

Safeguarding children through pediatric surgical care in war and humanitarian settings: a call to action for pediatric patients in Gaza

Abirami Muthumani  ^{1,2}

To cite: Muthumani A. Safeguarding children through pediatric surgical care in war and humanitarian settings: a call to action for pediatric patients in Gaza. *World J Pediatr Surg* 2024;7:e000719. doi:10.1136/wjps-2023-000719

Received 25 October 2023
Accepted 2 January 2024

INTRODUCTION

Pediatric surgical interventions may represent more than one-third of the surgical case-load in humanitarian settings.¹ The humanitarian crisis in Gaza has taken a devastating toll on children, many of whom have suffered injuries due to indiscriminate and heavy bombardment, resulting in severe polytraumatic injuries necessitating immediate and specialized pediatric surgical intervention. The conflict has strained the region's fragile healthcare system, resulting in a significant number of casualties, a substantial proportion of which are children. This exacerbates the demand for specialized pediatric surgical care, especially when the existing healthcare system and infrastructure has nearly collapsed and is under-resourced to handle the influx of pediatric patients.² The urgency for specialized pediatric surgical care and support for children in Gaza cannot be overstated. Access to healthcare in Palestine has been an ongoing challenge.³ Before the recent hostilities, 1.1 million children in Gaza and the West Bank were already in need of humanitarian aid, constituting approximately half of the child population.⁴ The current war in Gaza, as per a recent UNICEF report, has exacerbated the situation, with hundreds of thousands of children in desperate need of humanitarian assistance and protection.⁵ Team members of Médecins Sans Frontières (MSF) who are currently providing medical care in Gaza, have expressed deep concern regarding the critical medical and humanitarian crisis facing children in the region. Nearly half of the consultations MSF staff provided in the Martyrs and Beni Suheila clinics, in which they have now been forced to suspend operations in, were for children under the age of five.⁶ The conflict has resulted in a significant number of casualties, with a substantial proportion being children

who require specialized pediatric surgical care. One child in Gaza has been killed every 10 min on average.⁷ Thousands more have been injured in the region. There is a clear and pressing need for functional pediatric surgical systems and resources in the region.

TREATING PEDIATRIC POLYTRAUMA IN HUMANITARIAN SETTINGS

In combat settings, pediatric polytrauma emerges as a distressing clinical challenge. Common sites of pediatric poly trauma include the head, chest, abdomen, genitourinary and musculoskeletal systems. When reviewing relevant reviews and epidemiologic reports that draw from existing military and civilian data, it is essential to consider survivorship bias. The potential omission of children who died from injuries may impact reported injury patterns. Distributions and prevalence of reported injuries may be influenced by the inherent mortality risk associated with serious cranial, thoracic, and abdominal injuries. This can account for increased presentations of children with musculoskeletal injuries. The most common causes of long-term functional deficits after pediatric polytrauma involve injuries to the central nervous and musculoskeletal systems.⁸ These injuries, encompassing pelvic trauma, long bone fractures, crush injuries, and spinal injuries, among others, epitomize the devastating long-term consequences of conflict-induced polytrauma on the vulnerable pediatric population. UNICEF officials estimate about 1000 children in Gaza have suffered limb amputations since the start of the war.⁹

The intricate nature of pediatric polytrauma demands a tailored approach with specialized surgical tools designed to address these injuries comprehensively. This discussion underscores the critical imperative for



© Author(s) (or their employer(s)) 2024. Re-use permitted under CC BY. Published by BMJ.

¹UCSF Center for Health Equity in Surgery and Anesthesia, University of California San Francisco, San Francisco, California, USA

²Department of General Surgery, Columbia University Irving Medical Center, New York, New York, USA

Correspondence to

Dr Abirami Muthumani; am6088@cumc.columbia.edu

highly specific pediatric surgical instruments such as pediatric-sized pelvic binders, specialized fixation instruments suited for children, and analogous equipment specifically calibrated for pediatric musculoskeletal injuries. Moreover, it illuminates the potential of integrating specifically tailored pediatric surgical instruments into the WHO's Trauma and Emergency Surgery Kits (TESK Kits) and MSF Rapid Intervention Surgical Kits (RISK Kits). This integration can ultimately bridge the current gap in accessing vital pediatric surgical supplies in conflict zones.

