have meaningful affect on the entire population. Further community-based surgical epidemiological studies are needed in low-income and middle-income countries to provide the best data available for health system planning.

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Contributors

AFL, EK, GM, GN, GK, EN, FN, JM, TM, JGM, and RR conceived and designed the study. AFL, EK, GN, GK, FN, and JM collected the data. AFL, RM, BLH-G, GM, GN, GK, EN, JGM, and RR interpreted the data. AFL, RM, BLH-G, JGM, and RR wrote the Abstract. All authors approved the final Abstract for publication.

Declaration of interests

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Prevalence of chronic pain in low-income and middle-income countries: a systematic review and meta-analysis

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Abstract

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Poster 11

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Background The global burden of chronic pain and disability could be related to unmet surgical needs. This systematic review and meta-analysis aims to characterise existing data regarding the prevalence and associations of chronic pain in low-income and middle-income countries; this is essential to allow better assessment of its relationship to pre-operative and post-operative pain as emergency and essential surgical services are expanded.

Methods According to PRISMA guidelines, we searched PubMed, PsycInfo, and Cochrane registries for articles published before Dec 31, 2013, using the search terms “pain AND (chronic OR persistent) AND (low income countries OR middle income countries OR LMIC OR Africa OR Asia OR Central America OR South America) AND (incidence OR prevalence).” We excluded paediatric populations (aged younger than 18 years) and those with acute pain or pain associated with known trauma, surgery, infection, or medical disorders.

Findings We identified 122 publications in 28 low-income and middle-income countries for systematic review; 79 surveys from general adult populations, elderly general populations, or workers. The prevalence of any type of chronic pain was 33% (95% CI 26–40) in the general adult population, 56% (36–75) in the general elderly population, and 35% (4–88) in workers; lower back pain was 18% (14–24), 31% (22–41), and 44% (33–55), respectively; headache 39% (27–53), 49% (37–60), and 52% (16–86), respectively; chronic daily headache 5% (3–7), not available, and 12% (8–19), respectively; musculoskeletal pain 26% (19–33), 39% (23–57), and 86% (56–93), respectively; joint pain 14% (11–18), 42% (26–60), and not available, respectively; and widespread pain 14% (9–22), 22% (9–46), and not available, respectively. Due to limited data, meta-analysis could only be done in single populations for some conditions. For general adult populations, chronic migraine was 10% (5–20); chronic tension-type headache was 4% (2–9); chronic pelvic pain or prostatitis was 11% (8–17); and fibromyalgia was 4% (3–7). In elderly general populations, prevalence of temporomandibular disorder was 7% (1–31) and abdominal pain was 6% (1–28). Heterogeneity in prevalence was largely secondary to variable definitions of pain chronicity. Associations were not readily amenable to meta-analysis; yet of the 122 publications, pain was described in association with disability in 50, female sex in 40, older age in 34, depression in 36, anxiety in 19, and multiple somatic complaints in 13.

Interpretation The prevalence of pain in low-income and middle-income countries is consistent with Global Burden of Disease data, with higher rates in the elderly general population and workers than in the general adult population. 28% of the global burden of disease that could be averted by surgery and safe anaesthesia might also be related to the chronic pain burden. Trauma, cancer, birth complications, congenital defects, and other surgical diseases potentially lead to chronic pain if not treated or if treated inadequately. This meta-analysis shows the range of chronic pain in low-income and middle-income countries, but has fallen short of revealing clear causes for the pain. The demonstration of the prevalence of chronic pain is essential as the era of global surgery begins, to allow benchmarking of this prevalence in the future as emergency and essential surgery services are expanded in low-income and middle-income countries.

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Contributors

TJ conceived and designed the study. TJ and ST collected the data. TJ, MS, and XH interpreted the data. TJ wrote the Abstract. All authors approved the final version of the Abstract for publication.

Declaration of interests

We declare no competing interests.

Estimate of the global volume of surgery in 2012: an assessment supporting improved health outcomes



Thomas G Weiser*, Alex B Haynes*, George Molina, Stuart R Lipsitz, Micaela M Esquivel, Tarsicio Uribe-Leitz, Rui Fu, Tej Azad, Tiffany E Chao, William R Berry, Atul A Gawande

Abstract

Background It was previously estimated that 234·2 million operations were performed worldwide in 2004. The association between surgical rates and population health outcomes is not clear. We re-estimated global surgical volume to track changes over time and assess rates associated with healthy populations.

Methods We gathered demographic, health, and economic data for 194 WHO member states. Surgical volumes were obtained from published studies and other reports from 2005 onwards. We estimated rates of surgery for all countries without available data based on health expenditure in 2012 and assessed the proportion of surgery comprised by caesarean delivery. The rate of surgery was plotted against life expectancy to describe the association between surgical care and this health indicator.

Findings We identified 66 countries reporting surgical data between 2005 and 2013. We estimate that 312·9 million operations (95% CI 266·2–359·5) took place in 2012—a 33·6% increase over 8 years; the largest proportional increase occurred in countries spending US\$400 or less per capita on health care. Caesarean delivery comprised 29·8% (5·8 million operations) of the total surgical volume in poor health expenditure countries compared with 10·8% (7·8 million operations) in low health expenditure countries and 2·7% (5·1 million operations) in high health expenditure countries. We noted a correlation between increased life expectancy and increased surgical rates up to 1533 operations per 100 000 people, with significant but less dramatic improvement above this rate.

Interpretation Surgical volume is large and continues to grow in all economic environments. A single procedure—caesarean delivery—comprised almost a third of surgical volume in the most resource-limited settings. Surgical care is an essential part of health care and is associated with increased life expectancy, yet many low-income countries fail to achieve basic levels of service. Improvements in capacity and delivery of surgical services must be a major component of health system strengthening.

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Contributors

TGW, ABH, and AAG conceived the study. TGW, GM, ME, TUL, TA, TEC, and ABH acquired the data. TGW, ABH, GM, SRL, RF, WRB, and AAG analysed and interpreted the data. TGW, ABH, GM, and SRL drafted the Abstract, which was critically reviewed by all authors.

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Poster 13

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Proposed minimum rates of surgery to support desirable health outcomes: an observational study based on four strategies

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Abstract

Background The global volume of surgery in 2012 is estimated at 312·9 million operations per year, but rates of surgery vary substantially. Maternal health advocates proposed minimum caesarean delivery rates for benchmarking and to improve perinatal outcomes; however, this has not been done for surgery because the association between rates of surgical care provision as a whole and population health outcomes have not been well described. We use available data to estimate minimum rates of surgery that are associated with important health indicators.

Methods We defined surgical operations as procedures done in operating theatres that need general or regional anaesthesia or profound sedation to control pain. We used four strategies to identify rates of surgery based on estimated rates of surgery per country for 2012 associated with life expectancy of 74–75 years; estimated rates of surgery associated with a maternal mortality ratio of less than or equal to 100 per 100 000 live births; estimated minimum need for surgery in the 21 Global Burden of Disease (GBD) regions based on the prevalence of disorders; and surgical rates from the so-called 4C countries (Chile, China, Costa Rica, and Cuba) identified in The *Lancet* Commission on Global Surgery as exemplary for their achievement of high health status, despite resource limitations.

Findings Based on 2012 national surgical rates, countries with reported life expectancy of 74–75 years (n=17) had a median surgical rate of 4392 (IQR 2897–4873) operations per 100 000 population annually. The median surgical rate associated with maternal mortality ratio lower than 100 (n=109) is 5028 (IQR 4139–6778) operations per 100 000 population annually. The median surgical rate estimated for all 21 GBD regions was 4669 (IQR 4339–5291) operations per 100 000 population annually. The 4C countries had a mean surgical rate of 4344 (95% CI 2620–6068) operations per 100 000 population annually. 13 of the 21 GBD regions, accounting for 78% of the world's population, do not achieve the lowest end of the surgical rate range.

Interpretation We identified a surprisingly narrow range of surgical rates associated with important health indicators. This target range can be used for benchmarking of surgical services, and as part of a policy aimed at strengthening health-care systems and surgical capacity.

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Contributors

MME, JR, SWB, ABH, and TGW conceived the study. MME, TGW, GM, TUL, JR, SWB, and ABH acquired the data. MME, TGW, SRL, GM, JR, SWB, AAG, and ABH analysed and interpreted the data. MME and TGW drafted the Abstract. All authors have seen and approved the final version of the Abstract for publication.

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How much surgery is enough? Aligning surgical delivery with best-performing health systems

Mark G Shrime, Kimberly M Daniels, John G Meara

Abstract

Background Surgical delivery varies 150-fold across countries. However, no direct correlation exists between surgical delivery and health outcomes, making it difficult to pinpoint a goal for surgical scale-up. We attempted to determine the amount of surgery that would be delivered worldwide, if the world aligned itself with countries providing the best health outcomes.

Methods The number of cases performed annually has previously been published for 55 countries, which we stratified by World Bank income group. Life expectancy, maternal mortality, under-5 mortality, adult mortality, and a composite outcome of the four were plotted against reported surgical delivery. Univariate and multivariate polynomial regression curves were fit, and the optimum point on each regression curve was determined by solving for first-order conditions. The country closest to the optimum for each health outcome was taken as representative of the best-performing health system. Monetary inputs to, and surgical procedures provided by, these health systems were scaled to the global population.

Findings For the five health outcomes, four countries (Sweden, Germany, Singapore, and Canada) performed at the optimum. Currently, 318 million procedures are provided annually around the world. If global surgical delivery mirrored delivery in the four best-performing countries, however, between 630 million (maternal survival) and 870 million cases (composite outcome) would be provided annually. With population growth, this will increase to between 750 million and 1 billion annual cases, respectively, by 2030. The best-performing health systems spend roughly 10% of their gross domestic product on health-care, providing 9000–12 000 cases per 100 000 individuals in the population.

Interpretation To the best of our knowledge this is the first study to provide empirical evidence for the surgical output that an ideal health system would provide. The findings in this study provide a potential goal for surgical scale-up around the world.

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Contributors

MGS and JGM conceived and designed the study. MGS collected the data. MGS and KMD interpreted the data. MGS wrote the Abstract. All authors approved the final version of the Abstract for publication.

Declaration of interests

MGS received speaking fees from Ethicon in 2014 for a talk that was not related to this Abstract. We declare no competing interests.

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✚ Projections to achieve minimum surgical rate threshold: an observational study

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Abstract

Background Recent work has indicated an increase in surgical services, especially in resource poor settings. However, the rate of growth is poorly understood and likely insufficient to meet public health needs. We previously identified a range of 4344 to 5028 operations per 100 000 population annually to be related to desirable health outcomes. From this and other evidence, the *Lancet* Commission on Global Surgery recommends a minimum rate of 5000 operations per 100 000 population. We evaluate rates of growth in surgery and estimate the time it will take to reach this minimum surgical rate threshold.

Methods We aggregated 2004 and 2012 country-level surgical rate estimates into the 21 Global Burden of Disease (GBD) regions. We calculated mean rates of surgery proportional to population size and estimate rate of growth between these years. We then extrapolated the time it will take to reach a surgical rate of 5000 operations per 100 000 population based on linear rates of change.

Findings All but two regions (central Europe and southern Latin America) experienced growth in their surgical rates during the past 8 years; the fastest growth occurred in regions with the lowest surgical rates. 14 regions representing 79% of the world's population (5·5 billion people) did not meet the recommended surgical rate threshold in 2012. If surgical capacity grows at current rates, seven regions (central sub-Saharan Africa, east Asia, eastern sub-Saharan Africa, north Africa and middle east, south Asia, southeast Asia, and western sub-Saharan Africa) will not meet the recommended surgical rate threshold by 2035; Eastern Sub-Saharan Africa will not reach this level until 2124.

Interpretation The rates of growth in surgical service delivery are exceedingly variable, but the largest growth rates were noted in the poorest regions. Although this study does not address the quality of care, and rates of surgery are unlikely to change linearly, this exercise is useful to project how many years it could take regions to reach specific surgical rates. At current rates of growth, 4·9 billion people (70% of the world's population) will still be living in countries below the minimum recommended rate of surgery in 2035. A strategy for strengthening surgical capacity is essential if these targets are to be met as part of integrated health system development.

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Contributors

TU-L, MME, and TGW conceived the study. TU-L, MME, TGW, GM, SRL, and ABH acquired the data. TU-L, MME, GM, SRL, SV, JR, SWB, AAG, ABH, and TGW analysed and interpreted the data. TU-L, MME, and TGW drafted the Abstract. All authors have seen and approved the final version of the Abstract for publication.

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A qualitative study exploring contextual challenges to surgical care provision in 21 LMICs

Nakul P Raykar, Rachel R Yorlets, Charles Liu, Sarah L M Greenberg, Meera Kotagal, Roberta Goldman, Nobhojit Roy, John G Meara, Rowan D Gillies

Abstract

Background Billions of people worldwide are without access to safe, affordable, and timely surgical care. The *Lancet* Commission on Global Surgery (LCoGS) conducted a qualitative study to understand the contextual challenges to surgical care provision in low-income and middle-income countries (LMICs), and how providers overcome them.

Methods A semi-structured interview was administered to 143 care providers in 21 LMICs using stratified purposive sampling to include both urban and rural areas and reputational case selection to identify individual providers. Interviews were conducted in Argentina (n=5), Botswana (3), Brazil (10), Cape Verde (4), China (14), Colombia (4), Ecuador (6), Ethiopia (10), India (15), Indonesia (1), Mexico (9), Mongolia (4), Namibia (2), Pakistan (13), Peru (5), Philippines (1), Sierra Leone (11), Tanzania (5), Thailand (2), Uganda (9), and Zimbabwe (15). Local collaborators of LCoGS conducted interviews using a standardised implementation manual and interview guide. Questions revolved around challenges or barriers in the area of access to care for patients; challenges or barriers in the area of in-hospital care for patients; and challenges or barriers in the area of governance or health policy. De-identified interviews were coded and interpreted by an independent analyst.

Findings Providers across continent and context noted significant geographical, financial, and educational barriers to access. Surgical care provision in the rural hospital setting was hindered by a paucity of trained workforce, and inadequacies in basic infrastructure, equipment, supplies, and access to banked blood. In urban areas, providers face high patient volumes combined with staff shortages, minimal administrative support, and poor interhospital care coordination. At a policy level, providers identified regulations that were inconsistent with the realities of low-resource care provision (eg, a requirement to provide 'free' care to certain populations but without any guarantee for funding). Regional variation did exist on some matters, particularly related to prevalence of patient-provider mistrust and supply chain failures. Everywhere, providers have created innovative workarounds to overcome some of these barriers, such as clever financing mechanisms for planned surgery (eg, raising donated farm animals for cash in Zimbabwe, Ethiopia, and India), provision in scheduling and accommodations to facilitate patients from afar, reduction of cost and waste through re-sterilisation of disposable supplies, and locally sourcing consumables (eg, hand cleaning solution made of alcohol from the local distillery in India).

Interpretation Although some variation exists between countries, the challenges to surgical care provision are largely consistent and based on local resource availability; underfunded rural hospitals faced similar challenges worldwide. Global efforts to scale-up surgical services can focus on these commonalities (eg, investments in infrastructure, workforce), while local governments can tailor solutions to key contextual differences (eg, community-based outreach, supply chains, professional management, and interhospital coordination).

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Contributors

RDG, NR, NPR, SLMG, MK, JGM, and RG conceived and designed the study. NPR, RRY, and CL coordinated data collection. RRY and NPR interpreted the data. NPR, RRY, CL, and RDG wrote the Abstract. All authors approved the final version of the Abstract for publication.

Declaration of interests

We declare no competing interests.

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Geospatial mapping to estimate timely access to surgical care in nine low-income and middle-income countries

Nakul P Raykar, Alexis N Bowder, Charles Liu, Martha Vega, Jong H Kim, Gloria Boye, Sarah L M Greenberg, Johanna N Riesel, Rowan D Gillies, John G Meara, Nobhojit Roy

Abstract

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Background The *Lancet* Commission on Global Surgery calls for universal access to safe, affordable, and timely surgical care. Two requisite components of timely access are (1) the ability to reach a surgical provider in a given timeframe, and (2) the ability to receive appropriately prompt care from that provider. We chose a threshold of 2 h in view of its relevance in time-to-death in post-partum haemorrhage. Here, we use geospatial mapping to enumerate the percentage of a nation's population living within 2 h of a surgeon and the surgeon-to-population ratio for each provider.

