



Sex Disparities in the Global Burden of Surgical Disease

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Published online: 18 March 2020
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The 2015 Lancet Commission on Global Surgery and 2015 Global Burden of Disease study provide evidence for the increasing relative burden of noncommunicable diseases in low- and middle-income countries (LMICs), including surgical conditions such as injuries, gastrointestinal diseases, and cancer [1, 2]. While many of these conditions affect both men and women, women bear a large burden of sex-specific surgical disease.

We analyzed the 2015 Global Burden of Disease study [2] and isolated sex-specific surgical conditions. We define sex-specific conditions here in biological terms, as diseases that exclusively affect individuals with either male or female sex-specific organs, and use the term “sex” to refer to biological definitions rather than “gender.” Maternal physiologic disorders that are either surgically treated or require the expertise of a surgically trained provider were included, such as hemorrhage, hypertensive disorders and eclampsia, obstructed labor, uterine rupture, fistula, abortion, miscarriage, and ectopic pregnancy, but not maternal sepsis. Pathogenic conditions including female-specific cancers, uterine fibroids, endometriosis, and genital

prolapse were included. Male-specific surgical pathogenic conditions such as prostate and testicular cancer, as well as benign prostatic hyperplasia were included (Table 1). These data demonstrate that comparing potentially fatal sex-specific surgical diseases has a female:male prevalence ratio of 38,038,200:15,120,200 or approximately 2.5:1 (Fig. 1). The addition of surgical disease that leads to morbidity or disability increases the female:male ratio of overall prevalence of surgical conditions to 361,590,500:119,745,500 or approximately 3:1 (Fig. 2).

We compared the disability-adjusted life years (DALYs) caused by these disorders using the WHO’s DALY estimates for cancers for 2016 [3]. These estimates were not available for the surgery-specific maternal disorders and those diseases causing morbidity only; we used the Global Burden of Disease compare tool for these in 2015 [4]. Using these estimates of DALYs caused by surgical disease, the female:male ratio is 5.2 (Fig. 3). While there are certain other surgical conditions that affect men at higher rates—particularly trauma—these data demonstrate that for the sex-specific surgically treatable conditions recognized by the Global Burden of Disease study, women bear a hugely disproportionate burden.

The consequences of this burden are far-reaching. Obstetric complications and cervical cancer affect women during their reproductive years, when they are securing a future for their families and providing care for vulnerable infants and children. The resulting losses have crosscutting consequences, including financial instability, increased mortality rates for her children, loss of education, and difficulty managing the household [5]. On top of this, societal-level norms create barriers in access to care for women, which have been documented in country-level and region-level studies, such as education level, decision-making autonomy, cultural expectations, and employment.

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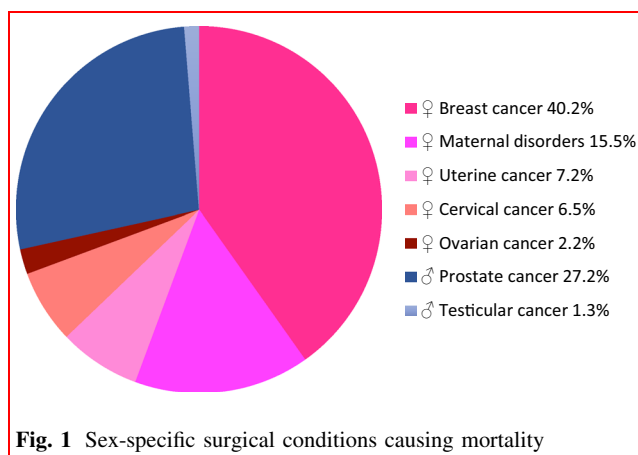
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Table 1 All sex-specific surgical conditions

	Prevalence (thousands)	% of all sex-specific surgical conditions causing mortality (out of 53,158.4)	% of all sex-specific surgical conditions (out of 481,336)	DALYs (thousands)
Maternal disorders (not including sepsis)	8232.1	15.5%	1.7%	7129
<i>Female-specific cancers</i>				
Breast cancer	21,361.8	40.2%	4.4%	18,958
Cervical cancer	3442.4	6.5%	0.7%	9654
Uterine cancer	3827.7	7.2%	0.8%	2479
Ovarian cancer	1174.2	2.2%	0.2%	5066
	29,806.1	38,038.2	29,806.1	36,157
<i>Female-specific surgical diseases</i>				
Uterine fibroids	151,115		31.4%	1550
Endometriosis	10,758.2		2.2%	4086
Genital prolapse	161,679.1		33.6%	341
	323,552.3		353,358.4	5977
			361,590.5	49,263
<i>Male-specific cancers</i>				
Prostate cancer	14,434.4	27.2%	3.0%	6452
Testicular cancer	685.8	1.3%	0.1%	647
	15,120.2	15,120.2	15,120.2	7099
<i>Male-specific surgical diseases</i>				
Benign prostatic hyperplasia	104,625.3		21.7%	2298
	104,625.3		119,745.5	9397
Total		53,158.4	481,336	58,660
Female:male ratio		2.52	3.02	5.2



