

Surgically avertable burden of obstetric conditions in low- and middle-income regions: a modelled analysis

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Objective To quantify the burden of maternal and neonatal conditions in low- and middle-income countries (LMICs) that could be averted by full access to quality first-level obstetric surgical procedures.

Design Burden of disease and epidemiological modelling.

Setting LMICs from all global regions.

Population The entire population in 2010.

Methods We included five conditions in our analysis: maternal haemorrhage; obstructed labour; obstetric fistula; abortion¹; and neonatal encephalopathy. Demographic and epidemiological data were obtained from the Global Burden of Disease 2010 study. We split the disability-adjusted life years (DALYs) of these conditions into surgically 'avertable' and 'non-avertable' burdens. We applied the lowest age-specific fatality rates from all global regions to each LMIC region to estimate the avertable deaths, assuming that the differences of death rates between each region and the lowest rates reflect the gap in surgical care.

Main outcome measures Deaths and DALYs avertable.

Results Of the estimated 56.6 million DALYs (i.e. 56.6 million years of healthy life lost) of the selected five conditions, 21.1 million DALYs (37%) are avertable by full coverage of quality obstetric surgery in LMICs. The avertable burden in absolute term is substantial given the size of burden of these conditions in LMICs. Neonatal encephalopathy constitutes the largest portion of avertable burden (16.2 million DALYs) among the five conditions, followed by abortion (2.1 million DALYs).

Conclusions Improving access to quality surgical care at first-level hospitals could reduce a tremendous burden of maternal and neonatal conditions in LMICs.

Keywords Burden of disease, maternal conditions, neonatal conditions, surgery, obstetrics.

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Introduction

Maternal and neonatal conditions have traditionally been areas of focus in the global public health domain. Two of the eight Millennium Development Goals have been dedicated to these areas (Goal 4: reduce child mortality rates; Goal 5: improve maternal health), which is a manifestation of global commitment in addressing the health of mothers and children. The Global Burden of Disease 2010 study (GBD 2010) reported an overall decline in the burden related to maternal and neonatal conditions.¹ GBD is a

systematic and scientific effort that aims to quantify the magnitude of health loss due to diseases, injuries, and risk factors globally.² The health loss is presented in terms of disability-adjusted life years (DALYs), which combines years of life lost due to premature mortality (YLLs) and years lived with a disability (YLDs). One DALY is equivalent to a loss of year of healthy life of a person that may result from a death occurring a year earlier than the expected years of a full life, suffering from half decent health for 2 years at any time of life, or by any combinations of these two. The burden of maternal conditions

dropped from 22 million DALYs in 1990 to 16 million DALYs in 2010 (i.e. 16 million years of healthy life were lost due to maternal conditions in 2010), and that for neonatal conditions from 274 million DALYs in 1990 down to 202 million DALYs, despite population growth over the two decades.

Despite these achievements, large regional disparities remain. Maternal and neonatal conditions account for only 1% of total burden in high-income countries (HICs), whereas they account for 10% of burden in low- and middle-income countries (LMICs).¹ Since 1987, the Safe Motherhood Initiative has been instrumental in reducing the global burden of maternal morbidity and mortality, focusing on key elements such as antenatal care, obstetric care, postnatal care, and others. Although many issues of these key elements can be effectively addressed by basic obstetric care, an important proportion requires access to comprehensive emergency obstetric care, including surgery (e.g. caesarean section). Further, because many patients require immediate interventions and there is no time for patients to be transferred to secondary or tertiary-level hospitals, it is critical that first-level hospitals and rural health facilities have the capacity to address surgical emergencies.³

When the second edition of the Disease Control Priorities in Developing Countries (DCP) was published in 2006,⁴ a chapter devoted to surgery suggested it is an essential component of public health.⁵ The DCP is a multi-country collaborative project that aims to provide evidence on intervention efficacy and programme effectiveness for the leading causes of disease burden in LMICs (<http://www.dcp-3.org/>). The authors estimated that conditions amenable to surgery accounted for 11% of the global burden of diseases and injuries in 2001, of which 10% was related to obstetric and perinatal conditions (i.e. 17 million DALYs, or 1.1% of the total global burden). Our work has been conducted as part of a systematic update of the Disease Control Priorities Project. The aim of this study is to quantify the avertable burden of maternal and neonatal conditions if obstetric surgery at first-level hospitals could (hypothetically) provide full access to quality obstetric surgical care.