Methods Geospatial mapping was used to identify the population living within a 2-h driving distance (access zone) of a health-care facility staffed by a surgeon. Surgeon locations were extracted from Ministries of Health, professional society databases, and published literature for countries which had available data. Data were reviewed by individuals knowledgeable of in-country distribution. Spatial distribution of providers was mapped with Google Maps engine. Access zones were constructed around every provider through estimation of driving times in Google Maps. The number of people living within zones was estimated with the Socioeconomic Data and Applications Center Population Estimation Service. Surgeon-to-population ratios were constructed for every individual access zone and averaged to report a single ratio.

Findings Results (% country's population living within an access zone; average surgeon:population ratio within all access zones) are reported for nine countries with available data: Somaliland (16.9%; 1:118 306), Botswana (31.0%; 1:64 635), Ethiopia (39.6%; 1:229 696), Rwanda (41.3%; 1:158 484), Namibia (43.4%; 1:69 385), Zimbabwe (54%; 1:148 292), Mongolia (55.5%; 1:10 500), Sierra Leone (70.3%; 1:106 742), and Pakistan (84.4%; 1:139 299). Surgeon-to-population ratios vary substantially even within countries; in Sierra Leone, urban access zones have a ratio of 1:45 058 and rural access zones have a ratio of 1:467 929.

Interpretation Surgical access is poor in many low-income and middle-income countries, even when using a narrow definition of surgical access consisting only of timeliness. Living outside of an access zone makes timely access to surgical care highly unlikely, and in view of low surgeon-to-population ratios and poor prehospital transport, even living within a 2-h access zone might not confer 2-h access. Investments in infrastructure and training must be prioritised to address widespread disparity in access to timely surgery.

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Contributors

NPR, SLMG, JNR, RDG, JGM, and NR conceived and designed the study. NPR and CL coordinated data collection. NPR, ANB, MV, JHK, and GB interpreted the data. NPR, ANB, CL, and MV wrote the Abstract. All authors approved the final version of the Abstract for publication.

Declaration of interests

We declare no competing interests.

Trauma and orthopaedic capacity of 267 hospitals in east central and southern Africa

Linda Chokotho, Kathryn H Jacobsen, David Burgess, Mohamed Labib, Grace Le, Christopher B D Lavy, Hemant Pandit

Abstract

Background Trauma and road traffic accidents are predicted to increase significantly in the next decade in low-income and middle-income countries. The College of Surgeons of East, Central, and Southern Africa (COSECSA) covers Ethiopia, Kenya, Tanzania, Uganda, Rwanda, Burundi, Mozambique, Malawi, Zimbabwe, and Zambia. Ministry of Health websites for these ten countries show that 992 hospitals are covering an estimated 318 million people.

Methods The WHO Tool for Situational Analysis to Assess Emergency and Essential Surgical Care was used with added questions relevant to trauma and orthopaedic care. A web-based survey platform was used and hospitals were contacted via COSECSA representatives. Consent to share data was requested, anonymised for country and hospital.

Findings 267 (27%) of 992 hospitals completed the survey. 185 were district level hospitals and 82 were referral or tertiary level hospitals. Formal accident and emergency departments were present in only 29% of district hospitals (95% CI 22.5–35.5) and 35% (24.7–45.3) of referral or tertiary level hospitals. The mean number (SD) of surgeons was 1.4 (3.0) in district hospitals and 2.6 (4.6) in referral or tertiary level hospitals. The mean number (SD) of orthopaedic surgeons was 0.3 (0.9) in district hospitals and 0.5 (0.9) in referral or tertiary level hospitals. Medically qualified anaesthetists were available in 16% (95% CI 10.7–21.3) of district hospitals and 20% (11.4–28.6) of referral or tertiary level hospitals. C arm radiography was available in 3% (95% CI 0.5–5.5) of district hospitals and 32% (21.9–42.1) of referral or tertiary level hospitals. CT scanning was available in 6% (95% CI 2.6–9.4) of district hospitals and 21% (12.2–29.8) of referral or tertiary level hospitals. Closed fracture treatment was offered in 75% (95% CI 68.8–81.2) of district hospitals and 82% (73.7–90.3) of referral or tertiary level hospitals. 37% (95% CI 30.1–43.9) of district hospitals and 40% (29.4–50.6) of referral or tertiary level hospitals had adequate instruments for the surgical treatment of fractures, but only 7% (3.4–10.6) of district hospitals and 8% (2.1–13.9) of referral or tertiary level hospitals had a sustainable supply of fracture implants. Elective orthopaedic surgery took place in 30% (95% CI 23.4–36.6) of district hospitals and 34% (23.8–44.2) of referral or tertiary level hospitals. Ponseti treatment of clubfoot was available at 46% (95% CI 38.8–53.2) of district hospitals and 44% (33.3–54.7) of referral or tertiary level hospitals.

Interpretation This study has limitations in that only 27% of eligible hospitals completed the survey, and it is certainly possible that there could be bias in that the less well resourced institutions could also be less likely to cooperate with data collection. Thus, it is possible that the figures we present overestimate the resources available in the region as a whole. However, despite the limitations in data quality, it is clear that current capacity to treat trauma and orthopaedic conditions is very limited, with particular areas of concern being manpower, training, facilities, and equipment. COSECSA will use these data as a baseline for further surveys and to develop a strategy to improve trauma and orthopaedic care in the region.

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Contributors

CBDL, LC, ML, and HP conceived and designed the study. LC, DB, and GL collected data. LC, DB, and KJ interpreted the data. CL and HP wrote the Abstract. All authors approved the final version of the Abstract for publication.

Declaration of interests

We declare no competing interests.

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Surgery in district hospitals in rural Uganda—indications, interventions, and outcomes

Jenny Löfgren, Daniel Kadobera, Birger C Forsberg, Jude Mulwooza, Andreas Wladis, Pär Nordin

Abstract

Background There is a vast unmet need for surgical interventions in resource scarce settings. The poorest 2 billion people share 3·5% of the world's operations. The highest burden of surgical disease is seen in Africa where surgery could avert many deaths. Prospective studies investigating interventions, indications, and outcomes including perioperative mortality rates (POMR) after surgery are scant. The aim of the study was to describe the situation of surgery in a low-income setting in sub-Saharan Africa.

Methods In this descriptive, facility-based study, data were prospectively collected in questionnaires by 41 staff employed at two hospitals (Iganga General Hospital and Buluba Mission Hospital) in eastern Uganda during 4 months (major surgeries) and 3 months (minor surgeries) in 2011. Data included patient characteristics, interventions, indications for surgery, and in-hospital mortality after surgery. Descriptive statistical methods were used to analyse the data.

Findings 2701 patients underwent 2790 surgical interventions. Of these, 1051 patients underwent major surgery, which corresponds to a major surgery rate of 224·8 per 100 000 population. Most patients undergoing major surgery were women (n=923, 88%). Pregnancy related complications (n=747, 66%) leading to caesarean section (n=496, 47%) and evacuation (n=244, 22%) or gynaecological conditions (n=114, 10%) were common indications for surgery. General surgery interventions registered were herniorrhaphy (n=103, 9%), explorative laparotomy (n=60, 5%), and appendectomy (n=31, 3%). Overall, the POMR was 0·6% (16 deaths); for major surgery it was 1·3% (14 deaths) and for minor surgeries it was 0·1% (two of 1650 patients). High POMR were seen following explorative laparotomy (13·3%, eight deaths) and caesarean section (0·8%, four deaths). Of the 510 babies delivered through caesarean section, 59 (12%) were still born or died before discharge.

Interpretation Rates of surgery are low in the study setting compared with in high-income settings where surgical rates exceed 11 000 per 100 000 population. POMR are high after exploratory laparotomy and caesarean section. Although very detailed, a larger study could be undertaken to investigate the situation in other settings. Underlying reasons leading to death and quality of surgical care should be investigated further so that POMR can be reduced in this setting.

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Contributors

JL, DK, BCF, JM, AW, and PN conceived and designed the study. JL and JM collected the data. JL, DK, BCF, JM, AW, and PN interpreted the data. JL wrote the Abstract. All authors approved the final version of the Abstract for publication.

Declaration of interests

We declare no competing interests.

Acknowledgments

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Rates of caesarean section and total volume of surgery in Sierra Leone: a retrospective survey

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Abstract

Background Surgical services are essential components of health-care systems. Monitoring of surgical activity is important, but resource demanding. Simpler tools to estimate surgical volume, particularly in low-income countries, are needed. Previous work hypothesises that the relative frequency of caesarean sections, expressed as a proportion of total operative procedures, could serve as a proxy measure of surgical capacity. We aimed to establish nationwide and district-wide rates of surgery and caesarean sections, and to explore correlations between districts rates for caesarean sections and corresponding rates for total volume of surgery in Sierra Leone in 2012.

Methods A nationwide, exhaustive, retrospective, facility-based study of all surgical providers and surgical procedures was performed in Sierra Leone. Between Jan 14, and May 20, 2013, four teams of 12 medical students collected data on the characteristics of the institutions and of the surgeries performed in 2012. Data were retrieved from operation, anaesthesia, and delivery logbooks.

Findings Of 60 facilities performing surgery, complete annual data for 2012 was collected from 58 (97%) institutions. 24 152 surgical procedures identified, gave a national rate of 400 surgeries per 100 000 inhabitants (district range 32–909 per 100 000 [IQR 95–502 per 100 000]). National caesarean section rate was 2.1% (district range 0.3–4.0% [IQR 0.8–2.1]). District caesarean sections rate significantly correlated with the rate of total surgical procedures per 100 000 population ($p < 0.01$). With known caesarean section rate, total volume of surgeries per 100 000 can be calculated with the equation: $-9.8 + 4.68 \times \text{caesarean sections per 100 000}$.

Interpretation The close correlation between rate of caesarean section and population rates of total volume of surgery at district level in Sierra Leone indicates that rate of caesarean section should be further explored as a proxy indicator for overall surgical volume in low performing settings. By collecting data from three sources, missing procedures was considered less likely.

Funding Norwegian University of Science and Technology.

Contributors

HAB, JvS, and AW researched the background of the study. HAB and JvS created the figures. All authors took part in designing the study. HAB, MMS, TBK, and DB-T took part in field implementation of the study. HAB, MMS, DB-T, and TBK took part in the data collection. HAB, JvS, TBK, ØS, BY, and AW analysed the data. HAB, JvS, ØS, BY, and AW interpreted the data. HAB, JvS, and AW wrote the manuscript; and all authors commented on and critically revised the final versions.

Declaration of interests

HAB is chairman of CapaCare, a non-governmental organisation offering postgraduate surgical training in Sierra Leone. All other authors declare no competing interests.

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The struggle for equity: an examination of surgical services at two NGO hospitals in rural Haiti

Alexi C Matousek, Stephen R Addington, Rodolphe R Eisenhower Jean-Louis, Jean Hamilton Pierre, Jacky Fils, Marguerite Hoyler, Sarah B Matousek, Jordan Pyda, Paul E Farmer, Robert Riviello

Abstract

Background Health systems must deliver care equitably to serve the poor. Both L'Hôpital Albert Schweitzer (HAS) and L'Hôpital Bon Sauveur (HBS) have longstanding commitments to provide equitable surgical care in rural Haiti. HAS charges fees that reflect a preference for the rural population near the hospital, with free care available for the poorest. HBS does not charge fees. The two hospitals are otherwise similar in surgical capacity and rural location. Using geography as a proxy for poverty, we analysed the equity achieved under the financial system at both hospitals.

Methods We retrospectively reviewed operative case-logs for general surgery and orthopaedic cases at both hospitals from June 1, to Aug 31, 2012. The records were compared by total number of operations, geographic distribution of patients, and number of elective operations. The service areas were defined as the governmental administrative units closest to both hospitals. For HAS, we analysed the number of operations performed on patients from the most poor and least poor regions within the service area; similarly detailed geographic information was not available from HBS. Rates were compared with χ^2 tests. The Ethics Committees at both hospitals and the Institutional Review Board at Partners Healthcare approved the study.

Findings Patients from the rural service area received 306 operations (86.2%) at HAS compared with 149 (38.1%) at HBS ($p<0.0001$). Only 16 operations (4.5%) at HAS were performed on patients from outside the service area for elective conditions compared with 179 (47.0%) at HBS ($p<0.0001$). Within its rural service area, HAS performed fewer operations on patients from the most destitute areas compared with other locations (4.0 operations per 10 000 population vs 10.1 operations per 10 000 population; $p<0.0001$).

Interpretation Use of fees as part of an equity strategy will likely disadvantage the poorest patients, while providing care without fees might encourage patients to travel from urban areas that contain other hospitals. Health systems striving to serve the poor should continually evaluate and seek to improve equity, even within systems that provide free care.

Funding None.

Contributors

ACM designed the study, collected the data, did the analysis, and wrote the first draft of the Abstract. SRA did a literature search and wrote portions of the Abstract. RREJ-L contributed to the portions of the Abstract that describe HAS and analysed data. JHP contributed to the portions of the Abstract that describe HBS and analysed data. JF, MH, and JHP collected and analysed data from HBS. SBM contributed to the study design, and wrote and edited portions of the Abstract. PEF contributed to the study design and reviewed the Abstract. RR provided guidance on the study design and edited the Abstract.

Declaration of interests

We declare no competing interests.

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Assessment of caesarean section and inguinal hernia repair as proxy indicators of total number of surgeries

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Abstract

Background The traditional instruments used to assess surgical capacity in low-income countries require substantial amounts of time and resources, and have thus not been systematically used in this context. Proxy indicators have been suggested as a simpler method to estimate surgical volume. The aim of this study was to assess caesarean section and inguinal hernia repair as proxy indicators of the total number of surgeries performed per capita in a given region in Sierra Leone in sub-Saharan Africa.

Methods Available handwritten surgical data were compiled from 58 (96.7%) health institutions that performed WHO defined major surgery in Sierra Leone in 2012 (from Jan 1, to Dec 31). 24 152 surgical procedures were included in the study. Validity of proxy indicators was tested by logistic regression analyses with the rate of caesarean sections compared with total operations (% CS), hernia repairs (% HR), or both (% CS plus HR) as dependent variables and the operations per 100 000 capita as the covariate.

Findings The number of operations per 100 000 capita for the 13 districts of Sierra Leone varied from 909 in the urban Western District to 32 in the rural district of Moyamba. There was a significant negative correlation between each of the proxy indicators and the number of operations per 100 000 capita. For changes in the operations per 100 000 capita of 100, we obtained an estimated odds ratio for the % CS proxy indicator of 0.675 (95% CI 0.520–0.876; $p < 0.01$), % HR being 0.822 (0.688–0.983; $p < 0.05$), and for % CS plus HR being 0.838 (0.731–0.962; $p < 0.05$).

Interpretation The unmet need for surgical services in Sierra Leone can be estimated by either of the three proxy indicators. However, it seems that % CS is more sensitive to small changes in operations per 100 000 capita compared with the % HR. There is no obvious added benefit of use of the combined proxy indicator. Although this study shows that proxy indicators are a promising method to evaluate surgical activity, this is a cross-sectional study and can thus only show correlation. Longitudinal studies would strengthen these findings.

Funding Faculty of Medicine, Norwegian University of Science and Technology, Trondheim, Norway, and CapaCare.

Contributors

AWB, MEK, and HAB conceived and designed the study. AWB, MEK, SMR, PFV, and HAB collected the data. AWB, MEK, HAB, ØS, AW, and JvS interpreted the data. AWB and MEK wrote the Abstract. All authors approved the final version of the Abstract for publication.

Declaration of interests

We declare no competing interests.

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A time-driven activity-based costing model to improve health-care resource use in Mirebalais, Haiti

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Abstract

Background In resource-limited settings, efficiency is crucial to maximise resources available for patient care. Time driven activity-based costing (TDABC) estimates costs directly from clinical and administrative processes used in patient care, thereby providing valuable information for process improvements. TDABC is more accurate and simpler than traditional activity-based costing because it assigns resource costs to patients based on the amount of time clinical and staff resources are used in patient encounters. Other costing approaches use somewhat arbitrary allocations that provide little transparency into the actual clinical processes used to treat medical conditions. TDABC has been successfully applied in European and US health-care settings to facilitate process improvements and new reimbursement approaches, but it has not been used in resource-limited settings. We aimed to optimise TDABC for use in a resource-limited setting to provide accurate procedure and service costs, reliably predict financing needs, inform quality improvement initiatives, and maximise efficiency.