Despite this huge disparity in sex-specific surgical burden of disease, evidence shows an inequitable distribution of access to surgical care for women, particularly in low-resource settings [6]. The third edition of Disease Control

Priorities recognized that after injuries, maternal–neonatal conditions are the second most common cause of surgically preventable deaths, responsible for 233,658 deaths per year [7]. Obstetric conditions, including maternal hemorrhage, obstructed labor, obstetric fistula, abortion, and neonatal encephalopathy, cause an estimated 56.6 million DALYs in LMICs, 37% of which would potentially be avertable by availability of quality surgical provision [8]. Breast cancer, which is estimated at 2,088,849 new cases a year, occurs in women in 99% of cases and is nearly as common as lung cancer, which is estimated at 2,093,876 new cases per year [9]. Along with cervical cancer, these diseases have become detectable earlier and are largely treatable in high-income countries (HICs), whereas they kill three times as many women as pregnancy and childbirth complications each year in LMICs, even in countries with high maternal mortality rates [10].

Primary prevention and secondary prevention of sex-specific diseases have the potential to play an important role in reducing this disparity in surgical demand; however,

Fig. 2 All sex-specific surgical conditions causing morbidity

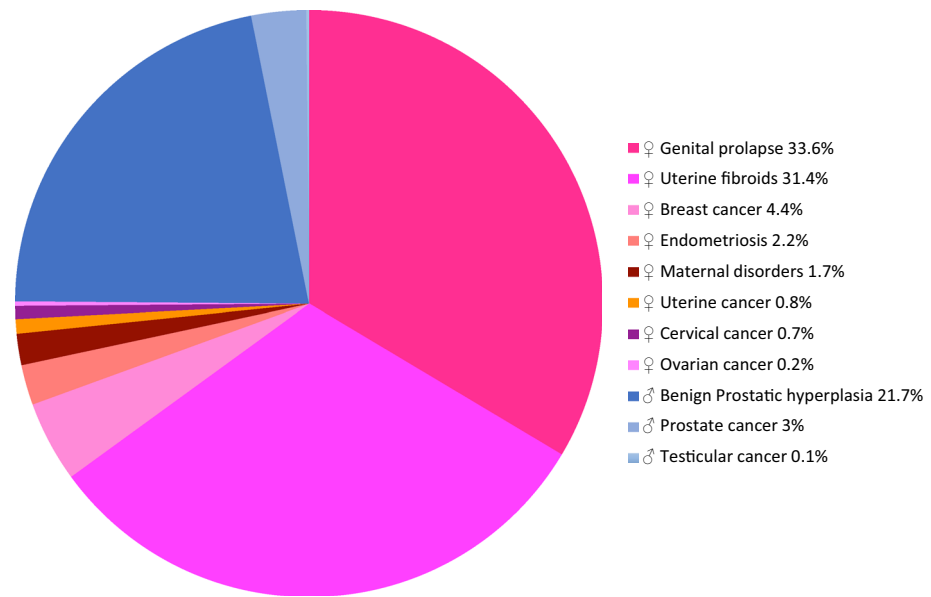
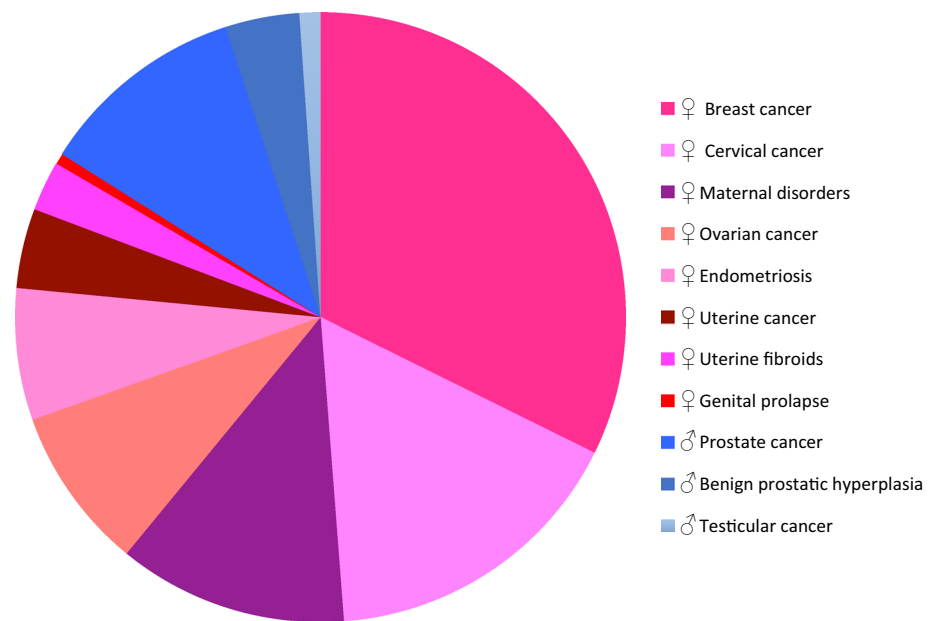