The WHO TESK kits encompass essential surgical instruments, equipment, and supplies tailored to facilitate life-saving surgical interventions in humanitarian crises and emergency situations. These kits are instrumental in providing comprehensive support for various surgical procedures, including surgeries for musculoskeletal injuries prevalent in conflict zones and humanitarian settings.¹⁰ In 2018, the WHO delivered trauma kits to the Ministry of Health in the Gaza strip.¹¹ The 18 trauma kits were disturbed to

treat up to 1800 patients who were in need of surgical care. Since October 7, 2023, significantly restricted humanitarian aid has entered Gaza through the Rafah border crossing between Egypt and the Gaza Strip.¹² While the WHO TESK kits that are currently entering serve a pivotal role in providing essential resources, there is an absence of adequate pediatric adaptations within these kits. Recognizing the anatomical and physiological differences in children, the comprehensive inclusion of tailored pediatric surgical instruments and equipment becomes imperative to optimize care delivery for young patients in crisis-affected regions.

The WHO TESK kits are categorized into modules, each containing specific sets tailored for different surgical needs () (figure 1). Kit TESK 2022 MODULE 2A, focused on General Surgery Instruments, includes a set designated as *TESK 2022 mod 2A SET, GENERAL SURGERY INSTRUMENTS, FINE(pediat)*, which incorporates some pediatric general surgery equipment (figure 2). However, this set lacks comprehensive

