

Surgical skills needed for humanitarian missions in resource-limited settings: Common operative procedures performed at Médecins Sans Frontières facilities

Evan G. Wong, MD,^{a,b,c} Miguel Trelles, MD, MPH, PhD,^d Lynette Dominguez, MD,^d Shailvi Gupta, MD,^{b,c,e} Gilbert Burnham, MD, PhD,^b and Adam L. Kushner, MD, MPH,^{b,c,f}
 Montreal, Canada, Baltimore, MD, New York, NY, Brussels, Belgium, and Oakland, CA

Background. Surgeons in high-income countries increasingly are expressing interest in global surgery and participating in humanitarian missions. Knowledge of the surgical skills required to adequately respond to humanitarian emergencies is essential to prepare such surgeons and plan for interventions.

Methods. A retrospective review of all surgical procedures performed at Médecins Sans Frontières Brussels facilities from June 2008 to December 2012 was performed. Individual data points included country of project; patient age and sex; and surgical indication and surgical procedure.

Results. Between June 2008 and December 2012, a total of 93,385 procedures were performed on 83,911 patients in 21 different countries. The most common surgical indication was for fetal-maternal pathologies, accounting for 25,548 of 65,373 (39.1%) of all cases. The most common procedure was a Cesarean delivery, accounting for a total of 24,182 or 25.9% of all procedures. Herniorrhaphies (9,873/93,385, 10.6%) and minor surgeries (11,332/93,385, 12.1%), including wound debridement, abscess drainage and circumcision, were also common.

Conclusion. A basic skill set that includes the ability to provide surgical care for a wide variety of surgical morbidities is urgently needed to cope with the surgical need of humanitarian emergencies. This review of Médecins Sans Frontières's operative procedures provides valuable insight into the types of operations with which an aspiring volunteer surgeon should be familiar. (Surgery 2014;■:■-■.)

From the Centre for Global Surgery,^a McGill University Health Centre, Montreal, QC, Canada; Department of International Health,^b Johns Hopkins Bloomberg School of Public Health, Baltimore, MD; Surgeons OverSeas (SOS),^c New York, NY; Surgery, Anesthesia, Gynecology, and Emergency Medicine Unit,^d Médecins Sans Frontières, Brussels, Belgium; Department of Surgery,^e University of California San Francisco-East Bay, Oakland, CA; and Department of Surgery,^f Columbia University, New York, NY

SURGEONS IN HIGH-INCOME COUNTRIES are increasingly expressing interest in global surgery and humanitarian missions. The desire to pursue international volunteerism as well as the benefits for surgical trainees is well documented.^{1,2} However, documentation regarding the scope of which surgical procedures are performed in resource-limited settings remains mostly anecdotal.³⁻¹³ Knowledge of the surgical skills required to adequately respond to a

humanitarian emergency is essential to educate potential volunteers and plan for interventions.

Médecins Sans Frontières (MSF), also known globally by their English name Doctors Without Borders, is an international medical humanitarian organization that “delivers emergency aid to people affected by armed conflict, epidemics, natural disasters and exclusion from healthcare [...] irrespective of race, religion, gender or political affiliation.”¹⁴ MSF has provided surgical care for more than 40 years and currently has projects in more than seventy countries.¹⁵ MSF is divided into five operational centers, each capable of providing surgical care. One of these operational centers is MSF-Brussels (MSF-OCB).

The aim of this study was to review the surgical procedures performed at MSF-OCB facilities

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Reprint requests: Evan G. Wong, MD, Department of Surgery, McGill University, 1650 Cedar Avenue, L9 411, Montreal, QC, Canada H3G 1A4. E-mail: evan.wong@mail.mcgill.ca.

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between 2008 and 2012 to ascertain the most commonly performed operations. Understanding the types of procedures most commonly performed can identify the surgical skills necessary to becoming proficient in a humanitarian or resource-limited setting and allow for better planning of surgical programs.