Methods A multidisciplinary team used TDABC to map clinical processes for obstetric care (vaginal and caesarean deliveries, from triage to post-partum discharge) and breast cancer care (diagnosis, chemotherapy, surgery, and support services, such as pharmacy, radiology, laboratory, and counselling) at Hôpital Universitaire de Mirebalais (HUM) in Haiti. The team estimated the direct costs of personnel, equipment, and facilities used in patient care based on the amount of time each of these resources was used. We calculated inpatient personnel costs by allocating provider costs per staffed bed, and assigned indirect costs (administration, facility maintenance and operations, education, procurement and warehouse, bloodbank, and morgue) to various subgroups of the patient population. This study was approved by the Partners in Health/Zanmi Lasante Research Committee.

Findings The direct cost of an uncomplicated vaginal delivery at HUM was US\$62 and the direct cost of a caesarean delivery was US\$249. The direct costs of breast cancer care (including diagnostics, chemotherapy, and mastectomy) totalled US\$1393. A mastectomy, including post-anaesthesia recovery and inpatient stay, totalled US\$282 in direct costs. Indirect costs comprised 26–38% of total costs, and salaries were the largest percentage of total costs (51–72%).

Interpretation Accurate costing of health services is vital for financial officers and funders. TDABC showed opportunities at HUM to optimise use of resources and reduce costs—for instance, by streamlining sterilisation procedures and redistributing certain tasks to improve teamwork. TDABC has also improved budget forecasting and informed financing decisions. HUM leadership recognised its value to improve health-care delivery and expand access in low-resource settings.

Funding Boston Children's Hospital, Harvard Business School, and Partners in Health.

Contributors

MM, KO, BMI, BMu, CP, RG, AC, SLMG, JGM, and RK designed the study. MM, KO, BMI, CM, YN, RD, and EL collected the data. MM, KO, BMI, BMu, CP, JCM, FL, KB, EL, JGM, and RK analysed the data. MM wrote the abstract with input from KO, BMI, BMu, CP, JCM, KB, AC, SLMG, JGM, and RK. All authors have seen and approved the final version of the Abstract for publication.

Declaration of interests

We declare no competing interests.

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Major surgery in south India: a retrospective audit of hospital claim data from a large community health insurance programme

Maaz Shaikh, Mark Woodward, Kazem Rahimi, Anushka Patel, Santosh Rath, Stephen MacMahon, Vivekanand Jha

Abstract

Background Information about use of major surgery in India is scarce. This study aims to bridge this gap by auditing hospital claims from the Rajiv Aarogyasri Community Health Insurance Scheme (RACHIS) that provides access to free tertiary care for major surgery through state-funded insurance to 68 million beneficiaries with limited household incomes—81% of population in states of Telangana and Andhra Pradesh (combined Human Development Index 0.485). Beneficiary households receive an annual coverage of INR 200 000 (US\$3333) for admissions to any empanelled public or private hospital.

Methods Publicly available deidentified hospital claim data for all surgical procedures conducted between mid-2008 and mid-2012 were compiled across all 23 districts in Telangana and Andhra Pradesh.

Findings 677 332 surgical admissions (80% at private hospitals) were recorded at a mean annual rate of 259 per 100 000 beneficiaries (95% CI 235–283), excluding cataract and caesarean sections as these were not covered under the insurance programme. Men accounted for 56% of admissions. Injury was the most common cause for surgical admission (185 733; 27%) with surgical correction of long bone fractures being the most common procedure (144 997; 20%) identified in the audit. Diseases of digestive (110 922; 16%), genitourinary (82 505; 12%), and musculoskeletal system (70 053; 10%) were other leading causes for surgical admissions. Most hospital bed-days were used for injuries (584 days per 100 000 person years; 31%), digestive diseases (314 days; 17%), and musculoskeletal system (207 days; 11%), costing 19% (INR 4.4 billion), 13% (3.03 billion), and 11% (2.5 billion) of claims, respectively. Cardiovascular surgeries (53 023; 8%) alone accounted for 21% (INR 4.9 billion) of cost. Annual per capita cost of surgical claims was US\$1.49 (95% CI 1.32–1.65).

Interpretation Our findings are limited to a population socioeconomically representative of India and other countries with low-income and middle-income. Despite near universal access for major surgery, use continues to remain low, at levels expected in countries with per capita health expenditure below US\$100, and lower than a tenth of rates estimated at spending (US\$400–1000) comparable with financial access provided. Hence, strategies beyond traditional financing for care are required to improve use of surgery in LMICs.

Funding The George Institute for Global Health.

Contributors

MS, MW, KR, and VJ conceived and designed the study. MS and MW collected data. MS, MW, SR, AP, KR, SM, and VJ interpreted the data. MS, MW, and VJ wrote the Abstract. All authors approved the final version of the Abstract for publication.

Declaration of interests

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Waiting at the hospital door: a prospective, multicentre assessment of third delay in four tertiary hospitals in India

Vineet Kumar, Monty Khajanchi, Nakul P Raykar, Martin Gerdin, Nobhojit Roy

Abstract

Background A common framework to assess delays in health-care in countries with low-income and middle-income (LMICs) defines three time periods that add to the interval between onset of symptoms and treatment; the time it takes to receive care after hospital arrival is known as the third delay. Tertiary centres in LMICs are known to be overcrowded and under-capacity, but few studies have formally assessed the third delay. This study aims to quantify the third delay in LMIC tertiary centres and identify contributing factors at the facility level.

Methods A prospective multicentre study was conducted from July, 2013, to July, 2014, in four tertiary care hospitals in the three largest cities in India: Mumbai, Delhi, and Kolkata. The time from patient arrival to the time when vital signs were first recorded was used as a proxy for the third delay. This delay was recorded by the research officers for those patients who were directly observed. For the rest of the patients the data were collected from patient records. Qualitative interviews were conducted with a subset of patients exploring reasons for the delay.

Findings Data were collected for 5087 patients (1664 from Delhi, 469 from Mumbai centre-1, 711 from Mumbai centre-2, and 2243 from Kolkatta); median age was 30 years (IQR 20–45), 3944 (78%) were men, 3372 (66%) were transfers from other facilities, and 3424 (67·3%) arrived in an ambulance. Researchers directly observed 1392 (27·4%) patients from arrival to time of vital signs. There were wide variations in delays between groups, transferred versus direct presentation (0 min vs 20 min) and in between hospitals (median time 0·0 min in Mumbai to 1·5 h in Kolkatta) and in groups within each hospital. The reasons for delay were multifactorial: administrative (police case recordings, admission paper registration), logistical (no vacant beds, no physician available), and process-based (investigations before vitals, multiple patients at one time, junior physicians in-charge); process based reasons were the most common (80%).

Interpretation Delays in care persist in tertiary centres in LMICs for a variety of reasons. Low-cost but context-specific changes that optimise care processes like prioritisation and transfer protocols could yield major reductions in third delay. Adoption of best practices of the better performing hospitals in the Indian setting will help to improve the trauma quality practices in India.

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Contributors

NPR conceived and designed the study. The consortium research officers collected the data. MG interpreted the data. VK wrote the Abstract. All authors approved the final version of the Abstract for publication.

Declaration of interests

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The role of facility-based surgical services in addressing the national burden of disease in New Zealand: an index of surgical incidence based on country-specific disease prevalence

Phil Hider, Leona Wilson, John Rose, Thomas G Weiser, Russell Gruen, Stephen W Bickler

Abstract

Background Surgery is a crucial component of health systems, yet its actual contribution has been difficult to define. We aimed to link use of national hospital service with national epidemiological surveillance data to describe the use of surgical procedures in the management of a broad spectrum of conditions.

Methods We compiled Australian Modification-International Classification of Diseases-10 codes from the New Zealand National Minimum Dataset, 2008–11. Using primary cause of admission, we aggregated admissions to 91 hospitals into 119 disease states and 22 disease subcategories of the WHO Global Health Estimate (GHE). We queried each admission for any surgical procedure in a binary manner to determine the frequency of admitted patients whose care required surgery. Surgical procedures were defined as requiring general or neuroaxial anaesthesia. We then divided the volume of surgical cases by counts of disease prevalence from the GBD 2010 to determine surgical incidence. This study was approved by the University of Otago Human Ethics Committee (Health; Reference Number HD14/42). Raw data was only handled by coauthors with direct affiliation with the New Zealand Ministry of Health.

Findings Between 2008 and 2011, there were 1108 653 hospital admissions with 275 570 associated surgical procedures per year. Surgical procedures were associated with admissions for all 22 GHE disease subcategories and 116 of 119 GHE disease states (excluding intestinal nematode infections, iodine deficiency, and vitamin A deficiency). The subcategories with the largest surgical case volumes were unintentional injuries (48 073), musculoskeletal diseases (38 030), and digestive diseases (27 640), and the subcategories with the smallest surgical case volumes were nutritional deficiencies (13), neonatal conditions (204), and infectious and parasitic diseases (982). Surgical incidence ranged widely by individual disease states with the highest in other neurological conditions, abortion, appendicitis, obstructed labour, and maternal sepsis.

Interpretation This study confirms previous research that surgical care is required across the entire spectrum of GHE disease subcategories, showing the crucial role of operative intervention in health systems. Surgical incidence might be useful as an index to estimate the need for surgical procedures in other populations.

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Contributors

JR, TGW, and SWB conceived and designed the study. PH, LW, and RG collected the data. All authors interpreted the data. JR wrote the Abstract. All authors approved the final version of the Abstract for publication.

Declaration of interests

We declare no competing interests.

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✦ Establishment of a urology service in a developing country: an observational study of outcomes in transurethral prostate resection procedures in Vanuatu

Ben Namdarian, Stuart Willder, Geoff Steele, Richard Leona, Richard Grills

Abstract

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Background The Royal Australasian College of Surgeons (RACS) via the Pacific Island Program (PIP) administer yearly urology visits to Vanuatu to perform surgery and deliver training in the management of urological conditions. In conjunction with the Vanuatu Ministry of Health a self-sufficient urology service has developed, specifically performing transurethral resection of the prostate (TURP) procedures. We review the TURP outcomes for the PIP and detail the development and outcomes of the first independent TURP service in the Pacific.

Methods With retrospective local and RACS medical records, an observational study was performed of TURP procedures undertaken in Port Vila Central Hospital, Vanuatu over 6 years. Outcome measures comprised significant morbidity, prolonged post-operative admission, blood transfusion, TUR syndrome, successful trial of void, postoperative urinary incontinence, and perioperative mortality. Comparisons were made with univariate analysis between the RACS, local team, and international standardised values, with *t*-tests for continuous variables, and with Fisher's exact test for binary variables.

Findings Since 2009, a total of 117 TURP procedures were performed. 84 by the PIP team and following training both in Vanuatu and Australia; the local team independently performed 33 TURPs. Comparisons of all outcomes measured between the local and PIP teams showed no statistically significant differences (appendix). 29 patients overall (22 in the PIP group and seven in the local group) required blood transfusions, eight (seven and one) failed their trial of void, 10 (seven and three) had a prolonged post-operative admission (>7 days); two patients died in the post-operative period both in the PIP group). 10 (seven and three) had postoperative urinary incontinence. There was no difference between mean length of stay (4.07 days vs 4.7 days; $p=0.2081$) and haemoglobin loss with no cases of TUR syndrome. Only the rate of transfusion was statistically significantly higher in the Vanuatu cohorts when compared with international standards (appendix).

Interpretation The development of a local urological service and in particular a TURP service is a first for a Pacific Island Nation. Baseline data were obtained with encouraging outcomes reflecting careful patient selection, cautious management, and expertise accumulation. Planned prospective audit should overcome some of the difficulties encountered in performing a longitudinal study in a developing nation with suboptimum follow-up and challenging medical records. Through linkage between the PIP and the Vanuatu Ministry of Health capacity building an independent service provision can be achieved. This model could be replicated to establish a sustainable and self-sufficient surgical service in a developing country.

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Contributors

BN wrote the Abstract with assistance from RG, was involved in data collection, study design, statistical and data analysis, data interpretation, and literature review. SW was involved in data collection and Abstract review. GS was involved in data collection and Abstract review. RL was involved in data collection and Abstract review. RG was involved in data collection, study design, data analysis, data interpretation, and literature review. All authors have seen and approved the final version of the Abstract submitted.

Declaration of interests

We declare no competing interests.

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Monitoring and evaluating surgical care: defining perioperative mortality rate and standardising data collection

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Abstract

Background Case volume per 100 000 population and perioperative mortality rate (POMR) are key indicators to monitor and strengthen surgical services. However, comparisons of POMR have been restricted by absence of standardised approaches to when it is measured, the ideal denominator, need for risk adjustment, and whether data are available. We aimed to address these issues and recommend a minimum dataset by analysing four large mixed surgical datasets, two from well-resourced settings with sophisticated electronic patient information systems and two from resource-limited settings where clinicians maintain locally developed databases.

Methods We obtained data from the New Zealand (NZ) National Minimum Dataset, the Geelong Hospital patient management system in Australia, and purpose-built surgical databases in Pietermaritzburg, South Africa (PMZ) and Port Moresby, Papua New Guinea (PNG). Information was sought on inclusion and exclusion criteria, coding criteria, and completeness of patient identifiers, admission, procedure, discharge and death dates, operation details, urgency of admission, and American Society of Anesthesiologists (ASA) score. Date-related errors were defined as missing dates and impossible discrepancies. For every site, we then calculated the POMR, the effect of admission episodes or procedures as denominator, and the difference between in-hospital POMR and 30-day POMR. To determine the need for risk adjustment, we used univariate and multivariate logistic regression to assess the effect on relative POMR for each site of age, admission urgency, ASA score, and procedure type.

Findings 1365 773 patient admissions involving 1514 242 procedures were included, among which 8655 deaths were recorded within 30 days. Database inclusion and exclusion criteria differed substantially. NZ and Geelong records had less than 0.1% date-related errors and greater than 99.9% completeness. PMZ databases had 99.9% or greater completeness of all data except date-related items (94.0%). PNG had 99.9% or greater completeness for date of birth or age and admission date and operative procedure, but 80–83% completeness of patient identifiers and date related items. Coding of procedures was not standardised, and only NZ recorded ASA status and complete post-discharge mortality. In-hospital POMR range was 0.38% in NZ to 3.44% in PMZ, and in NZ it underestimated 30-day POMR by roughly a third. The difference in POMR by procedures instead of admission episodes as denominator ranged from 10% to 70%. Age older than 65 years and emergency admission had large independent effects on POMR, but relatively little effect in multivariate analysis on the relative odds of in-hospital death at each site.

Interpretation Hospitals can collect and provide data for case volume and POMR without sophisticated electronic information systems. POMR should initially be defined by in-hospital mortality because post-discharge deaths are not usually recorded, and with procedures as denominator because details allowing linkage of several operations within one patient's admission are not always present. Although age and admission urgency are independently associated with POMR, and ASA and case mix were not included, risk adjustment might not be essential because the relative odds between sites persisted. Standardisation of inclusion criteria and definitions is needed, as is attention to accuracy and completeness of dates of procedures, discharge and death. A one-page, paper-based form, or alternatively a simple electronic data collection form, containing a minimum dataset commenced in the operating theatre could facilitate this process.

Funding None.

Contributors

CLP, RA, DAW, and RLG conceived and wrote the Abstract. PH, GLL, DAW, DS, CLP, and RA provided and analysed the data. All authors critically reviewed and approved the final version of the Abstract.

Declaration of interests

We declare no competing interests.

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The global blood supply: a literature review

Katherine E Kralieivits, Nakul P Raykar, Sarah L M Greenberg, John G Meara

Abstract

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Background A safe and sufficient blood supply is requisite for a functional surgical system. Although the disparity in blood donation rates between low-income and middle-income countries (LMICs) and high-income countries is well documented, less is known about the reasons for this inequity, which compromises efforts to remedy it. We aimed to review the state of the blood supply and elucidate unique country-specific challenges in each of the world's 196 countries.