Methods

Selection of conditions for analysis

We examined five maternal and neonatal conditions from the GBD 2010 Study that are potentially amenable to obstetric surgery at first-level hospitals: maternal haemorrhage, obstructed labour; obstetric fistula; abortion; and neonatal encephalopathy. We recognise that abortion is a term used in various ways, but the GBD 2010 Study includes termination of pregnancy, miscarriage and ectopic pregnancies, and our analysis has followed the GBD

definition. These conditions were selected based on the recommendations from literature and surgical guidelines,^{3,6,7} consultation with experts in global surgery and obstetrics, and the existence of corresponding and established surgical procedures. First-level hospitals in this study refer to any first referral point of care where provision of a basic package of surgical services could reasonably be expected. This could be a rural district hospital or higher level hospitals. The basic surgical package considered in this analysis includes caesarean section, instrumental delivery, dilatation and curettage/evacuation, manual vacuum aspiration, salpingectomy, manual removal of placenta, repair of vaginal/perineal/cervical tears, and hysterectomy.

Approach and analysis

The base population for the analysis was all newly diagnosed cases of each condition in 2010, except obstetric fistula for which we used the prevalent cases (i.e. fistula already present) in 2010. DALY was used as the metric to quantify the burden that is avertable by surgical procedures. We obtained data from the GBD 2010 Study.¹ Key parameters used for our analysis were: population, standard life expectancy, cause-specific mortality, incidence, prevalence, duration, and disability weight^{8–10} (see Table 1). Disability weights quantify the degree of health gap of a person that take values between 0 (i.e. full health) and 1 (i.e. complete health loss, equivalent to death). In GBD 2010, data to determine the disability weights for different health states were collected through household surveys where respondents considered pairs of health states and indicated which health state they perceived as being healthier (pair-wise comparison). More details of disability weights used in GBD 2010 have been reported elsewhere.¹⁰

Our analysis was conducted by aggregating parameters from the 17 LMIC regions as defined by the GBD 2010 Study. The burden of maternal and neonatal conditions amenable to surgery was calculated assuming

Table 1. Disability weights for maternal and neonatal conditions.

Condition	Disability weight (95% uncertainty interval)
Maternal haemorrhage	0.027 (0.019–0.042)
Obstructed labour	0.326 (0.219–0.451)
Obstetric fistula	0.346 (0.232–0.479)
Abortion	0.139 (0.094–0.204) for residual urinary incontinence
Neonatal encephalopathy	Mild: 0.121 (0.083–0.176) Severe: 0.275 (0.165–0.416)

$$\text{Avertable burden} = \text{DALY} - \text{DALY}' \quad (1)$$

where DALY denotes the DALYs reported in GBD 2010, and DALY' the estimated DALYs with the delivery of surgical care in a hypothetical state of full population coverage with access to quality care. We first estimated the number of deaths for the hypothetical state. We assumed that the lowest case fatality rate (CFR) from all global regions for each of the 5-year age-groups in the GBD 2010 Study reflect the situation of a full access to high quality obstetric surgical care that can be provided at first-level hospitals (and hence the difference of those CFRs reflecting the gap in surgical care). By applying those lowest CFRs to the newly diagnosed cases for each age-group and region, we calculated the number of deaths attributable to each maternal and neonatal condition for the hypothetical state. We then multiplied those number of deaths by the age-specific standard life expectancy used in GBD 2010 to convert into YLLs for the hypothetical state.^{2,8} Although deaths may occur as a direct result of surgical trauma, they are treated separately in GBD 2010 (i.e. burden related to adverse effects of medical treatment) and so were not counted here (e.g. Schuitemaker et al.¹¹ reported that 10 and four deaths following 108 587 caesarean sections conducted between 1983 and 1992 in the Netherlands were due directly to the complications of operation and anaesthesia, respectively). Some conditions are not fully amenable to surgical care, such as maternal haemorrhage and neonatal encephalopathy, and hence required adjustments to limit the effect to surgery. We referred to the literature that examined the proportion of conditions that can be managed by surgical care and adjusted the avertable death accordingly.^{12–15}

Although scaling up surgical coverage reduces the number of deaths (and hence the YLL), the averted death cases would still be subject to some non-fatal burden (YLD), at last for a short period after onset (e.g. 5 days assumed for obstructed labour in GBD 2010). In GBD 2010, YLDs were calculated by multiplying prevalence (rather than incidence) by the corresponding disability weights. As we used the newly diagnosed (i.e. incident) cases as the base population for our analysis (except for obstetric fistula), we first multiplied the averted fatal cases by the duration to convert them to prevalent cases, and then multiplied by the disability weight of each condition as shown in Table 1 to estimate the short-term disability experienced by the averted deaths.