METHODS

Data collection. Operative cases are performed at a number of MSF-OCB projects around the world. Data on all operative procedures performed in an operating theater are recorded using a standardized Patient Surgical Record Template developed by MSF in response to operational research needs. The data are recorded in a logbook, which is transcribed monthly into an electronic database (Excel; Microsoft, Redmond, WA). These data are then transmitted to a central location at MSF-OCB headquarters in Brussels. Upon receipt in Brussels, all data are reviewed for completeness and accuracy by the head of the Surgical, Anesthesia, Gynecology and Emergency Medicine unit (M.T.). Any question or discrepancies with the data are immediately followed up by contacting the program personnel who entered the data.

For this study, data from June 2008 to December 2012 were combined into a single file and analyzed with descriptive statistics. This timeframe was selected as better recording mechanisms were developed in June 2008 and data on individual procedures were available. Individual data points for this study included: country of project; patient age and sex; and surgical indication and surgical procedure.

Surgical indications were classified as trauma, nontrauma pathology, and obstetrical. These were further subdivided into violence, accidents, infection or ischemia, tumor, hemorrhage, fetal-maternal, postpartum, and other (Appendix 1). Surgical procedures were classified as minor, wound-related, visceral, orthopedic, gynecology and obstetric (with urology), and specialized surgery. These categories were subdivided into more specific types of procedures (Appendix 2).

Ethical approval. As a retrospective review, this study satisfied the criteria for ethics exemption from the MSF Ethical Review Board. Institutional Review Board approval was obtained from the Johns Hopkins School of Public Health.

RESULTS

Between June 2008 and December 2012, a total of 93,385 procedures were performed on 83,911 patients in 21 different countries (Table I). The

Table I. Countries in which MSF missions provided surgical care between 2008 and 2012

Africa
Burundi
Central African Republic
Chad
Cote d'Ivoire
Democratic Republic of Congo
Kenya
Lesotho
Libya
Mali
Niger
Sierra Leone
Somalia
Sudan
South Sudan
Americas
Haiti
Asia
Afghanistan
India
Indonesia
Iraq
Pakistan
Syria

demographic breakdown was as follows: 35,336 male (42.1%) and 48,575 female (57.9%) patients with an average age of 28.4 years. The age breakdown included 845 (1.0%) younger than 1 year of age; 4,098 (4.9%) between 1 and 5 years of age; 13,126 (15.8%) between 5 and 18 years of age; and 64,985 (78.3%) patients 18 years of age and older.

Indications for surgery were only recorded for a patient's first surgical procedure, and 4,365 procedures did not have an indication recorded. Therefore, a total of 65,373 indications were noted. Of these, 28,117 of 65,373 (43.0%) were linked to obstetrical pathologies and 23,026 of 65,373 (35.2%) were trauma-related. The most common surgical indication was for fetal-maternal pathologies, including all obstetrical indications other than postpartum complications, accounting for 25,548 of 65,373 (39.1%) of all cases (Table II).

For all surgical procedures, 35,476 of 93,385 (38.0%) were related to obstetrics and gynecology; 21,206 of 93,385 (22.7%) were visceral (or general surgery) procedures and 6,932 of 93,385 (7.4%) were orthopedic. Only 954 of 93,385 (1.0%) were procedures related to surgical subspecialties, such as neurosurgery, plastic surgery and ophthalmology.