World Health Organization		TESK-2019		TRAUMA & EMERGENCY SURGERY KIT (TESK 2019), for 50 patients hospitalized	
Product category	WHO item code	WHO item description		UoM	Quantity
KIT	KMEDTESK1----A1	KIT, TRAUMA & EMERGENCY SURGERY KIT (TESK 2019), for 50 patients hospitalized			
MODULE 1	KMEDTESM1----A1	(TESK 2019) MODULE 1, DRUGS & RENEWABLES, for 50 patients hospitalized			
MODULE 1A	KMEDTESM1A--A1	(TESK 2019) MODULE 1A, DRUGS			
SET1A1	KMEDTESM1AR--A1	(TESK 2019 module 1A) SET, DRUGS, BASIC			
SET1A2	KMEDTESM1AC--A1	(TESK 2019 module 1A) SET, DRUGS, CONTROLLED			
SET1A3	KMEDTESM1AAR--A1	(TESK 2019 module 1A) SET, DRUGS, ANTIDOTE RESCUE			
SET1A4	KMEDTESM1AGC-A1	(TESK 2019 module 1A) SET, DRUGS, COLD CHAIN, MUSCLE RELAXANTS			
SET1A5	KMEDTESM1ARG-A1	(TESK 2019 module 1A) SET, DRUGS, COLD CHAIN, TETANUS IG & VACCINES			
SET1A6	KMEDTESM1AL--A1	(TESK 2019 module 1A) SET, DRUGS, DANGEROUS GOODS			
SET1A7	KMEDTESM1AD--A1	(TESK 2019 module 1A) SET, DRUGS, INFUSIONS			
MODULE 1B	KMEDTESM1B--A1	(TESK 2019) MODULE 1B, RENEWABLES COMMODITIES, for 50 patients			
SET1B1	KMEDTESM1BRG-A1	(TESK 2019 module 1B) SET, RENEWABLES, GLOVES			
SET1B2	KMEDTESM1BRA--A1	(TESK 2019 module 1B) SET, RENEWABLES, ANAESTHESIA, basic material			
SET1B3	KMEDTESM1BRL--A1	(TESK 2019 module 1B) SET, RENEWABLES, INJECTION MATERIAL			
SET1B4	KMEDTESM1BRP--A1	(TESK 2019 module 1B) SET, RENEWABLES, DRESSING MATERIAL			
SET1B5	KMEDTESM1BRB--A1	(TESK 2019 module 1B) SET, RENEWABLES, DRESSING MATERIAL, BURNS			
SET1B6	KMEDTESM1BRPC-A1	(TESK 2019 module 1B) SET, RENEWABLES, PLASTER CASTING MATERIAL			
SET1B7	KMEDTESM1BRST-A1	(TESK 2019 module 1B) SET, RENEWABLES, STERILISATION, for autoclave			
SET1B8	KMEDTESM1BRSD-A1	(TESK 2019 module 1B) SET, RENEWABLES, SURGICAL DRAINAGE MATERIAL			
SET1B9	KMEDTESM1BRSE-A1	(TESK 2019 module 1B) SET, RENEWABLES, SUTURES			
SET1B10	KMEDTESM1BRUD-A1	(TESK 2019 module 1B) SET, RENEWABLES, URINE DRAINAGE MATERIAL			
SET1B11	KMEDTESM1BRSM-A1	(TESK 2019 module 1B) SET, RENEWABLES, SURGICAL MISCELLANEOUS MATERIAL			
MODULE 1C	KMEDTESM1C--A1	(TESK 2019) MODULE 1C, SUPPLEMENTARY, RENEWABLES COMMODITIES, for 50 patients			
SET1C1	KMEDTESM1CRA--A1	(TESK 2019 module 1C) SET, SUPPLEMENTARY, ANAESTHESIA MATERIAL			
SET1C2	KMEDTESM1CRG--A1	(TESK 2019 module 1C) SET, SUPPLEMENTARY, EXTRICATION COLLARS			
SET1C3	KMEDTESM1CRS--A1	(TESK 2019 module 1C) SET, SUPPLEMENTARY, SPLINTS, for 15-20 fracture cases			
SET1C4	KMEDTESM1CRA--A1	(TESK 2019 module 1C) SET, SUPPLEMENTARY, INTUBATION & LARYNGOSCOPE			
MODULE 2	KMEDTESKM2--A1	(TESK 2022) MODULE 2, SURGERY, INSTRUMENTS			
MODULE 2A	KMEDTESKM2A--A1	(TESK 2022) MODULE 2A, SURGERY, GENERAL SURGERY INSTRUMENTS			
SET2A1	KMEDTESKM2A01A1	(TESK 2022 mod 2A) SET, GENERAL SURGERY INSTRUMENTS, BASIC SURGERY			
SET2A2	KMEDTESKM2A02A1	(TESK 2022 mod 2A) SET, GENERAL SURGERY INSTRUMENTS, DRESSING			
SET2A3	KMEDTESKM2A03A1	(TESK 2022 mod 2A) SET, GENERAL SURGERY INSTRUMENTS, CRANIOTOMY, complementary			
SET2A4	KMEDTESKM2A04A1	(TESK 2022 mod 2A) SET, GENERAL SURGERY INSTRUMENTS, LAPAROTOMY + caesarian			
SET2A5	KMEDTESKM2A05A1	(TESK 2022 mod 2A) SET, GENERAL SURGERY INSTRUMENTS, DPC (suture)			
SET2A6	KMEDTESKM2A06A1	(TESK 2022 mod 2A) SET, GENERAL SURGERY INSTRUMENTS, DEBRIDEMENT			
SET2A7	KMEDTESKM2A07A1	(TESK 2022 mod 2A) SET, GENERAL SURGERY INSTRUMENTS, SKIN GRAFT			
SET2A8	KMEDTESKM2A08A1	(TESK 2022 mod 2A) SET, GENERAL SURGERY INSTRUMENTS, FINE(pediat), complementary			
SET2A9	KMEDTESKM2A09A1	(TESK 2022 mod 2A) SET, GENERAL SURGERY INSTRUMENTS, THORACOTOMY, complementary			
MODULE 2B	KMEDTESKM2B--A1	(TESK 2022) MODULE 2B, SURGERY, ORTHOPEDIC SURGERY INSTRUMENTS			
SET2B1	KMEDTESKM2B01A1	(TESK 2022 mod 2B) SET, ORTHO. SURGERY INSTRUMENTS, AMPUTATION			
SET2B2	KMEDTESKM2B02A1	(TESK 2022 mod 2B) SET, ORTHO. SURGERY INSTRUMENTS, BASIC BONE SURG., compitary			
SET2B3	KMEDTESKM2B03A1	(TESK 2022 mod 2B) SET, ORTHO. SURGERY INSTRUMENTS, BASIC BONE SURG., curettes			
SET2B4	KMEDTESKM2B04A1	(TESK 2022 mod 2B) SET, ORTHO. SURGERY INSTRUMENTS, BONE WIRING and KIRSHNER			
SET2B5	KMEDTESKM2B05A1	(TESK 2022 mod 2B) SET, ORTHO. SURGERY INSTRUMENTS, PLASTER CASTS REMOVAL			
MODULE 2C	KMEDTESKM2C--A1	(TESK 2022) MODULE 2C, SURGERY, SPECIALIZED SURGERY INSTRUMENTS			
SET2C1	KMEDTESKM2C01A1	(TESK 2022 mod 2C) SET, EAR-NOSE-THROAT INSTRUMENTS			
SET2C2	KMEDTESKM2C02A1	(TESK 2022 mod 2C) SET, OPHTHALMIC TRAUMA INSTRUMENTS, complementary			
SET2C3	KMEDTESKM2C03A1	(TESK 2022 mod 2C) SET, URETHRAL SOUNDING INSTRUMENTS, Dittel, curved			
SET2C4	KMEDTESKM2C04A1	(TESK 2022 mod 2C) SET, VASCULAR INSTRUMENTS, complementary			
SET2C5	KMEDTESKM2C05A1	(TESK 2022 mod 2C) SET, GYNAECOLOGICAL INSTRUMENTS			
SET2C6	KMEDTESKM2C06A1	(TESK 2022 mod 2C) SET, REPRODUCTIVE HEALTH KIT, INSTRUMENTS			
SET2C7	KMEDTESKM2C07A1	(TESK 2022 mod 2C) SET, EMBRYOTOMY INSTRUMENTS			
SET2C8	KMEDTESKM2C08A1	(TESK 2022 mod 2C) SET, SUPPLEMENTARY, SUTURES, for vaginal/cervix tears			
SET2C9	LEQTPHES001--A1	PHOTO EVIDENCE SCALE (PPSM300), 100mm, black aluminium			