In GBD 2010, no deaths were reported for obstetric fistula, so we only examined the non-fatal burden. Fistula has been virtually eliminated in HICs^{16,17} and, in principle, all obstetric fistula can be prevented with comprehensive care including surgery.¹⁸ Therefore we assumed that virtually all fistula cases could be prevented if surgical care for obstructed labour (i.e. caesarean section and instrumental

delivery) reaches the entire population with access to quality care. Repair of obstetric fistula requires advanced level surgery, with 80–95% of successful closure rate, although 16–32% will suffer from persistent urinary incontinence, which we incorporated as the residual YLDs from fistula repairs.¹⁸ Surgical repair is typically provided by vertical programmes, and hence do not form part of surgical services provided at first-level hospitals. Nonetheless, the avertable burden by fistula repair was estimated separately and provided as a comparison (i.e. not included in calculating the total avertable burden). Details of methods employed for each condition are provided as per Supporting Information Appendix S1.

Disease-specific background information and analytic considerations

The burden of selected maternal and neonatal conditions in all LMICs is provided in Table 2 (the results of high-income regions were subtracted from the global estimates of GBD 2010^{1,8,9}). Maternal haemorrhage accounts for the largest fatal burden among maternal conditions. Although maternal haemorrhage can pose a medical emergency, not all cases require surgical care. We calculated that 36% of cases are amenable to surgical interventions, which may include caesarean section, manual placenta removal, hysterectomy, repair of cervical tears and others, using resource requirements for maternal conditions estimated by Johns et al. (see Appendix S1 for details).¹²

Obstructed labour is a major cause of both maternal and neonatal morbidity and mortality. Surgical interventions have the potential virtually to eliminate maternal deaths from obstructed labour as has been the case in HICs.⁸ Aside from death, one of the most severe maternal sequelae from obstructed labour is obstetric fistula, which occurs with such frequency that it contributes a significant burden over and above the mortality due to obstructed labour in LMICs (see Table 2). However, the largest portion of burden as a consequence of obstructed labour is borne by the child as neonatal encephalopathy (birth asphyxia and trauma). A case-control study conducted in Nepal identified obstructed labour as a major risk factor for neonatal encephalopathy with an odds ratio of 5.73.¹⁹ Although most of maternal burden from obstructed labour is amenable to surgical care, not all of neonatal encephalopathy burden is (e.g. those caused by infection, placental thrombosis, or other factors that take place before labour). The World Health Organization Choosing Interventions that are Cost Effective (WHO CHOICE) Project assumed that 40% risk of deaths from birth asphyxia can be averted by preventing obstructed labour.¹³ We consider both caesarean section and instrumental delivery (vacuum, forceps, etc.) as surgical procedures for obstructed labour in our analysis.

Table 2. Burden of selected maternal and neonatal conditions in low-and middle-income countries, 2010 (in thousands).

	Maternal haemorrhage	Obstructed labour	Obstetric fistula	Abortion	Neonatal encephalopathy
Death	58	11	0	37	506
YLL	3184	610	0	2099	43 547
YLD	92	34	1121	28	5915
DALY	3276	644	1121	2128	49 462

YLL, years of life lost; YLD, years lived with disability; DALY, disability-adjusted life year.

Another spectrum of maternal burden is the category that is defined in GBD as ‘abortion’. To be consistent with the burden reported in GBD we used the same definition of abortion in our analysis: the category comprises spontaneous miscarriage, ectopic pregnancy, as well as induced termination of pregnancy (TOP). An unsafe TOP is either performed by unskilled persons, including self-induced, or in an environment that does not meet minimal medical standard.²⁰ Unsafe TOP accounts for 13% of all maternal deaths globally with substantial regional variation.²⁰ In all, 20–30% of cases cause reproductive tract infections.²¹ Improving the safety of abortion, including procedures such as vacuum aspiration, dilatation and curettage, and dilatation and evacuation, is critical for reducing maternal deaths, yet poses a unique challenge in countries where such practice is not legalised. Some of these conditions, particularly induced abortion, can be managed by medical therapy as an alternative to surgery. However, evidence shows superior outcomes from surgery,²² including studies from LMICs.^{23–25} Surgical backup is crucial in case the treatment is unsuccessful. As the failure rate for medically induced abortive cases increases with gestational age, and cases treated by medication are at least equally amenable to surgical care, surgery was assumed to be the mainstay of therapy for reducing TOP-related burden. Treatment of an ectopic pregnancy in LMICs is largely surgical.