Overall, the most common procedure was a Cesarean delivery; a total of 24,182 were performed

Table II. List of most common surgical indications for operations at MSF facilities between 2008 and 2012

<i>Indications</i>	<i>Number of procedures (%)</i>
Fetal-maternal	25,548 (39.1)
Abscess	9,916 (15.2)
Trauma other (disasters, foreign body)	7,414 (11.3)
Motor vehicle collision	5,581 (8.5)
Gunshot	5,321 (8.1)
Burns	3,314 (5.1)
Obstetrical hemorrhage	2,569 (3.9)
Benign tumor	2,089 (3.2)
Bomb injury	820 (1.3)
Tumor (not classified)	613 (0.9)

Table III. List of procedures covering 95% of all surgical procedures at MSF facilities between 2008 and 2012

<i>Procedures</i>	<i>Number of procedures performed (%)</i>
Cesarean delivery	24,182 (25.9)
Wound debridement, abscess drainage, circumcision	11,332 (12.1)
Herniorrhaphy, other anogenital	9,873 (10.6)
Fasciotomy, amputation of fingers or toes	8,566 (9.2)
Drain insertion, chest tube insertion, dressing change	5,094 (5.5)
Bowel resection	4,949 (5.3)
Minor tumor resection	3,316 (3.6)
Complex delivery, episiotomy, or perineal laceration repair	3,002 (3.2)
Fracture reduction	2,945 (3.2)
Exploratory laparotomy	2,498 (2.7)
Curettage	2,462 (2.6)
Dressing change (burns)	2,329 (2.5)
Hysterectomy, oophorectomy, pelvic tumorectomy	2,228 (2.4)
Obstetrical fistula repair*	1,585 (1.7)
Urological procedures	1,354 (1.5)
External fixation of fracture	974 (1.0)
Limb amputation	841 (0.9)
Internal fixation of fracture*	803 (0.9)
Skin/muscle graft	789 (0.8)

*These procedures were exclusively performed by subspecialists and should not be expected of general surgeons.

in this time period, representing 25.9% of all procedures (Table III). Herniorrhaphies (9,873/93,385, 10.6%) and minor surgeries (11,332/93,385, 12.1%) including wound debridement, abscess drainage and circumcision were also common. Procedures related to surgical subspecialties were

least prevalent, including neurosurgery (14/93,385, 0.01%), maxillofacial surgery (33/93,385, 0.04%), ophthalmological surgery (170/93,385, 0.18%), plastic surgery (210/93,385, 0.22%), and otolaryngological surgery (284/93,385, 0.30%).

More specifically, the most commonly performed obstetric, gynecologic, and urologic procedures are detailed in Table IV. Cesarean deliveries constituted 24,182 of 35,476 (68.2%) of all interventions performed in this category. Complications of pregnancy, such as episiotomy and perineal laceration repair (3,002/35,476, 8.5%), hysterectomy, oophorectomy or pelvic tumorectomy (2,228/35,476, 6.3%), and curettage (2,462/35,476, 6.9%) were most common. Of note, urologic procedures constituted 1,354 of 35,476 (3.8%) of all interventions of these subspecialties.

The most commonly performed general surgical procedures are in Table V. Hernia repairs were the most common general surgical intervention, accounting for 9,873 of 21,206 (46.6%) of procedures in this category. Bowel resection (4,949/21,206, 23.3%) was also common.

The most commonly performed orthopedic procedures are listed in Table VI. The most prevalent operation was fracture reduction (2,945/6,932, 42.5%). External and internal fixation accounted for 974/6,932 (14.1%) and 803/6,932 (11.6%) of all orthopedic procedures, respectively.

DISCUSSION

The disproportionate lack of surgical care in developing countries has been well documented. Of an estimated annual global volume of 234 million operations, only 8.1 million (3.5%) are performed in countries with per capita health expenditures of less than US\$ 100 per year.¹⁶ The unmet surgical burden of disease in these settings has also been addressed. For example, an estimated 25% of respondents of a countrywide community survey in Sierra Leone reported having a condition requiring surgical attention, and approximately 25% of household deaths in the previous year may have been averted by proper surgical interventions.¹⁷

The majority of humanitarian missions occur in areas of conflict and in tropical regions prone to natural disasters.^{9,18} Limited baseline surgical capabilities in these resource-limited settings compound the impact of such events. Ideally, elevating baseline surgical capacity in these countries would lessen the initial impact on the health care systems and facilitate the transition of care from relief agencies to local health systems during the chronic phases of a disaster response. Nevertheless, until surgical capacity is significantly