Fig. 3 DALYs caused by sex-specific disorders



prevention has proven challenging to implement. Quality antenatal care mitigates the development of complications in pregnancy, but just half of pregnant women in LMICs attend the World Health Organization (WHO) minimum recommended four visits during pregnancy [11]. Likewise, prevention and early detection are cornerstones in cancer control efforts, but mammographic screening availability is so low in LMICs that the WHO encourages focusing on breast self-exams and early diagnosis of symptomatic lesions rather than routine screening programs [12]. Efforts

in LMICs to expand access to cervical cancer screening methods that are feasible but which have not been shown to reduce morbidity and mortality have resulted in limited impact on the disease [13]. This is compounded by the limited reach of the human papilloma virus vaccination to an estimated 0.5% of all women in LMICs [14]. Improving universal healthcare coverage and community-based health care for early detection and appropriate referral of cases may be of utility in primary and secondary prevention efforts.

To address the existing surgical disease burden in LMICs, an estimated 1.27 million new providers of surgical, anesthetic, and obstetric care are needed [1]. To address the burden of surgical disease that disproportionately affects women, fostering interest among medical students in specialization in surgical fields that will address female-specific surgical disease including obstetrics and gynecology and surgery is essential. Supporting trainees through mentoring and modeling sustainable careers will, in turn, address the higher burden of surgical disease that is borne by women.

Parallel to the sex disparity in surgical disease globally, there is a need to address gender disparity of trainees in surgical specialties. (Here, we use the term “gender” to refer to gender identity rather than biological sex.) In high-income countries, there has been a gender revolution in medicine, and some countries have achieved gender parity in medical student enrollment as early as 2004 [15]. There are limited data regarding the overall gender ratios in LMICs, but anecdotal reports show that despite enrollment in some medical schools reaching 45–50% female, the rate of graduating females is very well below 30%. Unpublished graduate data from College of Surgeons of East, Central, and Southern Africa (COSECSA) indicate 16% enrollment and 14% graduation record of females. It would be worthwhile to clearly identify the proportion of women entering and graduating from medical schools in various LMIC regions.

There are a number of strategies that have been helpful in high income settings for recruiting women to medicine that could be employed in LMICs. Early recognition of the gender disparity and initiation of supportive policies, enrollment quotas or enrollment gender parity, scholarships and fellowships for women, gender parity in advanced training positions, equitable pay structure, improved maternity leave, and appointment of proportionate females in leadership roles are all important considerations in recruiting and retaining female surgeons and OB/GYNs. Surgical societies such as COSECSA Women in Surgery Africa, scientific conferences, deliberate mentorship, peer role modeling, as well as virtual mentorship from international colleagues, may help provide continuing education and support for these women. In turn, we propose that the greater number of female practitioners may contribute to improving the burden of surgical disease borne by women, because female medical students often, but not always, exhibit preferences toward specialization in OB/GYN [16]. Studies in some LMICs also indicate that there is a strong patient preference for a female gynecologists and obstetricians [17, 18].

There are challenges, including lack of female leadership and mentorship in surgical specialties, and barriers that a lifestyle in surgery uniquely presents to women [19].

There is also a lack of sufficient schools, training positions, and programs in surgical specialties in LMICs. Technology and innovation may contribute to these solutions by linking people and ideas across borders and institutions to address these gaps, but governments and Ministries of Health can commit to more gender equity in training surgeons in the existing positions. Both women and men should be involved in the advocacy and mentorship of female trainees to help address the disparity in disease. Examining some of the successful models of support for recruiting and retaining women in surgical careers may prompt a more serious conversation about context-adapted strategies to augment female human resource capacity in LMICs. This may be one critical step to address the sex disparities in the surgical burden of disease, so that women will no longer need to bear three times the prevalence and over five times the DALYs of surgical disease.

Compliance with ethical standards

Conflict of interest Drs. Chao, Luckett, Bekele, and Powell have nothing to disclose.

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