Results

Of the entire burden associated with the five maternal and neonatal conditions in LMICs, 21.1 million DALYs (37%) are avertable by scaling up obstetric surgical programmes at the first level to a hypothetical state of a full access to quality first-level obstetric surgical care. This corresponds to 0.9% of the 2.2 billion DALYs from all causes experienced by LMICs in 2010.¹ More specifically, 67 859 maternal deaths (64%) and 165 800 neonatal deaths (33%) could be averted. Table 3 and Figures 1–5 provide detailed results of avertable number of deaths, YLLs and DALYs for each condition and region. Avertable YLDs can be calculated by subtracting the avertable YLLs from the avertable DALYs (if the calculation provides a negative value,

it reflects the residual YLDs from averted deaths). More disaggregated results for the 17 LMIC regions are provided in Appendix S1. Obstructed labour, obstetric fistula and abortion have the highest proportion of avertable burden (89–100%). Maternal haemorrhage and neonatal encephalopathy have smaller proportions of avertable burden, but because of their considerable size, they account for 82% of the total avertable burden among the five conditions examined.

Sub-Saharan Africa and Asia South have the largest proportion of avertable burden overall. Eastern Europe & Central Asia and Latin America & Caribbean have much smaller portions of avertable burden, suggesting that a higher proportion of burden has already been averted through provision of surgical care.

Figures 1–5 demonstrate surgically avertable and non-avertable burden of each condition. From Figure 1, Sub-Saharan Africa and Asia South have the largest portion of avertable burden of maternal haemorrhage due to the large overall burden in these regions. Figure 5 suggests that there is considerable difference in the avertable burden of neonatal encephalopathy between regions. The burden in East Asia Pacific is largely not surgically avertable, whereas Asia South and Sub-Saharan Africa have substantial opportunities for averting the burden by surgery. Figures for deaths, YLLs and YLDs are provided in Appendix S1.

Discussion

Main findings

We estimate that 37% of the burden of maternal and neonatal conditions can be averted by universal access to quality obstetric surgery at first-level hospitals. The avertable burden in absolute terms is substantial given the size of burden of these conditions in LMICs. Although preventing a case of obstructed labour by surgery could prevent downstream health outcomes such as maternal haemorrhage, obstetric fistula and neonatal encephalopathy, the results from GBD 2010 are corrected for comorbidity and hence there is no ‘double-counting’ in aggregating the total avertable burden (refer to Vos et al. for details of comorbidity adjustment).⁹

Table 3. Avertable burden of maternal and neonatal conditions in low- and middle-income regions.

	East Europe & Central Asia	Sub-Saharan Africa	North Africa & Middle East	Asia South	East Asia Pacific	Latin America & Caribbean	LMIC total
Maternal haemorrhage (%)							
Death	63 (27)	10 228 (36)	703 (34)	6147 (33)	2424 (34)	478 (35)	20 043 (34)*
YLL	3485 (27)	577 152 (36)	39 034 (34)	346 845 (33)	132 130 (34)	26 409 (35)	1 125 055 (34)
DALY	3 485 (27)	577 146 (35)	39 034 (34)	346 842 (33)	132 128 (33)	26 409 (35)	1 125 044 (34)
Obstructed labour (%)							
Death	8 (100)	2248 (100)	59 (100)	8284 (100)	255 (100)	28 (100)	10 882 (100)
YLL	439 (100)	125 629 (100)	3230 (100)	462 404 (100)	13 637 (100)	1543 (100)	606 882 (100)
DALY	439 (81)	125 618 (94)	3230 (66)	462 367 (95)	13 636 (85)	1543 (58)	606 833 (94)
Obstetric fistula (%)							
DALY (obstetric)	1716 (100)	467 239 (100)	56 792 (100)	253 420 (100)	336 023 (100)	6156 (100)	1 121 346 (100)
DALY (repair)	1525 (89)	415 241 (89)	50 472 (89)	225 218 (89)	298 628 (89)	5471 (89)	996 555 (89)
Abortion (%)							
Death	333 (97)	16 756 (100)	364 (98)	15 179 (100)	3 440 (99)	862 (99)	36 934 (100)
YLL	18 412 (97)	953 741 (100)	20 398 (98)	863 458 (100)	189 764 (99)	48 444 (99)	2 094 217 (100)
DALY	18 411 (79)	953 725 (100)	20 397 (85)	863 443 (99)	189 761 (93)	48 443 (94)	2 094 180 (98)
Neonatal encephalopathy (%)							
Death	1475 (9)	62 271 (39)	2477 (16)	91 286 (40)	5871 (9)	2420 (10)	165 800 (33)
YLL	132 289 (9)	5 584 371 (39)	221 957 (16)	8 186 510 (40)	526 516 (9)	217 005 (10)	14 868 648 (33)
DALY	168 036 (10)	5 956 409 (39)	292 750 (18)	8 744 616 (40)	749 316 (11)	287 542 (12)	16 198 669 (33)
Total of five maternal and neonatal conditions** (%)							
Death	1879 (11)	91 503 (44)	3603 (20)	120 896 (45)	11 990 (15)	3788 (15)	233 659 (38)
YLL	154 625 (10)	7 240 893 (43)	284 619 (19)	9 859 217 (44)	862 047 (13)	293 401 (13)	18 694 802 (36)
DALY	192 087 (12)	8 080 137 (44)	412 203 (22)	10 670 688 (44)	1 420 864 (18)	370 093 (15)	21 146 072 (37)