Table IV. List of most commonly performed obstetric, gynecologic, and urologic (Ob/Gyn/Uro) procedures at MSF facilities between 2008 and 2012

<i>Procedures</i>	<i>Number of Ob/Gyn/Uro procedures performed (%)</i>
Cesarean delivery	24,182 (64.8)
Complex delivery, episiotomy or perineal laceration repair	3,002 (8.5)
Curettage	2,462 (6.9)
Hysterectomy, oophorectomy, pelvic tumorectomy	2,228 (6.3)
Obstetrical fistula repair	1,585 (4.5)
Urological procedures	1,354 (3.8)
Ectopic pregnancy	663 (1.9)

Table V. List of most commonly performed visceral surgical procedures at MSF facilities between 2008 and 2012

<i>Procedures</i>	<i>Number of visceral surgical procedures performed (%)</i>
Hernia, other anogenital	9,873 (46.6)
Bowel resection	4,949 (23.3)
Minor tumor resection	3,316 (15.6)
Exploratory laparotomy	2,498 (11.8)
Repair or resection of spleen, liver, kidney	570 (2.7)

augmented in these settings, the surge capacity provided by organizations such as MSF will be necessary.

This study offers one of the largest reviews of surgical procedures performed in the specific setting common for humanitarian assistance missions. It provides an estimate of the scope of interventions being performed across a broad range of relief environments and therefore a snapshot of the skill set required to be an effective resource in these settings. The most striking result is the diversity of procedures being performed in this environment.

Versatility and the ability to adapt to different situations are invaluable for surgeons wishing to participate in a humanitarian mission or a resource-limited setting. The distinction between general surgeons, trauma surgeons, obstetricians and gynecologists, and orthopedists frequently becomes blurred in these settings because of a lack of specialized personnel. Moreover, an

Table VI. List of most commonly performed orthopedic procedures at MSF facilities between 2008 and 2012

<i>Procedures</i>	<i>Number of orthopedic procedures performed (%)</i>
Fracture reduction	2,945 (42.5)
External fixation	974 (14.1)
Limb amputation	841 (12.1)
Internal fixation	803 (11.6)
Other (corrective procedure)	624 (9.0)
Internal fixation removal	464 (6.7)
Curettage for osteomyelitis	193 (2.8)
Joint procedure	35 (0.5)
Bone graft	35 (0.5)
Nerve repair	18 (0.3)

important proportion of patients in this review were younger than 18 years of age. The aspiring humanitarian surgeon must consequently be familiar with the management of pediatric patients and be comfortable with performing common pediatric surgical procedures.

Therefore, individuals wishing to pursue a position with organizations such as MSF should explore opportunities to hone their skills to be comfortable and competent in a range of subspecialties. For example, a general surgeon should consider pursuing clinical experience under the mentorship of an obstetrician to acquire competency in Cesarean deliveries and complicated deliveries or with an orthopedic surgeon to gain experience in fracture reduction and external fixation. Gaining experience operating with a specialized pediatric surgeon would also be beneficial. However, given the logistical difficulties and possible medicolegal consequences involved, aspiring surgeons may choose to pursue organized additional training. More specifically, based on the findings of this study, any individual wishing to operate in this setting should be comfortable performing most of the procedures listed in [Table III](#).