Methods We searched PubMed, MEDLINE, Google Scholar, and WHO reports using the search terms "blood donor", "blood donation", "blood safety", "blood bank", "transfusion safety", and "blood services". After an initial review of existing literature, we did a comprehensive country-by-country search of the aforementioned electronic databases, WHO regional reports, Ministry of Health websites, and National Blood Transfusion Services data for specific indicators and data points used to compare blood supply and safety across countries. These included donation rate per 1000 population, percent of donations from voluntary non-remunerated donors, number of blood banks or centres, and national blood policies. Both quantitative and descriptive data are included in a summary table in the appendix of the *Lancet* Commission on Global Surgery.

Findings Our review yielded 117 publications with data for 188 countries: 101 peer-reviewed manuscripts with 13 reporting data for high-income countries and 88 for LMICs, 16 WHO publications, and a subsequent search of select websites to collect additional country-specific indicator data. Generally, blood donation is limited because of poor health infrastructure (28 LMIC and four high-income country manuscripts), low public awareness of donation practices and safety (22 LMIC manuscripts), and stigmas surrounding voluntary blood donations, especially in LMICs. Most blood banks and donation centres are located in urban centres, inaccessible to those in rural areas. The prevalence of transfusion-transmissible infections in the blood supply is higher in LMICs (30 LMIC manuscripts), resulting in high discard rates and increased transfusion risks. Two-thirds of countries have a national blood policy in place, but are often unable to efficiently coordinate and regulate blood services nationwide. To overcome these barriers, some countries have developed innovative solutions.

Interpretation The blood supply in LMICs is of insufficient quantity and safety, and the reasons for these deficits are multifactorial. Addressing blood supply inadequacies requires focused attention at both local and global levels. Political prioritisation and innovative solutions to the blood crisis will be necessary to improve this situation and will require a culturally cognizant, pro-poor, pro-equity approach. Reviewing successful approaches to this crisis employed by some countries can be helpful in charting a way forward.

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Contributors

JGM, SLMG, and NPR conceived and designed the study. KEK collected data. KEK and NPR interpreted the data. KEK and NPR wrote the Abstract. All authors approved the final version of the Abstract for publication.

Declaration of interests

We declare no competing interests.



Use and definitions of perioperative mortality rates in low-income and middle-income countries: a systematic review

Joshua S Ng-Kamstra, Sarah L M Greenberg, Meera Kotagal, Charlotta L Palmqvist, Francis Y X Lai, Rishitha Bollam, John G Meara, Russell L Gruen

Abstract

Background Aggregate and risk-stratified perioperative mortality rates (POMR) are well-documented in high-income countries where surgical databases are common. In many low-income and middle-income country (LMIC) settings, such data are unavailable, compromising efforts to understand and improve surgical outcomes. We undertook a systematic review to determine how POMR is used and defined in LMICs and to inform baseline rates.

Methods We searched PubMed for all articles published between Jan 1, 2009, and Sept 1, 2014, reporting surgical mortality in LMICs. Search criteria, inclusion and exclusion criteria, and study assessment methodology are reported in the appendix. Titles and abstracts were screened independently by two reviewers. Full-text review and data extraction were completed by four trained clinician coders with regular validation for consistency. We extracted the definition of POMR used, clinical risk scores reported, and strategies for risk adjustment in addition to reported mortality rates.

Findings We screened 2657 abstracts and included 373 full-text articles. 493 409 patients in 68 countries and 12 surgical specialties were represented. The most common definition for the numerator of POMR was in-hospital deaths following surgery (55·3%) and for the denominator it was the number of operative patients (96·2%). Few studies reported preoperative comorbidities (41·8%), ASA status (11·3%), and HIV status (7·8%), with a smaller proportion stratifying on or adjusting mortality for these factors. Studies reporting on planned procedures recorded a median mortality of 1·2% (n=121 [IQR 0·0–4·7]). Median mortality was 10·1% (n=182 [IQR 2·5–16·2]) for emergent procedures.

Interpretation POMR is frequently reported in LMICs, but a standardised approach for reporting and risk stratification is absent from the literature. There was wide variation in POMR across procedures and specialties. A quality assessment checklist for surgical mortality studies could improve mortality reporting and facilitate benchmarking across sites and countries.

Funding None.

Contributors

SLMG, MK, JGM, and RLG conceived the study. SLMG and MK designed the search protocol and screened all abstracts. JNK, CP, FXYL, and RB extracted data. JSN-K analysed the data. This abstract was written by JSN-K, SLMG, JGM, MK, and RLG, and edited by all authors. All authors approved the final version of the Abstract for publication.

Declaration of interests

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Musculoskeletal trauma and all-cause mortality in India: a multicentre prospective cohort study

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Abstract

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Background There is little data in low-income and middle-income countries (LMICs) quantifying the burden of fractures and describing current practices. The aim of the study was describe the severity of musculoskeletal injuries in LMICS and identify modifiable factors that predict subsequent early all-cause mortality.

Methods We did a multicentre, prospective, observational study of patients who presented to 14 hospitals across India for musculoskeletal trauma (fractures or dislocations). Patients were recruited during an 8-week period, between November, 2011, and June, 2012, and were followed for 30-days or hospital discharge, whichever occurred first. Primary outcome was all-cause mortality with secondary outcomes of reoperation and infection. Logistic regression analyses were conducted to identify factors associated with all-cause mortality.

Findings We enrolled 4822 patients, but restricted analyses to 4612 (96%) patients who had complete follow-up. The majority (56·2% younger than 40 years old) of trauma patients were young (mean age 40·9 years [SD 16·9]) and 3148 (68%) were men. 2344 (518%) patients sustained trauma as a result of a road traffic accident. The most common musculoskeletal injury was a fracture (4514 [98%]) and 707 patients (15%) incurred an open fracture. Less than a third of musculoskeletal trauma patients (1374 [29%]) were transported to hospital by ambulance, and one in six patients (18%) arrived at the hospital later than 24 h after sustaining their injury. Over a third (239 [35%] of 707) of open fractures were definitively stabilised later than 24 h. 30-day mortality was 1·7% (95% CI 1·4–2·2) for all patients and 2·1% (95% CI 1·5–2·7) among road traffic victims ($p=0\cdot005$). Musculoskeletal trauma severity including the number of fractures (3·1 [95% CI 2·4–3·9]) and presence of an open fracture (2·1 [95% CI 1·2–3·4]) significantly increased the odds of all-cause mortality.

Interpretation Musculoskeletal trauma severity, particularly road related, is a key predictor of subsequent mortality. Improvement in road safety policies, and improvements in access to emergency medical services and timely orthopaedic care are critical to mitigate the burden of injury worldwide.

Funding Regional Medical Associates, AO International, Hamilton Health Sciences Trauma Fund.

Contributors

MB conceived the study. MB and CJF designed the study. Site investigators collected the data. MB, PD, CF, LI, and HG interpreted the data. CF wrote the Abstract. All authors approved the final version of the Abstract for publication.

Declaration of interests

MB is partly funded by a Canada Research Chair. RQI is funded by a National Health and Medical Research Council of Australia fellowship. We declare no competing interests.

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The study has also been referred to as the international orthopaedic multicentre fracture study (INORMUS). Members of the writing group include Clary Jefferson Foote, Raman Mundi, Rebecca Q Ivers, Lehana Thabane, Philip Devereaux, and Mohit Bhandari.

Care of surgical infections by Médecins Sans Frontières Operations Centre Brussels in 2008–14

Davina Sharma, Kate Hayman, Barclay T Stewart, Lynette Dominguez, Miguel Trelles, Sanaulhaq Saqeb, Cheride Kasonga, Theophile Kubuya Hangi, Jerome Mupenda, Aamer Naseer, Evan Wong, Adam L Kushner

Abstract

Background Surgical infections represent a substantial yet undefined burden of disease in low-income and middle-income countries (LMICs). Médecins Sans Frontières (MSF) provides surgical care in LMICs and collects data useful to describe the operative epidemiology of surgical need that would otherwise be unmet by national health services. We aimed to describe the experience of MSF Operations Centre Brussels surgery for infections during crisis; aid effective resource allocation; prepare humanitarian surgical staff; and further characterise unmet surgical needs in LMICs.

Methods We reviewed all procedures undertaken in operating theatres at facilities run by the MSF Operations Centre Brussels between July, 2008, and June, 2014. Projects providing only specialty care were excluded. Procedures for infections were quantified, related to demographics and reason for humanitarian response was described.

Findings 96 239 operations were undertaken at 27 MSF Operations Centre Brussels sites in 15 countries. Of 61 177 general operations, 7762 (13%) were for infections. Operations for skin and soft tissue infections were the most common (64%), followed by intra-abdominal (26%), orthopaedic (6%), and tropical infections (3%). The proportion of operations for skin and soft tissue infections was highest during natural disaster missions, intra-abdominal infections during hospital support missions, and orthopaedic infections during conflict missions. Most procedures for skin and soft tissue infections were minor (76%), whereas most operations for intra-abdominal infections were major (98%).

Interpretation Surgical infections are among the most common causes for operation in LMICs. Although many procedures were minor, they represent substantial use of perioperative resources. Growing evidence shows the need for improved perioperative capacity to aptly care for the volume and variety of conditions comprising the global burden of surgical disease.

Funding Médecins Sans Frontières.

Contributors

DS, KH, LD, and MT designed the study. SS, CK, TKH, JM, and AN collected or provided supervision for data collection. BTS analysed and interpreted the data. EW, BTS, and ALK prepared the Abstract. All authors contributed to the critique of the Abstract and have approved the final draft.

Declaration of interests

We declare no competing interests.

Acknowledgments

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Deaths from acute abdominal conditions and geographic access to surgical care in India: a nationally representative population-based spatial analysis

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Abstract

Background Acute abdominal conditions have high case-fatality rates in the absence of timely surgical care. In India, and many other low-income and middle-income countries, few population-based studies have quantified mortality from surgical conditions and related mortality to access to surgical care. We aimed to describe the spatial and socioeconomic distributions of deaths from acute abdomen (DAA) in India and to quantify potential access to surgical facilities in relation to such deaths.

Methods We examined deaths from acute abdominal conditions within a nationally representative, population-based mortality survey of 1·1 million Indian households and linked these to nationally representative facility data. Spatial clustering of deaths from acute abdominal conditions was calculated with the Getis-Ord G_i^* statistic from about 4000 postal codes. We compared high or low acute abdominal mortality clusters for their geographic access to well-resourced surgical care (24 h surgical and anaesthesia services, blood bank, critical care beds, basic laboratory, and radiology).

Findings 923 (1·1%) of 86 806 study deaths in those aged 0–69 years were identified as deaths from acute abdominal conditions, corresponding to an estimated 72 000 deaths nationally in India in 2010. Most deaths occurred at home (71%), in rural areas (87%), and were caused by peptic ulcer disease (79%). There was wide variation in rates of deaths from acute abdominal conditions. We identified 393 high-mortality geographic clusters and 567 low-mortality clusters. High-mortality clusters of acute abdominal conditions were located significantly further from well-resourced hospitals than were low-mortality clusters. The odds ratio of a postal code area being a high-mortality cluster was 4·4 (99% CI 3·2–6·0) for living 50 km or more from well-resourced district hospitals (rising to an OR of 16·1 for >100 km), after adjustment for socioeconomic status and caste.

Interpretation Improvements in human and physical resources at existing public hospitals are required to reduce deaths from acute abdominal conditions in India. Had all of the Indian population had access to well-resourced hospitals within 50 km, more than 50 000 deaths from acute abdominal conditions could have been averted in 2010, and likely more from other emergency surgical conditions. Our geocoded facility data were limited to public district hospitals. However, noting the high rate of catastrophic health expenditures in India, we chose to focus on publicly provided services which are the only option usually available to the poor.

Funding The Bill & Melinda Gates Foundation, Dalla Lana School of Public Health, and Canadian Institute of Health Research.

Contributors

MH and PJ conceived the study. JSN-K, AJD, JP, SHF, and PSR analysed the data. AJD, PJ, and JNK wrote the Abstract. All authors were involved with data interpretation, critical revisions of the Abstract, and approval of the final version. PJ is the guarantor.

Declaration of interests

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Avoidable maternal and neonatal deaths associated with improving access to caesarean delivery in countries with low caesarean delivery rates: an ecological modelling analysis

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Abstract

Background Reducing maternal and neonatal deaths are important global health priorities. We have previously shown that up to a country-level caesarean delivery rate (CDRs) of roughly 19·0%, cesarean delivery rates and maternal mortality ratio (MMR) and neonatal mortality rate (NMR) were inversely correlated. We investigated the absolute reductions in maternal and neonatal deaths if countries with low CDR increased their rates to a range of greater than 7·2% but less than or equal to 19·1%.

Methods We calculated maternal and neonatal deaths in 2013 and 2012, respectively, for countries with CDR 7·2% or less (N=45) with available data from the World Bank Development Indicators. We modelled the expected reduction in deaths in these countries if they had the 25th and 75th MMR and NMR percentiles observed for countries (N=48) with CDRs ranging from greater than 7·2% but less than or equal to 19·1%. This model assumes that if countries with low CDRs increased their rates of caesarean delivery to greater than 7·2% but less than or equal to 19·1%, they would achieve levels of MMR and NMR observed in countries with those CDRs.

Findings We estimate 176 078 (95% CI 163 258–188 898) maternal and 1117 257 (95% CI 1033 611–1200 902) neonatal deaths occurred in 45 countries with low CDRs in 2013 and 2012, respectively. If these countries had the 25th and 75th MMR and NMR percentiles (MMR, IQR 36–190; NMR, 9–24) observed in countries (N=48) with a CDR ranging from greater than 7·2% but less than or equal to 19·1%, there would be a potential reduction of 109 762–163 513 and 279 584–803 129 maternal and neonatal deaths, respectively.

Interpretation Increasing caesarean delivery in countries with low CDRs could avert as many as 163 513 maternal deaths and 803 129 neonatal deaths annually. These findings assume that as health systems develop the capacity to deliver surgical care, there is a concurrent improvement in the quality of care and in the ability to rescue women and neonates who would otherwise die. Improving access to safe caesarean delivery should be a central focus in surgical care globally.

Funding None.

Contributors

GM, TGW, and ABH conceived the study. GM, TGW, MME, TU-L, TA, and ABH acquired the data. GM, TGW, SRL, NS, KS, WRB, AAG, and ABH analysed and interpreted the data. GM, TGW, and ABH drafted the Abstract. All authors have seen and approved the final version of the Abstract for publication.

Declaration of interests

We declare no competing interests.

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Variability in mortality after caesarean delivery, appendectomy, and groin hernia repair in low-income and middle-income countries: implications for expanding surgical services

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Abstract

Background While surgical interventions occur at lower rates in resource-poor settings, rates of complication and death after surgery are substantial but have not been well quantified. A deeper understanding of outcomes is a crucial step to ensure that quality accompanies increased global access to surgical care. We aimed to assess mortality following surgery to assess the risks of such interventions in these environments.

Methods We collected the most recent demographic, health, and economic data from WHO for 114 countries classified as low-income or lower-middle-income according to the World Bank in 2005. We searched OVID, MedLine, PubMed, and SCOPUS to identify studies in these countries reporting all-cause mortality after three commonly performed operations: caesarean delivery, appendectomy, and groin hernia repair. Reports from governmental and other agencies were also identified. We modelled surgical mortality rates for countries without reported data with the lasso technique that performs continuous variable subset selection to avoid model overfitting. We validated our model against known case fatality rates for caesarean delivery. We aggregated mortality results by subregion to account for variability in data availability. We then created collective surgical case fatality rates by WHO region.

Findings We identified 42 countries with mortality data for at least one of the three procedures. Median reported mortality rates were 7·7 per 1000 operations for caesarean delivery (IQR 3–14), 4·0 per 1000 operations for appendectomy (IQR 0–17), and 4·7 per 1000 operations for hernia groin (IQR 0–13); all recorded deaths occurred during the same admission to hospital as the operation. Based on our model, case fatality rate estimates by subregion ranged from 0·7 (central Europe) to 13·9 (central sub-Saharan Africa) per 1000 caesarean deliveries, 5·6 (central Asia) to 6·4 (central sub-Saharan Africa) per 1000 appendectomies, and 3·5 (tropical Latin America) to 33·9 (central sub-Saharan Africa) per 1000 hernia repairs.