*Percentages in parentheses reflect the avertable proportions of burden from GBD.

**The total avertable burden does not include burden of obstetric fistula avertable by repair.

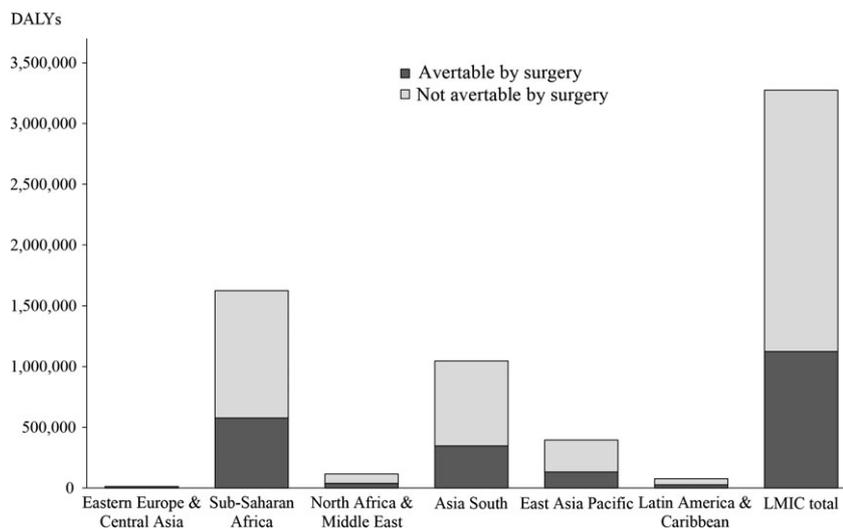


Figure 1. Surgically avertable burden of maternal haemorrhage in six LMIC regions.

There is a substantial difference in the proportion of surgically avertable burden between regions and conditions that warrants further discussions. Sub-Saharan Africa and

Asia South have the largest opportunity to reduce burden of maternal haemorrhage. However, the non-avertable burden remains large, suggesting that, in addition to surgery, a

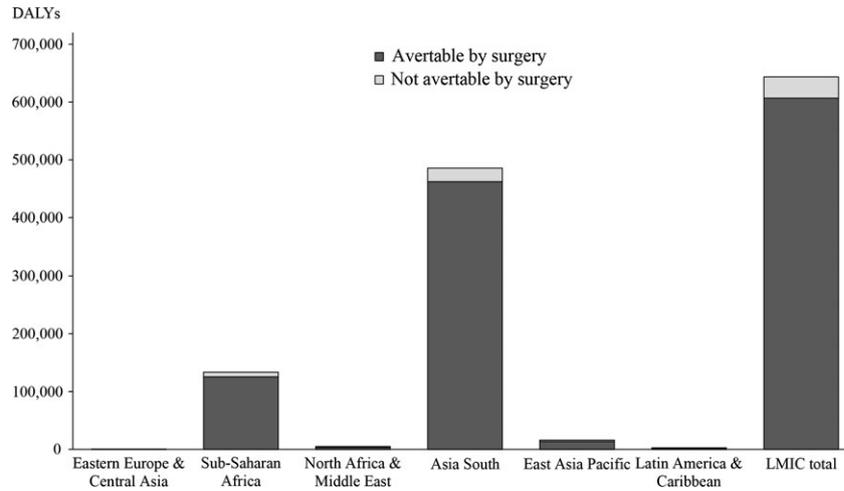


Figure 2. Surgically avertable burden of obstructed labour in six LMIC regions.