This study also has important implications for program planning. Given the large spectrum of interventions being performed in this setting, the choice of personnel must be planned accordingly, either by selecting individuals with complimentary skill sets or by recruiting versatile surgeons who have acquired the ability to perform a wide range of interventions. The scope of the needs also extends beyond the realm of surgery. For example, the prominence of fetal-maternal pathologies provides further evidence of the importance of women's reproductive health in humanitarian emergencies and shows the need for coordination

with colleagues in this field. Furthermore, this study also has important repercussions in terms of supplies and equipment. For example, given the high prevalence of Cesarean deliveries as opposed to neurosurgical or otolaryngologic procedures, demand for obstetrical surgical supplies may be greater and programs should take this into account when planning resources. It is interesting to note that many supplies and technologies used in high-income countries for many of the procedures in this study, such as surgical staplers, x-ray machines and mesh for hernia repairs, are often unavailable in these settings. Finally, planning for post-operative resources should also focus on obstetric and trauma patients.

It is important to note that MSF primarily responds to the acute phase of disasters and conflicts; surgical care is often transitioned to local health care systems once stability has been achieved. This review is therefore more representative of the response phase and may be less applicable to long-term program building.

This study has several limitations. Although it is a large dataset spanning a number of years, it only includes the procedures of MSF and is thus limited to the areas of operation of this organization. Indeed, in this study, a large number of maternity hospitals were included, which may have disproportionately increased the number of obstetrical and gynecological procedures performed. Although these results may not be applicable to other institutions providing surgical care in these settings, they do genuinely provide an estimate of the burden of surgical need as MSF only responds to areas requiring care. A related limitation is therefore the assumption that all surgical need was met by MSF. One hypothesis may be that surgical subspecialty procedures only represented a small proportion of interventions because of a lack of skilled personnel. These procedures may therefore represent part of the desired skillset of an aspiring humanitarian surgeon or an opportunity to expand programs into these areas or to allow for other organizations to provide such services. Moreover, another limitation is the fact that surgical indications were only recorded for the primary procedure. Since subsequent operations are less likely to be fetal-maternal or disaster-related, it is likely that these indications are overestimated in our sample. Information from the surgical procedures however suggests that those pathologies are still prominent. Finally, one limitation is the classification system used to record surgical indications and procedures in the electronic database ([Appendix 1 and 2](#)). The nature of the

classification leads to groups of indications and procedures, which limits the ability to pinpoint specific diagnoses or procedures, as this system was developed to respond to MSF's operational needs.

In conclusion, in the context of growing interest in international volunteerism by surgeons in high-income countries, documentation of the skillset required to be proficient in these settings is useful. This review of MSF's operative procedures provides valuable insight into the types of operations that an aspiring volunteer surgeon should be familiar with.

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Appendix 1. Classification of surgical indications (Additional material only for electronic version)

<i>Group</i>	<i>Category</i>	<i>Code</i>	<i>Remarks</i>
T Trauma	TV Violence	TVM	Mine: injury caused by mines
		TVG	Gunshot: includes gunshots caused in a non war context
		TVB	Bombs: explosions Including shells, bombs, grenades,
		TVK	Knives: caused by knife, machete, etc
		TVA	Assault
		TVR	Rape
		TVT	Torture: also beating up with intentional character (ex. not drunken fighting)
	TA Accidents	TAT	Traffic: driver or passenger of a motorized vehicle, pedestrians or cyclists
		TAB	Burns: fire, scald & chemical burns
		TAO	Others: foreign objects, natural catastrophes, hurricanes, earthquakes, spontaneous and stress fractures, work & domestic accidents, sport & game injuries, fall out of tree, etc.
P Nontrauma pathology	PI Infection, Inflammation, Ischemia	PIA	Abscess: caused by infection, inflammation, suppuration, cysts, abscesses
		PIT	Tropical: Typhoid fever, echinococcus cyst, schistosomiasis, Guinea worm, ulcus buruli, etc.
		PIV	Vascular: ischemia, gangrene, thrombosis of vascular origin, vasculopathies (diabetes).
	PT tumor	PTB	Benign: tumours of benign cause, includes cysts
		PTM	Malignant: tumours of malignant cause
		PTU	Unknown: tumours of unknown cause
	PV various	PVI	Iatrogenic: includes traditional and clandestine medicine
		PVC	Congenital: imperforation ani, cleft palate, etc.
		PVO	Other causes: including obstruction (not due to tumour), bladder & kidney stones, hernia, unknown diagnosis, traditional circumcision, ligature of Fallopian tubes, etc.
	PH hemorrhage	PHE	Haemorrhage: internal or external bleeding not due to traumatology (ex. gastric bleeding, aneurism rupture, etc.)
OF Foetal-Maternal		OFM	Foetal-Maternal: indication due to children or mother. Ex. foetal distress, children or mother's life is at risk, placenta previa, abruptio, extra-uterine gravidity, former Caesarean section, uterine rupture, etc.
		OP Postpartum complications	OPH
OPO	Other complications, becoming manifest postpartum and are of infectious or tumour origin (ex. endometritis, vesico-vaginal fistula, uterine perforation, etc.)		