Interpretation All-cause postoperative mortality rates are exceedingly variable within resource-constrained environments, and substantially higher than those in middle-income and high-income settings. Efforts to expand surgical access and provision of services must include a strong commitment to improve the safety and quality of care.

Funding None.

Contributors

TGW and AAG developed the idea for the study. TGW, TU-L, FR, and ABH designed the analysis plan. TGW, TU-L, JJ, LM, and MME acquired the data. TGW, TU-L, RF, MME, AAG, and ABH analysed and interpreted the data. TGW and TU-L drafted the Abstract, which was critically reviewed by all authors. All authors have seen and approved the final version of the Abstract for publication.

Declaration of interests

We declare no competing interests.

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Neonatal surgery in Africa: a systematic review and meta-analysis of challenges of management and outcome

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Abstract

Background Advances in diagnostic techniques and perioperative care have greatly improved the outcome of neonatal surgery. Despite this, disparity still exists in the outcome of neonatal surgery between high-income countries and low-income and middle-income countries. This study reviews publications on neonatal surgery in Africa over 20 years with a focus on challenges of management, trends in outcome, and potential interventions to improve outcome.

Methods We did a literature review by searching PubMed and African Index Medicus for original articles published in any language between January, 1995, and September, 2014, with the search terms “neonatal surgery” and “Africa”, further supplemented by “(surgery OR anaesthesia) AND (neonatal OR newborn) AND (developing countries OR Africa)”. A data extraction sheet was used to collect information, including type of study, demographics, number of cases, outcome, challenges, and suggestions to improve outcome. For the meta-analysis, data were analysed by χ^2 test or Student's *t*-test as appropriate. In all, the significance level was set to $p < 0.05$.

Findings We identified 859 published papers, of which 51 studies from 11 countries met the inclusion criteria. The 16 studies in the first 10 years (before 2005; group A) were compared with the 35 in the last 10 years (2005–14; group B). Nigeria ($n=32$; 62.7%), South Africa ($n=7$; 13.7%), Tanzania ($n=2$; 3.9%), and Tunisia ($n=2$; 3.9%) were the predominant source of the publications, of which were retrospective in 38 (74.5%) studies and prospective in 13 (25.5%) studies. The mean sample size of the studies was 97.8 (range 5–640). Overall, 4989 neonates were studied, with median age of 6 days (range 1–30). Common neonatal conditions reported were intestinal atresia in 28 (54.9%) studies, abdominal wall defects in 27 (52.9%), anorectal malformations in 24 (47.1%), and Hirschsprung's disease, necrotising enterocolitis, and volvulus neonatorum in 23 (45.1%) each. Mortality was lowest (<3%) in spina bifida and facial cleft procedures, and highest (>50%) in emergency neonatal surgeries involving bowel perforation, bowel resection, congenital diaphragmatic hernia, oesophageal atresia, and ruptured omphalocele or gastroschisis. Overall average mortality rate was higher in group A than in group B (36.9% vs 29.1%; $p < 0.001$), but mortality did not vary between the groups for similar neonatal conditions. The major documented challenges were delayed presentation and inadequate facilities in 39 (76.5%) studies, dearth of trained support personnel in 32 (62.7%), and absence of neonatal intensive care in 29 (56.9%). The challenges varied from country to country but did not differ in the two groups.

Interpretation Improvement has been achieved in outcomes of neonatal surgery in Africa in the past two decades, although several of the studies reviewed are retrospective and poorly designed. Cost-effective adaptations for neonatal intensive care, improved health-care funding, coordinated neonatal surgical care via regional centres, and collaboration with international partners are potential interventions that could help to address the challenges and further improve outcome.

Funding None.

Contributors

SOE and BCN conceived the study. SOE and OVA collected the data. SOE analysed the data. SOE, BCN, and OVA wrote the Abstract. SOE, OVA, and BCN approved the final Abstract for publication.

Declaration of interests

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✦ Ultrasound guided transversus abdominis plane versus sham blocks after caesarean section in an Ugandan village hospital: a prospective, randomised, double-blinded, single-centre study

Sadic Kagwa, Mark A Hoeft, Paul G Firth, Stephen Ttendo, Vicki E Modest

Abstract

Background Transversus abdominis plane (TAP) block provides 12–24 h of analgesia to the parietal peritoneum and abdominal wall, and are best used combined with oral or intravenous medications. Despite ease of use, a large margin of safety, and a high success rate, TAP blocks remain under used in settings where patients could most benefit from their use. Previous studies have used oral or intravenous narcotics for supplementation. However, the efficacy of TAP blocks in low-resourced settings where patients do not have dependable access to these medications is unknown. This study examines TAP block analgesic efficacy after caesarean section in a poorly resourced setting. We compared the post-operative status of 170 women with self-administered paracetamol-diclofenac with or without TAP blocks. We hypothesised that the block would decrease pain at 8 h, 16 h, and 24 h at rest, with coughing and upon standing.

Methods Between Oct 31, and Dec 28, 2013, 180 women were enrolled and randomly assigned to receive either TAP or sham blocks after caesarean section. Bi-institutional (Mbarara Regional Referral Hospital and Massachusetts General Hospital) institutional review board approval was obtained for this single-centre study. After informed written consent, patients received TAP or sham blocks after caesarian section. Inclusion criteria for enrolment were: age 18 years or older, weight at least 50 kg, no allergies to study medications, otherwise healthy (American Society of Anesthesiologists classification status I or II), and having undergone elective, urgent, or emergent caesarian section under spinal anaesthesia without sedation. Under ultrasound guidance, 20–25 mL of 0.25% bupivacaine (epinephrine 1:400 000) were injected near the triangles-of-Petit. Sham blocks consisted of a transducer with a needleless syringe pressed over each flank. In the post-anaesthesia recovery area, all patients received 1000 mg paracetamol and 50 mg diclofenac, orally, to be continued on an 8-h schedule for 3 days. A skilled (masked) research nurse collected all data. The primary outcomes measured were numerical rating scale at 8 h, 16 h, and 24 h at rest, with coughing, and upon standing. The association between the pain scores at each time and type of treatment (TAP *vs* sham blocks) was assessed using general linear model with repeated measures. Demographics were compared using the two sample *t*-test (appendix).

Findings 170 patients completed the study; 86 in the sham group and 84 in the study group. Demographics (age, weight, and parity) were similar between both study groups. One participant from the sham group was missing parity information (appendix). Preliminary data analysis showed reduced pain scores at all times, and with all degrees of movement for the TAP group (appendix). The largest reduction in pain was at 8 h (resting 33%, coughing 36%, and standing 44%). With time, the pain scores of the TAP group changed a little, whereas a decreasing trend can be noted in the sham group. No adverse events occurred.

Interpretation This study show a significant improvement in pain scores for obstetric patients receiving a transversus abdominis plane block in comparison to standard of care in a low income, limited resource setting. The use of these blocks shows the use of an easy, inexpensive, and achievable pain control option. Especially in resource-limited areas, this approach could allow for better pain management and a new standard of care for the world's most common operative procedure.

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Contributors

SK and VEM performed all TAP blocks and oversaw the surgical anaesthetics. VEM wrote the Abstract with input from all co-authors. All authors have seen and approved the final version of the Abstract for publication.

Declaration of interests

We declare no competing interests.

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See Online for appendix

Palatal fistula risk after primary palatoplasty: a retrospective comparison of humanitarian operations and tertiary hospitals

Kimberly M Daniels, Emily Yang Yu, Rebecca G Maine, Scott Corlew, Shi Bing, William Y Hoffman, George A Gregory

Abstract

Background Humanitarian surgical organisations provide cleft palate repair for patients without access to surgical care. Despite decades of experience, very little research has assessed the outcomes of these trips. This study investigates the fistula rate in patients from two cohorts in rural China and one in the USA.

Methods This retrospective study compared the odds of fistula presentation among three cohorts whose palates were repaired between April, 2005, and November, 2009. The primary cohort included 97 Chinese patients operated on in China by surgeons from ReSurge International. A second Chinese cohort of 250 patients was operated on at Huaxi University Hospital by Chinese surgeons. The third cohort of 120 patients from the University of California San Francisco (UCSF) was included for comparison over the same time period; data was taken from medical records. Age, fistula presentation, and Veau Class were compared between the three cohorts with χ^2 tests. Logistic regression was used to analyse predictors of fistula presentation among the three cohorts. This study received institutional review board approval from the UCSF, the Harvard School of Public Health, and physicians at Huaxi University Hospital, and written consent was obtained from study participants in China.

Findings The fistula risk was 41·1% in ReSurge patients, 12·8% for patients at Huaxi University Hospital, and 2·5% for patients at UCSF ($p < 0\cdot001$). At the time of surgery 14·1% of the ReSurge patients were younger than 2 years old, whereas 90·55% of the UCSF children and 40·7% of the Huaxi children were ($p < 0\cdot001$). In the ReSurge cohort, 21·1% of patients had a Veau class of I or II, whereas 40·8% and 58·9% of UCSF and Huaxi patients, respectively, were in class I or II ($p < 0\cdot001$). Age and Veau Class were associated with fistula formation in a univariate analysis. (Veau Class III or IV vs I or II, odds ratio [OR] 7·021 [95% CI 3·499–14·081]; age, OR 1·077 [95% CI 1·03–1·13]). A multivariate model controlling for the surgical group, age at palatoplasty, and sex showed an association between Veau Class and the odds of fistula presentation (Class III or IV vs I or II, OR 6·140 [95% CI 2·925–12·891]). In this model, UCSF patients and Huaxi patients had 0·053 and 0·367 times the odds of developing a fistula, respectively, compared with ReSurge patients ($p < 0\cdot001$ both).

Interpretation Chinese children undergoing palatoplasty on surgical missions have higher post-operative odds of palatal fistula than do children treated by local physicians. Children in low-resource settings have higher complication rates than do children in high-resource settings. Older age at palatoplasty and a Veau class III and IV are associated with post-palatoplasty fistula. Furthermore demographic, socioeconomic, and cultural differences could play a part in palatoplasty fistula outcomes between these three populations. More research is needed to determine the effects of post-operative care, the skill of the providers, and the technique used in the surgery that play a role on fistula outcomes after primary palatoplasty, particularly in low-resource environments.

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Contributors

KMD did the statistical analysis, interpreted the data, and wrote the Abstract. RGM provided background information, collected and interpreted the data, and edited the Abstract. EYY collected and interpreted the data and reviewed the Abstract. SC assisted with data collection and interpretation and edited the Abstract. WYH provided with data and edited the Abstract. BS provided data and reviewed the Abstract. GAG, RGM, and WYH conceived and designed the study, and edited the Abstract. All authors approved the final version of the Abstract for publication.

Declaration of interests

We declare no competing interests.

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Expansion of laparoscopic cholecystectomy in a resource limited setting, Mongolia: a 9-year cross-sectional retrospective review

Katie M Wells, Yu-Jin Lee, Sarnai Erdene, Sandag Erdene, Urjin Sanchin, Orgoi Sergelen, Angela Presson, Chong Zhang, Brandon Rodriguez, Catherine deVries, Raymond Price

Abstract

Background The benefits of laparoscopic cholecystectomy have been largely unavailable to most people in developing countries. Mongolia has an extremely high incidence of gallbladder disease. In 2005, only 2% of cholecystectomies were being done laparoscopically. Open cholecystectomies were associated with high rates of wound infections, complications, and increased recovery time. Because of the unacceptable complications associated with open cholecystectomies, and nearly 50% of the nomadic population needing faster post-operative recovery times, a national project for the development of laparoscopic surgery was organised. Multi-institutional collaboration between the Mongolia Health Sciences University, the Dr W C Swanson Family Foundation (SFF), the University of Utah, Intermountain Healthcare, and the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) led to the promulgation of a formalised countrywide laparoscopic training programme during the past 9 years. This is a retrospective review of the transition from open to laparoscopic cholecystectomy throughout Mongolia.

Methods Demographic patient data, diagnosis, and operation preformed-laparoscopic versus open cholecystectomy, between January, 2005, and September, 2013, were collected and trends were analysed from seven regional diagnostic referral and treatment centres, and two tertiary academic medical centres from six of the 21 provinces (Aimags) throughout Mongolia. Data were analysed by individual training centre, by year, and then compared between rural and urban centres.

Findings Nearly 16 000 cholecystectomies were analysed and compared (4417 [28·2%] men; 11 244 [71·8%] women). Men and women underwent laparoscopic cholecystectomy with the same frequency (41·2% men, 43·2% women) and had similar age (men, mean 52·2 years [SD 14·8]; women, mean 49·4 years [SD 15·7]). By 2013, 62% of gallbladders were removed laparoscopically countrywide as opposed to only 2% in 2005. More than 315 Mongolian practitioners have received laparoscopic training in 19 of 21 Aimags. On average 60% of cholecystectomies are done laparoscopically in urban surgical centres, up from 2%, versus 55% in rural surgical centres, up from 0%, in 2005. Laparoscopic cholecystectomy surpassed open cholecystectomy as the primary method for gallbladder removal countrywide in 2011.

Interpretation By 2013, 62% of cholecystectomies countrywide were done laparoscopically, a great increase from 9 years ago. Despite being a resource limited country, the expansion of laparoscopic cholecystectomy has transformed the care of biliary tract disease in Mongolia.

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Contributors

Y-JL, KMW, RP, OS, SarE, and SanE were primarily responsible for data collection. KMW wrote the Abstract with input from RP, CdV, Y-JL, and SanE. AP, CZ, and BR did the statistical analysis. All authors approved the final version of the Abstract for publication.

Declaration of interests

We declare no competing interests.

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General surgery education: a systematic review of training worldwide

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Abstract

Background Surgical care is an essential component of health management worldwide. As the prevalence of injuries and non-communicable diseases increases, the provision of effective surgical care will become an increasingly important priority to reduce death and disability. To assess the ability of health systems to meet current surgical needs, we did a review of surgical training programmes worldwide.

Methods We searched Medline, EMBASE, and the Global Health Library databases with the search terms “surgical training” and “surgeon training” for abstracts and citations in all languages published between Jan 1, 1998, and Dec 31, 2013, describing a national general surgery training system. We extracted the following data: a brief description of the programme, years of training required, year after medical school graduation when training begins, name of national oversight organisation(s), in-country opportunities for subspecialty training, and whether programmes self-identified as being similar to or affected by the surgical education system in the USA or the UK.

Findings We identified 5229 abstracts (3888 from Medline, 971 from EMBASE, and 726 from the Global Health Library databases). 228 (4.4%) articles underwent full text review. 60 articles were included for data extraction. We identified descriptions of general surgery training programmes in 52 countries. Data from an additional 17 countries represented by a regional college of surgeons were also recorded. Training duration ranged from 2–8 years (median total training, 6 years; median surgical training, 5 years), and lasted on average 6 years after medical school graduation. 19 countries self-identified as being similar to or affected by the US or UK training model. Many low-income and middle-income countries (LMICs) are working to expand access to surgical care through programmes, often focusing on training non-physician clinicians. Programmes in high-income countries have also undergone substantial reforms, affected by evolving practice environments, trainee preferences, and training bottlenecks.

Interpretation General surgery training programmes are often responsive to national health care needs. We show a global trend towards standardisation of curricula and competency-based training. Countries expanding or developing their programmes show benefit from association or partnership with larger surgical organisations and academic institutions, but there are questions of sustainability. Both LMICs and high-income countries stand to benefit from coordinating development of global training standards and educational exchanges. Although more research is needed to understand the role of surgical education in meeting the demand for surgical care, it is clear that a cross-nationally coordinated strategy will be important to address the burden of surgical disease.

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Contributors

YZ, MM, and FA conceived and designed the study. YZ, MM, and NA reviewed the articles and extracted the data. YZ, MM, SG, JB, and FA analysed the data, and wrote and edited the Abstract. All authors approved the final version of the Abstract for publication.