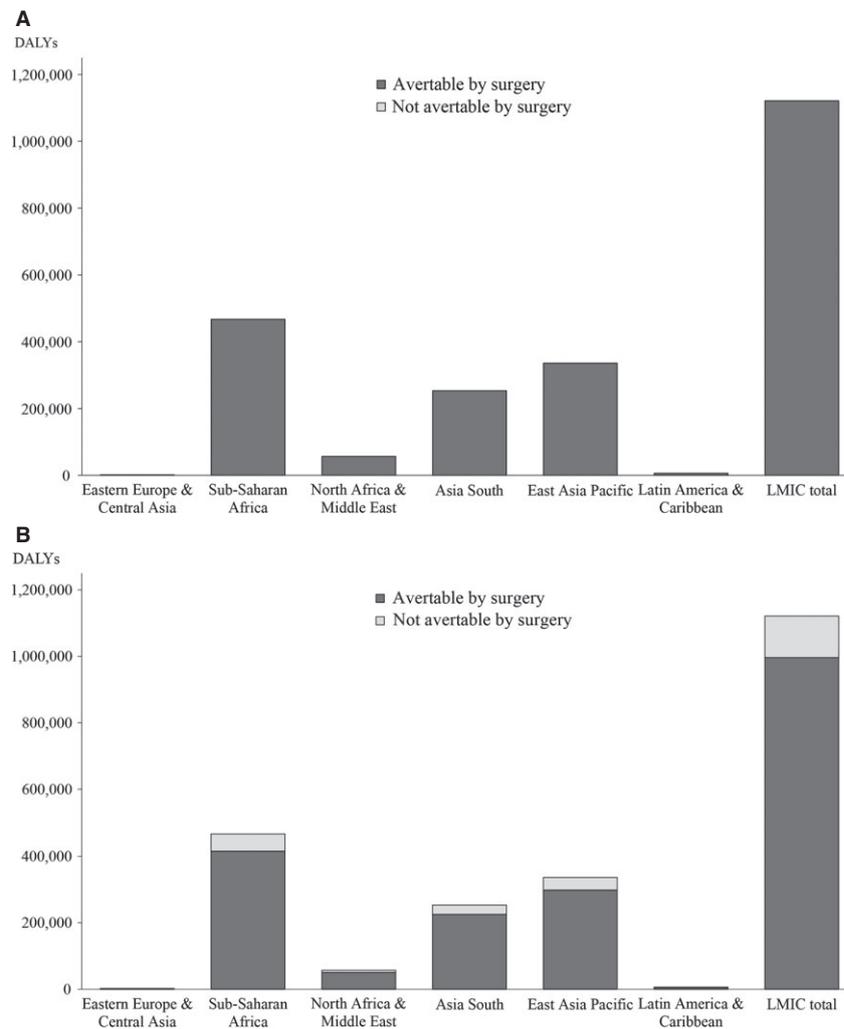


Figure 3. Surgically avertable burden of obstetric fistula in six LMIC regions (A: assisted birth by caesarean section or instrumental delivery; B: repair).

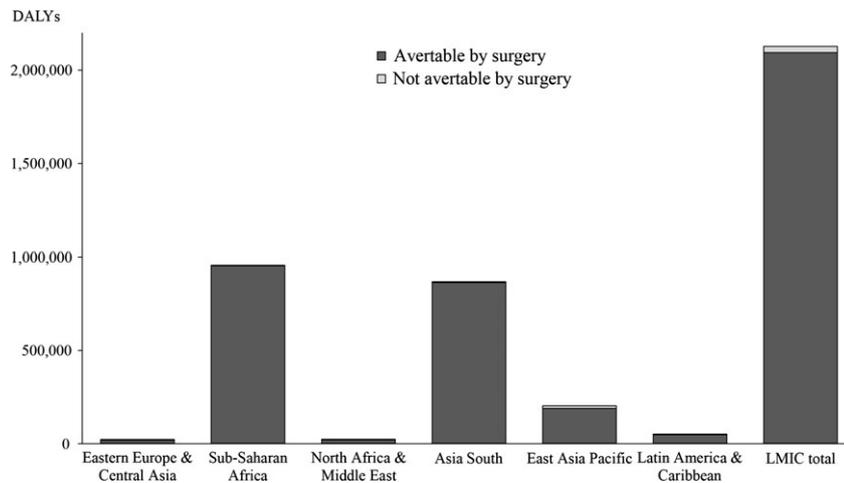


Figure 4. Surgically avertable burden of abortion in six LMIC regions.