Figure 1 Components of WHO Trauma & Emergency Surgery Kit (TESK KIT). <https://www.who.int/emergencies/emergency-health-kits/trauma-emergency-surgery-kit-who-tesk-2019>.

item	WHO item code	WHO item description	UoM	Quantity
	KMEDTESKM2A08A1	(TESK 2022 mod 2A) SET, GENERAL SURGERY INSTRUMENTS, FINE(pediat), complementary	1 Set	
1		SCALPEL, HANDLE, No 3 (for blades 10/11/15)		1
2		SCISSORS, MAYO, 17 cm, curved		1
3		SCISSORS, METZENBAUM, 14 cm, curved		1
4		FORCEPS, ADSON, 12 cm, serrated jaws		1
5		FORCEPS, ADSON, 12 cm, 1x2 teeth		1
6		FORCEPS, McINDOE, 15 cm, serrated		1
7		FORCEPS, GILLIES, 15 cm, 1x2 teeth		1
8		PROBE, 16 cm/diam. 1.5 mm, round double-ended		1
9		SUCTION TUBE, FRAZIER, CH 12, 12.5 cm, angular		1
10		NEEDLE HOLDER, BABY-CRILE-WOOD, 15 cm		1
11		FORCEPS, HEMOSTATIC, H-MOSQUITO, 12.5 cm, curved		10
12		FORCEPS, HEMOSTATIC, CRILE, 14 cm, curved		4
13		FORCEPS, HEMOSTATIC, KOCHER, 14 cm/1x2 teeth, straight		2
14		FORCEPS, TOWEL CLAMP, BACKKAUS, 13cm		6
15		FORCEPS, SPONGE, FOERSTER, 24cm, serrated jaws, straight		2
16		RETRACTOR, SENN-MILLER, 16 cm, double-ended, blunt prong		1
17		RETRACTOR, VOLKMANN, 22 cm, 3sharp prongs, 10 mm curve		2
18		RETRACTOR, SELF-RET., WEITLANER, 13 cm, 3 x 4 blunt prongs		1
19		BOWL, ROUND, 100 ml, 80 x 35 mm, stainless steel		1
20		FORCEPS, TISSUE, ALLIS-BABY, 14 cm / 3x4 teeth		2
21		FORCEPS, TISSUE, BABCOCK, 16 cm, 9 mm jaws, standard		2
22		BASKET, STERILIZING, 240 x 255 x 100mm, Ref 49.97.03 + lid 24x25cm		1