Declaration of interests

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Towards closing the gap of the global surgeon, anaesthesiologist, and obstetrician workforce: thresholds and projections towards 2030

Hampus Holmer, Mark G Shrime, Johanna N Riesel, John G Meara, Lars Hagander

Abstract

Background Billions of people are without access to surgical care, in part because of the inequitable distribution of the surgical workforce. Drawing on recently collected data for the number of surgeons, anaesthesiologists, and obstetricians worldwide, we sought to show their global maldistribution by identifying thresholds of surgical workforce densities, and by calculating the number of additional providers needed to reach those thresholds.

Methods From the WHO Global Surgical Workforce Database, national data for the number of specialist surgeons, anaesthesiologists, and obstetricians per 100 000 population (density) were compared with the number of maternal deaths per 100 000 live births (maternal mortality ratio; MMR) in WHO member countries. A regression line was fit between density of specialist surgeons, anaesthesiologists, and obstetricians and the logarithm of MMR, and we explored the correlation for an upper and a lower density threshold. Based on previous estimates of the global volume of surgical procedures, a global average productivity per specialist was derived. We then multiplied the average productivity with the derived upper and lower threshold densities, and compared these numbers to previously estimated global need of surgical procedures (4664 procedures per 100 000 population). Finally, the numbers of additional providers needed to reach the thresholds in countries with a density below the respective threshold were calculated.

Findings Each 10-unit increase in density of surgeons, anaesthesiologists, and obstetricians, corresponded to a 13·1% decrease in MMR (95% CI 11·3–14·8). We saw particularly steep improvements in MMR from 0 to roughly 20 per 100 000 population. Above roughly 40 per 100 000 population, higher density was associated with relatively smaller improvements in MMR. These arbitrary thresholds of 20 and 40 specialists per 100 000 corresponded with a volume of surgery of 2917 and 5834 procedures per 100 000 population, respectively, and were symmetrically distributed around the estimated global need of 4664 surgical procedures per 100 000 population. Our density thresholds are slightly higher than the current average in lower-middle income countries (16 per 100 000) and upper-middle-income countries (38 per 100 000), respectively. To reach the threshold of at least 20 per 100 000 in each country today, another 440 231 (IQR 438 900–443 245) providers would be needed. To reach 40 per 100 000, 1 110 610 (IQR 1 095 376–1 183 525) providers would be needed.

Interpretation Assuming uniform productivity, a global surgical workforce between 20 and 40 per 100 000 would suffice to provide the world's missing surgical procedures. We concede that causality cannot be implied, but our results suggest that countries with a workforce density above certain thresholds have better health outcomes. Although the thresholds cannot be interpreted as a minimum standard, they are useful to characterise the global surgical workforce and its deficits. Such thresholds could also be used as markers for health system capacity.

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Contributors

HH, LH, and MGS did the statistical analysis. JNR and LH provided input to analysis and interpretation of the results. HH wrote the Abstract with input from LH, MGS, JNR, and JGM. All authors have seen and approved the final version of the Abstract for publication.

Declaration of interests

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The scale-up of the surgical workforce

Kimberly M Daniels, Johanna N Riesel, John G Meara

Abstract

Background Countries with fewer than 20 specialist surgeons, anaesthetists, and obstetricians (SAO) per 100 000 population have worse health outcomes. To achieve surgical workforce densities of 20 per 100 000 by 2030, a scale up of the surgical workforce is required. No previous study has shown what this will cost, how many providers will be required, or how long it will take to increase the global surgical workforce. We aim to identify these answers for health-care systems that employ SAO alone and for those that use a hybrid model of SAO and task shifting to inform strategic planning.

Methods Data for the density of SAO per country were obtained from the WHO Global Surgical Workforce Database. To find the total number of SAO that need to enter the workforce by 2030 to achieve surgical workforce thresholds of 20 per 100 000, the population growth formula ($P=e^{rt}$) was used and we assumed exponential surgical workforce growth and two potential retirement rates of either 1% or 10%. We did not account for migration. The same calculations were used for associate clinicians needed to enter the workforce in either a 2:1 or 4:1 associate clinicians-to-SA0 ratio. The costs to train SAO and associate clinicians were estimated with data for training costs imputed into a regression analysis with health-care expenditure per capita for each country. We assumed training costs will remain constant, and we did not account for inflation. The time needed to train new surgical and anaesthetic providers was estimated with average length of training for SAO and associate clinicians and was measured in person years. Two models (one for a system of SAO only and one for a hybrid of SAO and associate clinicians) were created to show how many providers will need to enter the workforce per year once training is complete to reach targets by 2030. The model did not involve the scale-up of the surgical workforce needed to address unmet needs of essential surgical services.

Findings By 2030, the world will need 1 272 586 new surgical workforce providers to meet a surgical workforce density of 20 per 100 000 assuming a 1% retirement rate. This will cost US\$71–146 billion depending on the model used. Low-income and lower-middle-income countries show the largest required scale-up. An additional 806 352 (median 3412 [IQR 691–6851]) providers are needed in those countries. In the SAO only model, this will cost a median of US\$19·66 per 2013 capita (IQR 15·79–25·07) and will take a median of 34 121 person years (IQR 6911–68 509). In the 4:1 associate clinician-to-SA0 ratio, it will cost a median of US\$7·57 per capita and take 20 472 person years. When accounting for the delay of entry to the workforce due to training in these countries, the median rate of entry to meet the goal density will have to increase 10·9 times after a 10 year delay in an SAO only model as opposed to 4·98 times with a 5 year delay in the hybrid 4:1 associate clinician-to-SA0 model.

Interpretation Although low-income countries, lower-middle-income countries, and upper-middle-income countries will require a surgical workforce scale-up, lower-middle-income countries will require the largest scale-up. In these countries, implementing a system of task shifting can decrease costs and training times by 40%. Meeting densities of 20 per 100 000 will not guarantee quality care or improved access in rural areas, and equal attention must be paid to the provision of safe, affordable, accessible surgical care to all who need it.

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Contributors

JGM and JNR conceived the study concept. KMD designed the model and ran the analysis with data from the WHO Global Surgical Workforce Database. JGM, JNR, and KMD equally contributed to writing and editing the Abstract. All authors have seen and approved the final version of this Abstract for publication.

Declaration of interests

We declare no competing interests.

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Surgical care by non-surgeons in low-income and middle-income countries: a systematic review

Marguerite Hoyler, Lars Hagander, Rowan Gillies, Robert Riviello, Kathryn Chu, Staffan Bergström, John G Meara

Abstract

Background Anecdotal evidence suggests that task-shifting or the redistribution of responsibilities from fully-trained surgeons to clinicians with fewer qualifications could become a major component of surgical care delivery in many low-income and middle-income countries (LMICs). Our goal was to summarise the scope of surgical task-shifting in LMICs through a systematic review of the medical literature.

Methods We searched PubMed, EMBASE, CINAHL, LILACS, and African Index Medicus databases for papers and abstracts published between 1975, and November, 2014, that provided original data regarding non-surgeon providers, the type and volume of operations they perform, and the outcomes they achieve. The search was done in English, French, Spanish, and Portuguese, and included terms related to surgery, non-physician providers, and LMIC country names. Outcomes included the number of non-physicians and non-surgeons practicing surgery in LMICs, their qualifications, practice models and locations, and the types and volume of operations performed.

Findings We identified 65 articles and 14 abstracts that described non-surgeon and non-physician providers performing 46 types of surgical procedures, across eight surgical disciplines, in 41 LMICs. These procedures extended beyond those recommended by WHO, such as male circumcision and emergency obstetric surgery. Non-surgeons and non-physicians provided a large amount of surgical care in some locations, including 90% of obstetric surgeries, 38.5% of general surgery procedures, and 43% of non-obstetric laparotomies at three separate hospitals. Of the 38 papers that specified urban or rural locations, 35 described task-shifting in rural areas or district hospitals. A variety of formal training models for surgical task-shifting were noted, including collaborations between national governments, WHO, and private non-governmental organisations. Surgical providers often had no formal surgical training, and did not operate under the supervision of a fully trained provider.

Interpretation Our results suggest that non-surgeon physicians and non-physician clinicians provide surgical care many in low-resource settings. A limitation of our study is that our search was conducted in only four languages. Because many studies described the same country, countries or regions in overlapping time frames, it was not possible to determine the total number of task-shifting providers. In view of the shortage of fully-trained surgeons in many LMICs, it seems likely that task-shifting is far more widespread than is indicated by the medical literature. More research is needed to accurately determine the full extent and implications of surgical task-shifting in LMICs worldwide.

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Contributors

MH and LH conceived and designed the study. MH collected the data. All authors interpreted the data. MH wrote the Abstract. All authors approved the final version of the Abstract for publication.

Declaration of interests

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A multicountry health partnership programme to establish sustainable trauma training in east, central, and southern African countries using a cascading trauma management course model

Noel Aaron Peter, Hermant Pandit, Grace Le, Mathenge Nduhiu, Emmanuel Moro, Christopher Lavy

Abstract

Background Injury accounts for 267 000 deaths annually in the nine College of Surgeons of East, Central, and Southern Africa (COSECSA-ASESA) countries, and the introduction of a sustainable standardised trauma training programme across all cadres is essential. We have delivered a primary trauma care (PTC) programme that encompasses both a “provider” and “training the trainers” course using a “cascading training model” across nine COSECSA countries. The first “primary course” in each country is delivered by a team of UK instructors, followed by “cascading courses” to more rural regions led by newly qualified local instructors, with mentorship provided by UK instructors. This study examines the programme’s effectiveness in terms of knowledge, clinical confidence, and cost-effectiveness.

Methods We collected pre-training and post-training data from 1030 candidates (119 clinical officers, 540 doctors, 260 nurses, and 111 medical students) trained over 28 courses (nine primary and 19 cascading courses) between Dec 5, 2012, and Dec 19, 2013. Knowledge was assessed with a validated PTC multiple choice questionnaire and clinical confidence ratings of eight trauma scenarios, measured against covariants of sex, age, clinical experience, job roles, country, and health institution’s workload.

Findings Post-training, a significant improvement was noted across all cadres in knowledge (19% [95% CI 18·0–19·5]; $p<0\cdot05$) and clinical confidence (22% [20·3–22·3]; $p<0\cdot05$). Non-doctors showed a greater improvement in knowledge (22% vs 16%; $p<0\cdot05$) and confidence (24% vs 20%; $p<0\cdot05$) than doctors. Candidates attending cascading courses also showed larger improvements in knowledge (21% vs 15%; $p<0\cdot002$) and clinical confidence (23% vs 19%; $p<0\cdot002$) than their primary course counterparts. Multivariate regression analysis showed that attending cascading courses (Coef=4·83, $p<0\cdot05$), being a nurse (Coef=3·89, $p=0\cdot007$) or a clinical officer (Coef=4·11, $p=0\cdot015$), and attending a course in Kenya (Coef=9·55, $p<0\cdot002$) or Tanzania (Coef=9·40, $p<0\cdot002$) were strong predictors to improvement in multiple choice questionnaire performance. However, improvement in clinical confidence was affected by the job-role of the clinical officer (Coef=6·49, $p=0\cdot002$) and attending a course in Kenya (Coef=16·12, $p<0\cdot02$) or Tanzania (Coef=7·01, $p<0\cdot05$). Cascading courses were on average £2000 less expensive than primary care courses.

Interpretation To the best of our knowledge, this is the largest series in the literature on multicountry trauma management training in sub-Saharan Africa. Our study supports the concept of cascading courses as an educationally and cost-effective method in delivering vital trauma training in low-resource settings led by local clinicians.

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Contributors

NAP did the literature search, data collection, data analysis, data interpretation, and drafted the Abstract. HP, MN, CL, and EM critically analysed the data and revised the Abstract. CL developed the concept. GL did the data collection and revised the Abstract. All authors approved the final version of the Abstract for publication.

Declaration of interests

We declare no competing interests.

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Who is performing surgery in low-income settings: a countrywide inventory of the surgical workforce distribution and scope of practice in Sierra Leone

Håkon A Bolkan, Lars Hagander, Johan von Schreeb, Donald Bash-Taqi, Thaim B Kamara, Øyvind Salvesen, Arne Wibe

Abstract

Background Scope of practice and in-country distribution of surgical providers in low-income countries remains insufficiently described. Through a nationwide comprehensive inventory of surgical procedures and providers in Sierra Leone, we aimed to present the geographic distribution, medical training, and productivity of surgical providers in a low-income country.

Methods Following exhaustive sampling, a total of 60 facilities performing surgery in Sierra Leone 2012 was identified. Annual surgical activity was obtained from 58 (97%) facilities, while institution and workforce data was retrieved from 56 (93%). Characteristics of patients, facilities, procedures, and surgical providers were collected retrospectively from operation theatre logbooks and by interviewing facility directors.

Findings In 2012, 164 full-time positions of surgical providers performed 24152 surgeries in Sierra Leone. Of those, 58 (35.6%) were consultant surgeons, obstetricians, or gynaecologists (population density: 0.97 per 100 000 inhabitants). 86 (52.9%) were medical doctors (1.42 per 100 000), whereas the 14 (8.4%) associate clinicians and six (3.8%) nurses represented a density of 0.23 and 0.10 per 100 000 inhabitants, respectively. Almost half of the districts (46%), representing more than 2 million people (34% of the population), had less than one fully trained consultant. Density of consultant and medical doctors were 27 and six times higher in urban areas compared with rural areas, respectively. The surgical providers performed 144 surgeries per position in 2012 (2.8 surgeries per week). Nurses performed 6.6% and associate clinicians 6.8% of the total national volume of surgeries. Districts with lower surgical rates had a significant lower productivity per surgical provider ($Rho=0.650$, $p=0.022$). We noted a significant positive correlation between the facility volume of surgery and the productivity of each surgical provider ($p<0.001$).

Interpretation Surgical providers with higher qualifications seem to have a preference for urban settlements. Increasing the output of the existing workforce can contribute to expansion of surgical services.

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Contributors

HAB did the literature search, designed the study, collected the data, analysed the data, interpreted the data, and edited and wrote the Abstract. LH interpreted the data and wrote and edited the Abstract. JvS did the literature search, designed the study, analysed the data, interpreted the data, and edited the Abstract. DB-T designed the study, collected the data, analysed the data, and edited the Abstract. TBK designed the study, collected the data, and edited the Abstract. ØS designed the study, collected the data, analysed the data, and interpreted the data. AW did the literature search, designed the study, collected the data, analysed the data, interpreted the data, and wrote and edited the Abstract. All authors approved the final version of the Abstract for publication.

Declaration of interests

HAB is chairman of CapaCare, a non-governmental organisation behind a surgical training programme in Sierra Leone. All other authors declare no competing interests.

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Delivering trauma training to multiple health-worker cadres in nine sub-Saharan African countries: lessons learnt from the COOL programme

Noel Aaron Peter, Hermant Pandit, Grace Le, Godfrey Muguti, Christopher Lavy

Abstract

Background Africa has one of the highest road-traffic mortality rates in the world. Nurses and clinical officers play a pivotal part in trauma care as a result of substantial shortage of doctors. The COOL (COSECSA-Oxford-Orthopaedic-Link) programme has delivered primary trauma care (PTC) training in nine sub-Saharan African countries across a wide cadre of health-workers (540 doctors, 260 nurses, 119 clinical officers, and 111 medical students). This prospective study investigates the effect of 28 consecutive PTCs and the training challenges that exist between different cadres and health institutions.

Methods The course trains delegates in key trauma concepts: primary survey, airway management, chest injuries, major haemorrhage, and paediatric trauma. Candidates' knowledge of these concepts was assessed before and after the course with a validated 30 Single-Best-Answer multiple choice questionnaire. Assessment scores were analysed by cadre, urban (383 candidates) or rural institutions (647 candidates), and sex (657 men, 373 women). A concept was categorised as being poorly understood when half the candidates achieved less than 50% of the correct answers. Descriptive statistics and MANOVA analysis were used, with an alpha level set at 0.05.