Appendix 2. Classification of surgical procedures (Additional material only for electronic version)

<i>Group</i>	<i>Code</i>	<i>Remarks</i>
M Minor Surgery	MS	Simple wound treatment (suturing, cleaning, dressing), minor debridement, drainage of abscesses, circumcision, etc.
	MD	Insertion and removal of drain, puncture or drainage of cavity, chest drains, laparo- and pericardiocentesis. Dressings under sedation (except burn), etc.
W Wound surgery	WB	Burns dressings
	WD	Extensive debridement, including fasciotomy, delayed closure, removal of sequestrs, amputation of digits or toes, etc .
	WG	Graft of skin or muscle
	WF	Foreign body removal
V Visceral surgery	VH	Hernia, hydrocele, haemorrhoids. Includes all interventions on external genitals and anus, except circumcision (MS)
	VE	Exploratory laparotomy, if no other surgical actions performed (open, look & close). Includes 2 nd look laparotomy with lavage
	VS	Solid viscous: resection or repair. Spleen, liver, kidney (ex. splenectomy, liver repair, nephrectomy, etc.)
	VG	Gut: resection or repair. Intestine, stomach (perforation), colon, etc. Includes stoma and restoration of integrity or continuity, volvulus, appendectomy, etc.
	VO	Other general/visceral surgery. Removal of tumours, mammectomy, thyroidectomy, etc. Excludes minor surgery and pelvic tumour (GH).
	O Orthopaedics	OR
OF		Reduction with placement of external fixator
OO		Osteosynthesis or internal fixation
OX		Osteosynthesis out (removal)
OB		Bone graft
OC		Curettage for osteomyelitis
OJ		Orthopaedic joint surgery
ON		Orthopaedic nerve
OA		Amputation of a limb. Excludes amputation of fingers or toes (WD)
OV		Other orthopaedic surgery. Corrective procedures, etc.
G Gynaecology & Obstetrics + urology		GC
	GE	Extra uterine gravidity
	GF	Obstetric fistula correction or relief (of vesico-vaginal, recto-vaginal, etc.)
	GH	Hysterectomy + variants, ovariectomy, removal of pelvic tumour (only if access to small pelvis)
	GP	Curettage: curettage post delivery (placenta retention), abortion, therapeutic
	GU	Urology: small pelvis. Prostatectomy, bladder stones. Excludes intervention on external genitals (VH) and kidney (VS)
	GO	Other gyn/obs surgery. Ex. delivery in OT, craniotomy, ligature of tuba, repair of episiotomy or laceration of perineum but excludes mammectomy (VO)
	S Specialized surgery	SN
SV		Vascular surgery: suturing, patching or anastomosis of major vessel
SP		Plastic and reconstructive, relief of contractures, etc.
ST		Thoracotomy. Implies opening of thoracic cavity, excludes chest drain.
SE		Ear-nose-throat. Includes tracheotomy. Excludes thyroidectomy (VO)
SO		Ophthalmology
SM		Maxillofacial
SX		Other forms of specialized surgery.