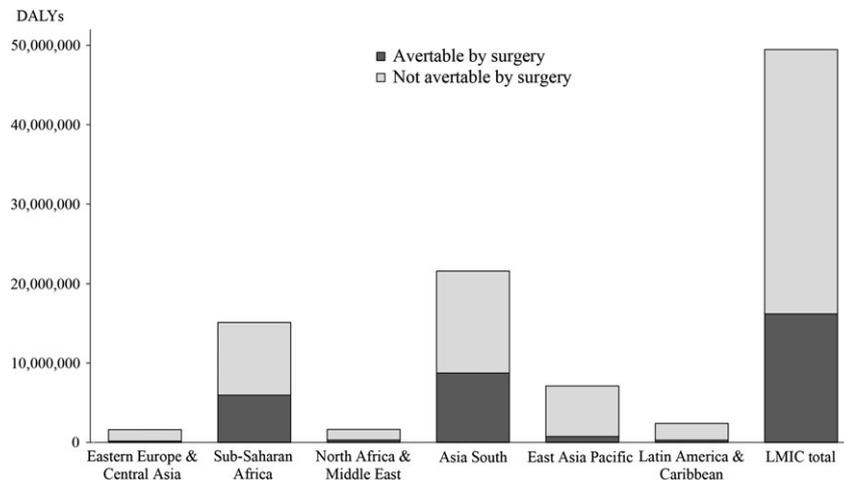


Figure 5. Surgically avertable burden of neonatal encephalopathy in six LMIC regions.

major investment is needed in strengthening obstetric care more generally. Neonatal encephalopathy is another condition that requires a wider approach in reducing the burden, although this varies between regions. East Asia Pacific in particular has little opportunity to reduce the burden, which implies a good coverage of obstetric surgery as of 2010. In contrast, Asia South and Sub-Saharan Africa would benefit considerably from investment in first-level surgical care. Obstructed labour, obstetric fistula and abortion can be largely addressed by appropriate surgical care. These are the areas where investment in surgery could result in rapid health gains, particularly in Asia South, Sub-Saharan Africa and East Asia Pacific.

Strengths and limitations

As has been mentioned in Methods section, the approach we employed relied on a number of assumptions that

are potential limitations of this study. The critical assumption we made was that the lowest fatality rates from all GBD regions reflect the hypothetical state assumed by 100% surgical coverage with access to quality care at first level. Not surprisingly, most of the lowest figures were from HIC regions. However, whether those data are applicable to LMIC contexts remains questionable. Even if barriers to access to quality emergency obstetric care were removed both physically and financially, legal and cultural constraints vary substantially between regions, patterns of comorbidity are heterogeneous between populations, and delays in presentation may be common due to long travel distance and poor road conditions, all of which affect health outcomes. Such factors can lead to biased estimation of the avertable burden. For maternal haemorrhage and neonatal encephalopathy, the extent of burden that is amenable to

surgery was estimated by relying on a small number of studies. Given that these two conditions constitute the largest portion of burden of the five analysed, these estimates are less robust. We performed a sensitivity analysis on these conditions by varying the critical parameters by $\pm 25\%$ to examine the overall impact on the results (see Appendix S1). The avertable burden ranges from 16.8 million DALYs (30% avertable) to 25.4 million DALYs (45% avertable). These correspond to 0.76–1.15% of the 2.2 billion DALYs from all causes experienced by LMICs in 2010.

Interpretations

The only study that has systematically quantified the surgically avertable burden of maternal and neonatal conditions in LMICs is DCP2.⁴ That study reported the burden of maternal and neonatal conditions amenable by surgery as 1.1% of the total burden from all causes. Our estimate of 0.9% (21.1 million avertable DALYs over 2.2 billion total DALYs in LMICs) is smaller and not directly comparable due to substantial methodological differences. The analytic approach employed for DCP2 was not data-driven and relied on pooled opinions of a limited number of experts in terms of condition-specific proportions of burden amenable to surgery. Nonetheless, both studies suggest that around 1% of total burden in LMICs from all causes can be potentially averted by investing in obstetric surgical care at first-level hospitals.