Findings 1030 PTC providers were trained between Dec 5, 2012, and Dec 19, 2013. There was significant increase in multiple choice questionnaire (58% to 77%, $p < 0.05$) and clinical confidence (68% to 90%, $p < 0.05$) scores among delegates post course, with independent covariants of institution location and cadre significantly affecting post-course scores. Doctors achieved satisfactory scores on all key concepts (67% to 84%, $p < 0.05$). Clinical officers (all concepts 53% to 76%, $p < 0.05$) particularly struggled with paediatric trauma (94 candidates $< 50\%$, mean 24.23 [95% CI 19–30]). Nurses (all concepts 42% to 64%, $p < 0.05$) had difficulty with chest injuries (203 pre-course to 153 post-course candidates $< 50\%$, mean 49% [95% CI 45–52]) and paediatric trauma (212 pre-course to 161 post-course candidates $\leq 50\%$, post course mean 46% [95% CI 43–53]). Medical students achieved satisfactory scores in all concepts (overall 53% to 74%, $p < 0.05$). Health-workers based in urban hospitals (82%) outperformed those in rural hospitals (72%) ($p = 0.001$) and sex had no significant effect on performance ($p = 0.07$).

Interpretation Our study shows that PTC courses led to improvement in trauma management knowledge and clinical confidence among a wide cadre of health-workers. However, these are new concepts for many front-line health-workers, and regular refresher training will be required. There is also a difference in understanding of key trauma concepts among the different cadres. Future training in this region should address areas of weakness unique to each cadre, particularly paediatric trauma care.

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Contributors

NAP did the literature search, data collection, data analysis, data interpretation, and drafted the Abstract. HP critically analysed the data and revised the Abstract. GL did the data collection and revised the Abstract. GM critically analysed the data and revised the Abstract. CL developed the concept, critically analysed the data, and revised the Abstract. All authors approved the final version of the Abstract for publication.

Declaration of interests

We declare no competing interests.

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Global surgical and anaesthetic task shifting: a systematic literature review and survey

Frederik Federspiel, Swagoto Mukhopadhyay, Penelope Milsom, John W Scott, Johanna N Riesel, John G Meara

Abstract

Background Billions of people worldwide lack access to surgical care; this is in part driven by severe shortages in the global surgical workforce. Task shifting, the movement of tasks to associate clinicians or non-specialist physicians, is a commonly implemented yet often contentious strategy to expand the surgical workforce. A more complete understanding of the global distribution and use of surgical and anaesthetic task shifting is needed to strengthen strategic planning efforts to bridge the gap between surgical and anaesthetic providers. We aimed to document the use of task shifting worldwide with an in-depth review of the literature and subsequent confirmation of practices through a provider survey.

Methods We did a literature search according to PRISMA guidelines. We searched PubMed, Embase, The Cochrane Library, CINAHL, WHOLIS, and five regional databases for journal articles published between Jan 1, 1995, and Aug 29, 2014, for titles or abstracts mentioning surgical or anaesthetic care provision by associate clinicians or non-specialist physicians. We also searched article references and online resources. We extracted data for health cadres performing task shifting, the types of tasks performed, training programmes, and supervision of those performing tasks and compared these across regions and income groups. Additionally, we then undertook an unvalidated survey to investigate the use of task shifting at the country level, which was sent to surgeons and anaesthetists in 19 countries across all major regions of the world.

Findings We identified 62 studies. The review and survey provided data for 163 and 51 countries respectively, totalling 174 countries. Surgical task shifting occurred in 30 (33%) of 92 countries. Anaesthetic task shifting occurred in 108 (65%) of 165 countries. Task shifting was documented across all World Bank income groups. Where relevant data were available, in high-income countries, associate clinicians were commonly supervised (100% [four countries] for surgery and 90% [20 countries] for anaesthesia). In low-income countries, associate clinicians undertook surgical and anaesthetic procedures without supervision (100% for surgery [five countries] and 100% for anaesthesia [22 countries]).

Interpretation Task shifting is used to augment the global surgical workforce across all geographical regions and income groups. Associate clinicians are ubiquitous among the global surgical workforce and should be considered in plans to scale up the surgical workforce in countries with workforce shortages. Reporting bias is likely to have favoured the more novel and successful task shifting initiatives, which could have caused our results to underestimate the absolute number of countries that use task shifting. Although surgical and anaesthetic task shifting has been described in many countries, further research is required to assess outcomes, especially in low-income and middle-income countries where supervision is less robust.

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Contributors

FF, SM, PM, JNR, and JGM conceived and designed the study. FF, SM, and PM collected the data. JS provided critical research assistance and assisted with interpretation and management of results. All authors were involved in the interpretation of the data and writing of the Abstract, and approved the final version of the Abstract for publication.

Declaration of interests

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Community health workers and smartphones for the detection of surgical site infections in rural Haiti: a pilot study

Alexi Matousek, Ken Paik, Eric Winkler, Jennifer Denike, Stephen R Addington, Chauvet Exe, Rodolphe R E Jean Louis, Robert Riviello

Abstract

Background Absence of outcome data is a barrier to quality improvement in resource poor settings. To address this challenge, we set out to determine whether follow up for surgical site infections (SSIs) using community health workers (CHWs) and smartphones is feasible in rural Haiti.

Methods In this pilot study, all patients from a specific mountain region who received an operation between March 10, and July 1, 2014, at Hôpital Albert Schweitzer in rural Haiti were eligible for inclusion. Patients or guardians of minors were approached for consent. We designed a smartphone application to enable CHWs to screen for SSIs during home visits by administering a questionnaire, obtaining GPS data, and submitting a photograph of an incision. We selected and trained CHWs to use the smartphone application and compensated them based on performance. CHWs completed home visits for 30 days after an operation for all participants. Surgeons examined all participants within 24 h after the second CHW home visit. Primary outcomes included the number of participants completing 30-day follow-up and home visits made on time. Secondary outcomes included the quality of the photographs and the agreement between surgeons and CHWs on the diagnosis of SSI. The Partners Healthcare institutional review board and the Ethics Committee at Hôpital Albert Schweitzer approved the study protocol.

Findings Five CHWs completed 30-day follow up for 37 of 39 participants (94·9%) and completed 107 of 117 home visits on time (91·5%). High quality photographs were submitted for 101 of 117 visits (86·3%). Surgeons and CHWs agreed on the diagnosis of SSI in 28 of 33 cases (84·8%).

Interpretation Outpatient follow up for SSIs with CHWs and smartphones is feasible in rural Haiti. Further validation of the programme needs to be done before widespread adoption or advocating for task shifting post-operative follow up to CHWs.

Funding Partners Healthcare, Children's Hospital Boston, and Swiss Bündner Partnerschaft Hôpital Albert Schweitzer Haiti.

Contributors

AM designed the study, collected the data, did the analysis, and wrote the first draft of the Abstract. KP designed the mobile health application and assisted with data interpretation. EW designed and wrote the mobile health application and collected and analysed the data. JD supervised the community health workers and collected study data. SRA did the literature search and wrote portions of the Abstract. CE and RREJL provided guidance, did the operations, assessed the patients, and collected study data. RR provided guidance on the study design and edited the Abstract. All authors approved the final version of the Abstract for publication.

Declaration of interests

We declare no competing interests.

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Out-of-pocket expenses incurred by patients obtaining free breast cancer care in Haiti

Kathleen M O'Neill, Morgan Mandigo, Jordan Pyda, Yolande Nazaire, Sarah L M Greenberg, Rowan Gillies*, Ruth Damuse*

Abstract

Background Women with breast cancer in low-income and middle-income countries (LMICs) account for 51% of cases globally and often present with advanced disease. Fear of costs contributes to delay in seeking care, as health expenditures are financially catastrophic for families worldwide. Despite efforts to improve affordability of health care in LMICs, the financial burden of indirect costs (eg, transportation and lost wages) is often overlooked. We aimed to identify and quantify the expenditures of patients seeking breast cancer care in a LMIC.

Methods Patients receiving breast cancer care free of charge at Hôpital Universitaire de Mirebalais (HUM) in Haiti were interviewed to quantify their costs and assess the effect of these costs on patients and families. These costs included expenses for food, lodging, transportation, childcare, medical costs at other institutions, and lost wages. 61 patients were interviewed during diagnostic, chemotherapy, and surgical visits between March 1, and May 12, 2014. Institutional review board exemption was granted from Boston Children's Hospital and Partners in Health/Zanmi Lasante.

Findings The median non-medical out-of-pocket expenses incurred by breast cancer patients at HUM were US\$233 (95% CI 170–304) for diagnostic visits, US\$259 (95% CI 200–533) for chemotherapy, and US\$38 (95% CI 23–140) for surgery. The median total out-of-pocket expense (including medical costs) was US\$717 (95% CI 619–1171). These costs forced 52% of participants into debt and 20% to sell possessions. The median percentage of potential individual income spent on out-of-pocket costs was 60%. The median sum of out-of-pocket costs and lost wages was US\$2996 (95% CI 1676–5179).

Interpretation In Haiti, 74% of people earn less than US\$2 per day. Even when breast cancer treatment is provided for free, out-of-pocket expenses could account for more than 91% of annual earnings at this income level. This financial burden is an overwhelming obstacle for Haiti's poorest citizens, and probably for many patients in LMICs. High-powered, multisite studies are needed to further characterise this burden worldwide. Funders and health-care providers should reduce indirect costs to achieve equitable access to oncology care.

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Contributors

JP, RD, and YN designed the study. KMO, MM, and JP designed the questionnaire. KMO conducted interviews. All authors contributed to data analysis and the editing of this Abstract. All authors approved the final version of the Abstract for publication.

Declaration of interests

We declare no competing interests.

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An analysis of out-of-pocket costs associated with hospitalised injuries in Vietnam

Ha Nguyen, Rebecca Ivers, Stephen Jan, Cuong Pham

Abstract

Background Injuries create major financial burden for families. In this study, we estimated the distribution of out-of-pocket payment for medical care of injuries and the role of health insurance in containing such costs.

Methods A prospective cohort study of 892 injured patients admitted to a provincial general hospital between Jan 1, 2010, and Aug 31, 2010, in Vietnam was done. Data for demographic, injury characteristics, and costs by specific categories paid out-of-pocket by patients were included in the analyses. Generalised linear models with log link and gamma distribution were used to examine the associations between insurance status and total medical care costs and specific cost component.

Findings The average total medical care costs paid out-of-pocket by patients during hospital stays were greater than US\$270 (SD 193). Major drivers of total medical care costs related to surgery (nearly 25%), diagnostic tests or examinations (24%), and drugs (23%). Burn injuries incurred the highest medical care costs during hospital stays (mean US\$321 [SD 179]) and assault incurred the lowest costs (mean US\$167 [SD 165]). Total costs were higher for more severe injuries and those that required a higher level of surgery (from US\$122 for maximum abbreviated injury score [MAIS] of 1 to US\$485 to MAIS of 5; and US\$194 for non-surgery, US\$202 for minor surgery, and US\$428 for major surgery). Patients using health insurance had lower total costs than those who did not (US\$245 vs US\$279). However, no significant associations were noted between health insurance and total costs ($p=0.142$), costs for surgery ($p=0.154$), diagnostic tests or examinations ($p=0.689$), or drugs ($p=0.341$).

Interpretation This study provides estimates and distribution of costs of medical care for injuries in hospital. Patients and their families seemed to bear all or most of these costs. Although the study highlights the need for ongoing efforts in injury prevention, it also provides further evidence on the few benefits of health insurance in protecting patients and their families from the high costs of hospital stays in Vietnam.

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Contributors

HN, RI, SJ, and CP conceived the study, and developed and refined the study design, instrument, and analysis plan. HN analysed the data and wrote the Abstract with input from RI and SJ. All authors have seen and approved the final version of the Abstract for publication.

Declaration of interests

We declare no competing interests.

Acknowledgments

The researchers would like to thank participants and their relatives in providing information used in this study and gratefully acknowledge the huge effort made by individual doctors and nurses in Thai Binh General Hospital in collecting data. We acknowledge funding for the study through the Atlantic Philanthropies, the National Health and Medical Research Council of Australia in 2011.

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Cost of surgery and catastrophic expenditure in people admitted to hospital for injuries: estimates from a cohort study in Vietnam

Ha Nguyen, Rebecca Ivers, Stephen Jan, Cuong Pham

Abstract

Background Little is known of the effect that surgery has on out-of-pocket health-care expenditure or on catastrophic health payments in low-income settings. Our study aims to estimate the surgery cost paid out-of-pocket by injury patients admitted to a provincial hospital in Vietnam and the risk of catastrophic expenditure at 12 months after discharge.

Methods We conducted a prospective cohort study in a provincial hospital in Vietnam. Participants were patients admitted to hospital due to injuries, aged 18 years or older, had a current residential address in the province (Thai Binh province), and consented to participate in the study. We collected data during hospital stay and at 1 month, 2 months, 4 months, and 12 months after discharge. Out-of-pocket costs incurred by injured people and their caregivers associated with care and treatment were collected. These covered all direct expenses incurred during hospital stay (surgery, emergency department, diagnostic examinations, medication, equipment, transportation, hospital stay, and others—eg, meals for both participants and their caretakers) and during follow-up (ongoing health checks, medication, meals, and transportation to outpatient clinic). Cost data were collected from the hospital bill and collected during face-to-face interviews with participants and their caretakers. The main outcome variables were surgery during hospital stay, total out-of-pocket payment, and catastrophic expenditure, defined as the out-of-pocket payment exceeding 40% of non-subsistence spending, by 12-month follow-up. Modified Poisson regression was used to determine the association between surgery and the risk of catastrophic expenditure.

Findings Of 892 participants recruited during admissions to hospital, surgery was undertaken in 634 participants, including 354 minor (40%) and 280 major (31%) surgeries. The mean costs of major and minor surgery were US\$129 (SD 90) or 30.0% of the total medical care costs during hospital stays and US\$68 (SD 41) or 33.6%, respectively. By 12 month follow-up, mean total direct out-of-pocket costs was US\$625 (SD 603). Of 732 participants, 432 (59%) faced catastrophic expenditure. Specifically, this was 84% among those with major surgery, 47% with minor surgery, and 48% with no surgery. Compared with those with no surgery, the adjusted risk of catastrophic expenditure was only significantly higher for those had major surgery (RR 1.45 [95% CI 1.24–1.69]).

Interpretation Costs of surgery create substantial financial burden for people admitted to hospital for injuries in Vietnam; although major surgery accounting for around 30% of total medical costs it is strongly associated with risk of catastrophic health payments. Although injury prevention efforts need greater investment, there is also a need to reform health-care insurance mechanisms to minimise the impact of out-of-pocket costs.

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Contributors

HN, RI, SJ, and CP conceived the study, and developed and refined the study design, instrument, and analysis plan. HN analysed the data and wrote the Abstract with input from RI and SJ. All authors have seen and approved the final version of the Abstract for publication.

Declaration of interests

We declare no competing interests.

Acknowledgments

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Funding flows to global surgery: an analysis of contributions from the USA

Lily A Gutnik, Joseph Dielman, Anna J Dare, Margarita S Ramos, Robert Riviello, John G Meara, Gavin Yamey, Mark G Shrime

Abstract

Background In recent years, funds for global health have risen substantially, particularly for infectious diseases. Although conditions amenable to surgery account for 28% of the global burden of disease, the external funds directed towards global surgical delivery, capacity building, and research are currently unknown and presumed to be low. We aimed to describe external funds given to these efforts from the USA, the world's largest donor nation.

Methods We searched the United States Agency for International Development (USAID), National Institute of Health (NIH), Foundation Center, and registered US charitable organisations databases for financial data on any giving exclusively to surgical care in low-income and middle-income countries (LMICs). All nominal dollars were adjusted for inflation by converting to 2014 US dollars.

Findings After adjustment for inflation, 22 NIH funded projects (totalling US\$31.3 million, 1991–2014) were identified; 78.9% for trauma and injury, 12.5% for general surgery, and 8.6% for ophthalmology. Six relevant USAID projects were identified; all related to obstetric fistula care totalling US\$438 million (2006–13). US\$105 million (2003–13) was given to universities and charitable organisations by US foundations for 14 different surgical specialties (ophthalmology, cleft lip/palate, multidisciplinary teams, orthopaedics, cardiac, paediatric, reconstructive, obstetric fistula, neurosurgery, burn, general surgery, obstetric emergency procedures, anaesthesia, and unspecified specialty). 95 US charitable organisations representing 14 specialties (ophthalmology, cleft lip/palate, multidisciplinary teams, orthopaedics, cardiac, paediatric, reconstructive, obstetric fistula, neurosurgery, urology, ENT, craniofacial, burn, and general surgery) totalled revenue of US\$2.67 billion and expenditure of US\$2.5 billion (2007–13).