Figure 2 Pediatric general surgery instruments within WHO TESK KIT. <https://www.who.int/emergencies/emergency-health-kits/trauma-emergency-surgery-kit-who-tesk-2019>.

tools to adequately address pediatric polytrauma and amputation cases. Notably, within the five sets of Kit TESK 2022 MODULE 2B, concentrating on orthopedic surgery instruments, there are no inclusions specifically designed for pediatric patients, creating a gap in addressing pediatric orthopedic trauma within the kits. Focusing on the comprehensive customization of the TESK kits to cater specifically to pediatric polytrauma will significantly enhance healthcare management in challenging settings like Gaza.

MSF RISK kits are comprehensive packages designed for rapid surgical intervention. One kit, accommodating 20 cases, includes a sufficient supply of medical equipment, surgical tools, medicines, logistical support, and water and sanitation gear essential for treating patients in the initial 72 hours (figure 3). MSF also has other surgical kits including the “PAEDIATRIC SET, supplementary” that includes 14 instruments (figure 4). To comprehensively address pediatric surgical requirements, there is a pressing need for further customization within existing MSF kits or the development of specialized pediatric-focused kits to ensure optimal care for younger patients. In addition, continued inflow of pharmaceutical agents such as antibiotics, analgesics, and anesthetics is vital to complement surgical interventions.

Addressing these gaps in current emergency surgical resources will play a pivotal role in improving surgical outcomes and mitigating the long-term impact of musculoskeletal trauma on children affected by crises. We must work toward prioritizing and implementing pediatric adaptations within emergency surgical kits. This integration holds promise in ameliorating the dire healthcare challenges encountered in managing pediatric polytrauma within the profoundly challenging setting of Gaza and beyond.

ADVOCATING FOR THE DELIVERY OF PEDIATRIC SURGICAL AID AND PROTECTION OF HEALTHCARE

Beyond the need for tailored pediatric adaptations within emergency surgical kits, a fundamental recommendation emerges to enhance their accessibility in conflict-affected regions. Advocating for humanitarian ceasefires and the establishment of humanitarian corridors stands as a critical measure to facilitate delivery of these specialized kits. The uninterrupted transportation and prompt deployment of these resources are pivotal in augmenting the capacity of healthcare providers to administer precise and immediate care to children—amidst persistent conflict. This recommendation, in conjunction with the development and integration of pediatric-specific adaptations, embodies a holistic approach to mitigate the healthcare adversities encountered in areas of conflict. By doing so, it aims to fortify the response framework for pediatric trauma in challenging humanitarian settings, thereby ameliorating the overall healthcare landscape. The restriction to the flow of essential surgical supplies and equipment into the territory has left hospitals in critical shortages, hampering the ability of pediatric surgeons to provide the necessary care for injured children. An MSF surgeon who provided surgical care in Gaza in the recent context reports that the hospitals were so short of supplies, one of them being chlorhexidine. Because of this, he had to resort to cleaning 70% surface burns on a teenage girl with soap and water.¹³ Another MSF surgeon working in the region shares the story of him and his team having to amputate the foot of a 9-year-old boy on the floor of the hospital under limited sedation due to lack of supplies.¹⁴ “Surgeons operate without anaesthetics and by torchlight,” says Medical Aid for Palestinians’ Gaza Director.¹⁵ In addition, the pediatric surgical community must

MSF'S RISK KIT

When an emergency strikes, the first 72 hours are critical.