Scaling up obstetric surgeries in low-resource settings will be a challenge. Training of obstetricians is expensive and time-consuming and, once qualified, many practitioners tend to prefer working in urban hospitals rather than hospitals in rural areas. Nonetheless, some countries, such as Burkina Faso, have successfully trained general practitioners to provide emergency obstetric care.²⁶ Other countries have introduced a nonphysician cadre to perform emergency obstetric care in first-level hospitals.²⁷ Five countries in Sub-Saharan Africa have authorised such nonphysicians to perform obstetric operations: Ethiopia, Ghana, Malawi, Mozambique, and Tanzania.²⁸ Several postoperative outcome comparisons of caesarean sections performed by physicians versus nonphysicians did not reveal significant differences between the two,^{28–30} suggesting such trained nonphysician clinicians to be a reasonable alternative for performing obstetric procedures at first-level hospitals. Similar initiatives have been underway in other countries, including Senegal, Niger, Burkina Faso, and Sudan.^{31,32} Given that the greatest burden of obstetric and neonatal conditions is borne by those countries where adequate human resources are least available (e.g. obstetricians), obstetric care should, and is able to, expand its service delivery by exploiting available resources that have not been traditionally considered.

Conclusion

There is a tremendous potential for first-level obstetric surgical care to avert maternal and neonatal burden in LMICs. Scaling up surgical capacity in rural districts should thus be highly prioritised. Given the critical shortage of qualified obstetricians in many parts of the world, particularly in remote district hospitals, investment may be directed towards training general practitioners or nonphysicians to fill the gap, as has been successful in a number of countries.

Disclosure of interests

The authors declare that they have no conflicts of interest.

Contribution to authorship

HH participated in conceptualising and designing the study, performed primary analyses, and drafted the initial manuscript. JJB and TV participated in conceptualising and designing the study, provided analytical expertise, and critically reviewed the manuscript. NJK, TGW and SWB participated in conceptualising and designing the study, provided technical expertise of surgery, and critically reviewed the manuscript. All authors approved the final manuscript as submitted.

Details of ethics approval

This study does not involve human subjects, and therefore ethics approval was not required.

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Appendix S1. Detailed approaches and results. ■

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Is the enabling environment ready to address the surgically avertable burden of obstetric conditions in low- and middle-income regions?

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Millennium Development Goals 4 and 5 challenged low- and middle-income countries (LMICs) to vastly improve the access to and quality of maternal and newborn health care to reduce maternal and child mortality. Within months of the deadline for these goals, achievements vary widely with the maternal health goal being the most elusive. Hideki Higashi and colleagues examined four maternal and one newborn outcome avertable by access to emergency obstetric surgery, and determined from the Global Burden of Disease (GBD) database that 37% of maternal and perinatal deaths and newborn morbidity could be prevented by universal access to obstetric surgery. This will provide a useful guide as the package of interventions to further improve maternal and perinatal outcomes in the post-2015 agenda is being developed. The regions with the greatest global burden of maternal death, sub-Saharan African (62%) and Southern Asia (24%), should benefit the most.¹

Recognising the dearth of data from the countries most in need, they used the risk in high-income countries as their baseline of what is possible. This may be setting the bar too high. Over the medium term it

may have been more realistic to use the situation among upper middle-income countries as a more appropriate index of potentially feasible goals. Such countries have the advantage of vital registration systems, which produce acceptable mortality data for monitoring impact.

Given the model outlined, and existing evidence, a cost-effective strategy for first-line district hospitals could be to train interested general practitioners to manage the most common surgical emergencies, including obstetric interventions (Hounton et al. *Human Resources for Health* 2009;7:34). Appropriate retention incentives (Gosselin et al. *World J Surg* 2011; 35:258–61) alongside inbuilt redundancy are needed to avoid high attrition and collapse of services if a team member is away for any reason (De Brouwere et al. *Reprod Health Matters* 2009;17:32–44). I will ignore the need to address the legal status of abortion in many of these countries.

Averting maternal or neonatal morbidity or mortality among mothers requiring caesarean section or instrumental delivery, however, depends on their early identification (Ellis et al. *BMJ* 2000;320:1229–36) and timely access to care. Quality intrapartum care will be critical to the

effectiveness of an adequately staffed surgical service, whether run by assistant medical officers (McCord et al. *Health Affairs* 2009;28:w876–85) or surgically trained general practitioners. The facilities will need well-maintained basic equipment, including diagnostic capability, consistent supplies, and reliable water and electricity. Although task-shifting is a laudable goal, politicians must support such strategies with resources to upgrade and maintain these rural hospitals. In 2007 Johns et al. (*Bull WHO* 2007;85:256–63) estimated that the 75 countries most in need would require a minimum of \$39 billion to provide comprehensive care from pregnancy through to the postnatal period. The prediction of what needs to be done must give way to harnessing the resources to implement these recommendations, or papers such as this will remain mere academic exercises.

Disclosure of interests

The author has no conflicts of interest to declare.

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