Interpretation A strong surgical system is an indispensable part of any health system and requires financial investment. Tracking funds targeting surgery helps not only to quantify and clarify this investment, but also to ultimately serve as a platform to integrate surgical spending within health system strengthening. Although USAID is a vital foreign aid service and the NIH is a leader in biomedical and health research, their surgical scopes are restricted both financially (less than 1% of respective total budgets over the study years) and in surgical specialty. By contrast, the private charitable sector has contributed more financially and to more specialties. Still, current financial global health databases do not have precise data for surgery. To improve population health in LMICs, more resources should be dedicated to surgical system strengthening. Furthermore, exact classification measures should be implemented to track these important resources.

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Contributors

LAG, GS, AJD, JD, and JGM contributed to the design of the study. LAG did the analysis. LAG wrote the Abstract with input from all authors. All authors have seen and approved the final version of the Abstract for publication.

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Financial contribution to global surgery: an analysis of 160 international charitable organisations

Lily A Gutnik, Gavin Yamey, Anna J Dare, Margarita S Ramos, Robert Riviello, John G Meara, Mark G Shrime

Abstract

Background The non-profit and volunteer sector provides substantial contributions to global health. Within the field of surgery, this sector has made notable service contributions in low-income and middle-income countries (LMICs) where access to surgical care is poor. Little is known about financing and funding flows to surgical care in LMICs from both domestic and international sources. Because an estimated 55% of surgical care delivered in LMICs is via charitable organisations, understanding the financial contributions of this sector could provide valuable insight into estimating funding flows and understanding financing priorities in global surgery.

Methods Between June, and September, 2014, we searched public online databases of registered charitable organisations in five high-income nations (the USA, the UK, Canada, Australia, and New Zealand) to identify organisations committed exclusively to surgical needs. Based on availability, the most current 5 years (2007–13) of financial data per organisation were collected. For each charitable organisation, we identified the type of surgical services provided. We examined revenues and expenditures for each organisation.

Findings 160 organisations representing 15 different surgical specialties were included in the analysis. Total aggregated revenue over the years 2008–2013 was US\$3·3 billion. Total aggregated expenses for all 160 organisations amounted to US\$3·0 billion. 28 ophthalmology organisations accounted for 45% of revenue and 49% of expenses. 15 cleft lip and palate organisations totalled 26% of both revenue and expenses. 19 organisations providing a mix of diverse surgical specialty services amounted to 14% of revenue and 16% of expenses. The remaining 15% of funds represented 12 specialties and 98 organisations. The US accounted for 77·7% of revenue and 80·8% of expenses. The UK accounted for 11·0% of revenue and 11·91% of expenses. Canada accounted for 1·85% of revenue and 2·01% of expenses. Australia and New Zealand accounted for 4·94% of revenue and 5·29% of expenses.

Interpretation Charitable organisations addressing surgical conditions primarily focus on elective surgical care and cover a broad range of subspecialties. The largest funding flows from charitable organisations are directed at ophthalmology, followed by cleft lip and palate surgery. However, there is a clear need for improved, transparent tracking of funds to global surgery via charitable organisations.

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Prioritisation of surgery in the National Health Strategic Plans of Africa: a systematic review

Isabelle Citron, Linda Chokotho, Chris Lavy

Abstract

Background Disease amenable to surgical intervention accounts for 11–15% of world disability and there is increasing interest in surgery as a global public health issue. National Health Strategic Plans (NHSPs) have been established in most countries and reflect their long-term health priorities, plans, and targets. To assess surgery's perceived importance in Africa, we reviewed its place in all such available plans.

Methods We analysed all 43 of the 55 independent countries in Africa that had NHSPs available in the public domain in March, 2014, in English or French. We searched for policies electronically with the search terms “surg*”, “ortho*”, “trauma”, “cancer”, “appendic*”, “laparotomy”, “HIV”, “tuberculosis”, and “malaria” and included those from 2002 to 2030. We then searched manually for disease prevalence, targets, and human resources.

Findings Eight (19%) of 43 NHSPs had no mention of surgery or surgical conditions. 28 (65%) of 43 had five or less mentions of surgery. HIV and malaria had 3801 mentions across all the policies compared with surgery with only 379 mentions. Trauma had 243 mentions, while the common surgical conditions of appendicitis, laparotomy, and hernia had no mentions at all. More than 95% (41 of 43) of NHSPs specifically mentioned the prevalences of HIV, tuberculosis, malaria, infant mortality, and maternal mortality. The most commonly mentioned surgical condition for which a prevalence was given was trauma, in only 47% (23 of 43) of policies. All NHSPs had plans and measurable targets for the reduction of HIV and tuberculosis and all but one had targets for malaria, maternal mortality, and child mortality. Of the 4232 health targets across 43 NHSPs, only 96 (2·3%) were related to surgical conditions or surgical care. 14 (33%) of 43 policies had no surgical targets.

Interpretation NHSPs are the best available measure of health service and planning priorities. It is clear from our findings that surgery is poorly represented and that surgical conditions and surgical treatment are not widely recognised as a public health priority. A paradigm shift is required if surgery is to be considered a public health concern, which should include greater prioritisation in national health strategic policies.

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Contributors

IC did the literature search, collected and analysed the data, wrote the initial Abstract, and cowrote the Abstract. LC edited and improved the Abstract. CL conceived the project, recruited the writing team, devised the search methods and criteria, cowrote the Abstract, and edited and cowrote the Abstract.

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We declare no competing interests.

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Generation of national political priority for surgery: a qualitative case study of three low-income and middle-income countries

Anna J Dare, Josh Bleicher, Katherine C Lee, Alex E Elobu, Thaim B Kamara, Osborne Liko, Samuel Luboga, Akule Danlop, Gabriel Kune, Lars Hagander, Andrew J M Leather, Gavin Yamey

Abstract

Background Surgical conditions exert a major health burden in low-income and middle-income countries (LMICs), yet surgery remains a low priority on national health agendas. Little is known about the national factors that influence whether surgery is prioritised in LMICs. We investigated factors that could facilitate or prevent surgery from being a health priority in three LMICs.

Methods We undertook three country case studies in Papua New Guinea, Uganda, and Sierra Leone, using a qualitative process-tracing method. In total 72 semi-structured interviews were conducted between March and June, 2014, in the three countries. Interviews were designed to query informants' attitudes, values, and beliefs about how and why different health issues, including surgical care, were prioritised within their country. Informants were providers, policy makers, civil society, funders, and other stakeholders involved with health agenda setting and surgical care. Interviews were analysed with Dedoose, a qualitative data analysis tool. Themes were organised into a conceptual framework adapted from Shiffman and Smith to assess the factors that affected whether surgery was prioritised.

Findings In all three countries, effective political and surgical leadership, access to country-specific surgical disease indicators, and higher domestic health expenditures are facilitating factors that promote surgical care on national health agendas. Competing health and policy interests and poor framing of the need for surgery prevent the issue from receiving more attention. In Papua New Guinea, surgical care is a moderate-to-high health priority. Surgical care is embedded in the national health plan and there are influential leaders with surgical interests. Surgical care is a low-to-moderate health priority in Uganda. Ineffectively used policy windows and little national data on surgical disease have impeded efforts to increase priority for surgery. Surgical care remains a low health priority in Sierra Leone. Resource constraints and competing health priorities, such as infectious disease challenges, prevent surgery from receiving attention.

Interpretation Priority for surgery on national health agendas varies across LMICs. Increasing dialogue between surgical providers and political leaders can increase the power of actors who advocate for surgical care. Greater emphasis on the importance of surgical care in achieving national health goals can strengthen internal and external framing of the issue. Growing political recognition of non-communicable diseases provides a favourable political context to increase attention for surgery. Lastly, increasing internally generated issue characteristics, such as improved tracking of national surgical indicators, could increase the priority given to surgery within LMICs.

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Contributors

AJD, LH, AJML, and GY conceived and designed the study. AJD, JB, KCL, AEE, OL, SL, AD, and GK collected the data. All authors interpreted and wrote the Abstract. All authors approved the final version of the Abstract for publication.

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Mapping the playing field—a novel web-based strategy to identify non-governmental actors in global surgery

Joshua S Ng-Kamstra, Sumedha Arya, Timothy E Chung, Brad Weston, Claudia Frankfurter, Lily A Gutnik, Tino Kreutzer, Johanna N Riesel, John G Meara

Abstract

Background In the face of staggering global unmet need for surgical care, non-governmental organisations (NGOs) play a substantial part in the surgical workforce, providing surgical care for those who are without it. The number of NGOs providing surgical care in low-income and middle-income countries (LMICs) is unknown. This information is needed to determine the scope of such care, its contributions to global surgical case volume, to improve collaboration in an effort to maximise efficiency, and to inform national surgical workforce planning. We aimed to create a comprehensive, publicly available catalogue of NGOs providing surgery in LMICs.

Methods We used the United Nations Rule Of Law definition to define NGOs. We included low-income, lower-middle-income, and upper-middle-income countries as defined by World Bank lending groups. Delivery of surgical care by an NGO was defined as the therapeutic manipulation of tissues taking place within an operating room, and was distinguished from the financial or logistical support of such care. We screened an online humanitarian clearing house (ReliefWeb), a large public NGO database (Idealist.org), two surgical volunteerism databases (Operation Giving Back and the Society for Pediatric Anesthesia), and the US State Department Private Volunteer Organizations database, did a review of the literature, and used a social media outlet (Twitter) to identify organisations meeting criteria for inclusion. A complementary analysis additionally provided a list of organisations delivering exclusively surgical care from a search of the OmniMed database, the Foundation Center Online Directory, UK Charity Commission, Australia Charity Commission, New Zealand Charity Commission, and the Canada Revenue Agency Charity Search.

Findings We identified 313 unique organisations, working in all 139 LMICs. Organisations often used more than one model of care and engaged in several surgical specialties. Both short-term surgical missions (206 organisations, 66%) and long-term partnerships (213, 68%) were common models, with 40 organisations (13%) engaging in humanitarian interventions in crisis settings. The most commonly represented specialty was general surgery (120, 38%), but subspecialty surgery such as ophthalmology (88, 28%) and cleft lip and palate surgery (70, 22%) were also frequently performed.

Interpretation To our knowledge, this is the most complete directory of NGOs undertaking surgery in resource-limited settings in existence. However, it is difficult to determine whether this review is exhaustive. Further work is needed to determine the total and relative contributions of these organisations to global surgical volume. This database will be made available for public use and should be maintained and updated to further coordinate global efforts and maximise impact.

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Contributors

JNR, JSN-K, and JGM conceived this study. TK and JNK designed the web strategy. JNK, SA, TEC, BW, and CF extracted data. JSN-K analysed the data. All authors contributed to the writing and editing of this Abstract. LAG provided additional data and contributed to the writing and editing of the Abstract. All authors approved the final version of the Abstract for publication.

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Head and neck cancer in South Asia: macroeconomic consequences and the role of surgery

Blake C Alkire, Regan W Bergmark, Kyle Chambers, Mack L Cheney, John G Meara

Abstract

Background Head and neck cancer, for which the diagnosis and treatment are often surgical, comprises a substantial proportion of the burden of disease in South Asia. Further, estimates of surgical volume suggest this region faces a critical shortage of surgical capacity. We aimed to estimate the total economic welfare losses due to the morbidity and mortality of head and neck cancer in India, Pakistan, and Bangladesh for 1 year (2010).

Methods We used publicly available estimates from the Institute for Health Metrics and Evaluation regarding the morbidity and mortality of head and neck cancer in India, Pakistan, and Bangladesh, along with an economic concept termed the value of a statistical life, to estimate total economic welfare losses due to head and neck cancer in the aforementioned countries in the year 2010. The counterfactual scenario is absence of disease. Sensitivity analyses were done with regard to how the value of a statistical life changes with income.

Findings In 2010, the most conservative estimate of economic welfare losses due to head and neck cancer in the three studied countries is US\$16.9 billion (2010 USD, PPP), equivalent to 0.26% of their combined gross domestic product (GDP). The welfare losses experienced by the population younger than 70 years of age accounted for US\$15.2 billion (90% of the total losses). When adjusted for the size of their respective economies, Bangladesh, the poorest of the three countries, incurred the greatest loss (US\$930 million), equivalent to 0.29% of its GDP. India and Pakistan experienced welfare losses of US\$14.1 billion and US\$1.9 billion, respectively. These figures are equivalent to 0.26% of the GDP for both countries. Oropharyngeal and hypopharyngeal cancer made up the largest share of the total burden at 39% (US\$6.6 billion), followed closely by oral cavity cancer at 34% (US\$5.7 billion).

Interpretation The burden of non-communicable diseases, to which cancer contributes greatly, is growing at a rapid pace in South Asia. Head and neck cancer is a leading cause of cancer-related mortality in this region, and this study suggests that the associated economic welfare losses, estimated to be US\$16.9 billion in 2010 alone, are substantial. A number of strategies are available to address this burden. Surgery, as part of a multidisciplinary approach that includes radiation therapy and chemotherapy, plays a central part in the diagnosis and treatment of head and neck cancer, and building surgical capacity, which offers large economies of scope and scale, can not only address the burden of head and neck cancer, but also create a platform for beginning to confront the rising tide of non-communicable diseases.

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Contributors

BCA and JGM conceived the project. BCA did the data collection and analysis. BCA and RWB wrote the first draft of the Abstract. KC, MLC, and JGM revised the Abstract and provided comments. All authors approved the final version of the Abstract for publication.

Declaration of interests

We declare no competing interests.

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Estimation of the economic burden of injury in north India: a prospective cohort study

Shankar Prinja, Jagnoor Jagnoor, Akashdeep S Chauhan, Sameer Aggarwal, Rebecca Ivers

Abstract

Background Injuries are a serious cause of mortality and morbidity worldwide, with trauma being the leading cause of death in the first four decades of life. By contrast with the declining rates of injury seen in high-income countries, low-income and middle-income countries (LMICs) are experiencing an increase in injury rates, largely due to increased motorisation in these countries. In this study, we report the out-of-pocket expenditure and financial risk protection from trauma care in a tertiary care hospital of India.

Methods Patients who were admitted for at least one night in a tertiary care hospital of Chandigarh during a 1 month period from April 15, 2013, and May 15, 2013, were recruited. Data were collected for the type of injury, out-of-pocket expenditure, and mechanisms undertaken to cope up with the expenditure. Cases were followed up at 1 month, 2 months, and 12 months after discharge to collect information about out-of-pocket expenditure. Prevalence of catastrophic expenditure—ie, if it exceeded 30% of the patient's annual household income—and distress financing—ie, if borrowing (with or without interest) or selling of assets was used to cope with high out-of-pocket expenditure, were assessed among patients recruited. Assuming prevalence of catastrophic expenditure to be 22%, with a precision of 5·5% and 5% alpha error, the sample size was estimated to be 218.

Findings 227 patients were recruited, of whom 155 (68%) were followed up until 12 months. No significant differences were noted based on sociodemographic, injury, and hospitalisation characteristics between the patients who were followed up and those who were lost to follow-up. Average out-of-pocket expenditure per admission to hospital was US\$388 (95% CI 332–441) and at 12 months after injury was US\$1046 (871–1221). Mean out-of-pocket expenditure for road traffic injury cases at the time of hospitalisation was US\$400 (95% CI 344–456) and for non-road traffic injury cases was US\$369 (313–425). The prevalence of catastrophic expenditure was 30% (95% CI 26·95–33·05), which was significantly associated with lower income quartile (OR 23·3 [95% CI 5·7–93·9]; $p < 0·01$), inpatient stay greater than 7 days (OR 8·8 [95% CI 3·8–20·6]; $p < 0·01$), major surgery (OR 4·9 [95% CI 2·2–10·8]; $p < 0·01$), and occupation as wage labourers (OR 8·1 [95% CI 1·6–39·9]; $p = 0·01$).

Interpretation High private out-of-pocket expenditure for treatment of injury poses major economic burden on families. Measures aimed to increase public health spending for prevention of injury and to provide financial risk protection to those injured deserve urgent priority in India.

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Contributors

JJ and RI conceived and designed the study. SA and SP collected data. ASC and SP interpreted data. SP, ASC, and JJ wrote the Abstract. All authors approved the final version of the Abstract for publication.

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