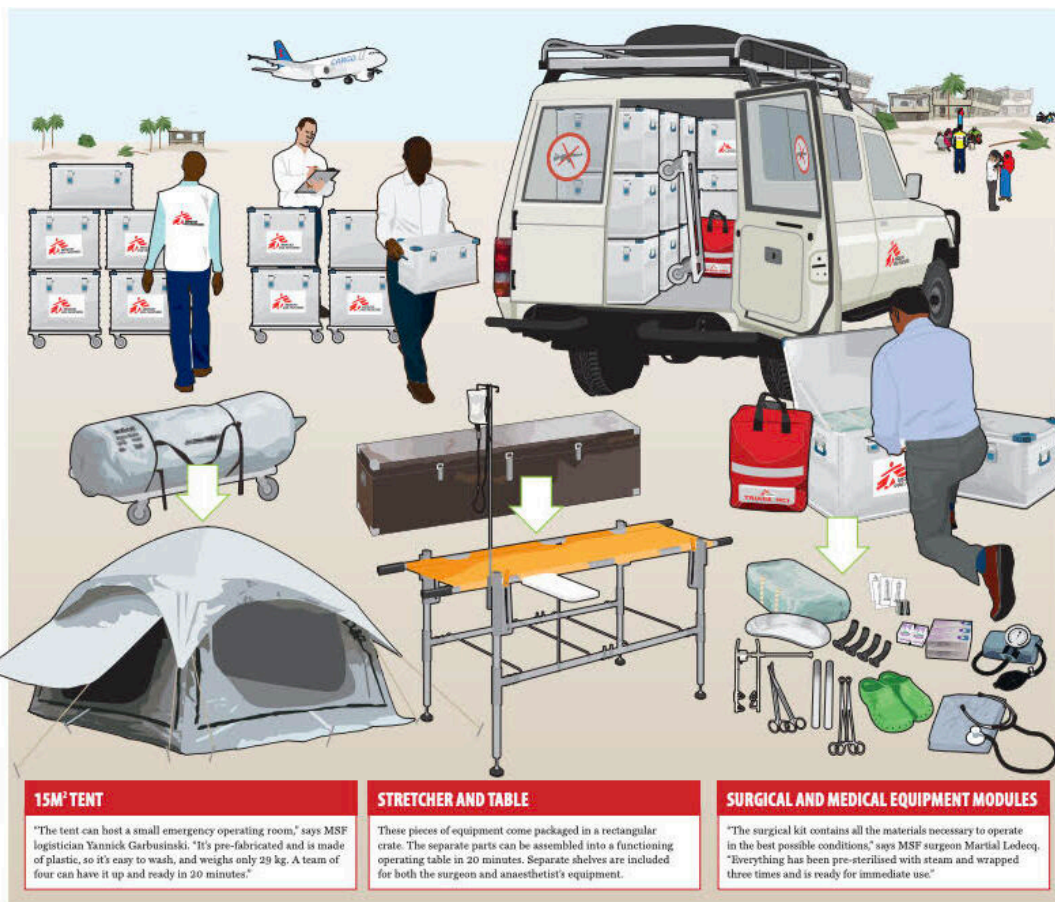
This is the lifesaving phase, when medical care is most crucial. During this small window of opportunity, it's vital that MSF gets on the ground quickly with the equipment and supplies necessary to start saving lives.

To this end, MSF has developed the RISK kit (or rapid intervention surgical kit): a 20-case kit which contains enough medical supplies, surgical equipment, medicines, logistical equipment and water and sanitation gear to treat patients for the first 72 hours. Each case weighs no more than 32 kilograms for easy handling, and all 20 cases can fit into the back of an MSF Land Cruiser.

"The RISK kit is basically a mini-operating room," says MSF nurse Anne Khoudiacoff. "It's transportable by hand, and we can set it up anywhere: in the aftermath of natural disasters; in conflict zones; wherever we need to move fast and be mobile in hard-to-access areas."

MSF developed the kit after the Haiti earthquake, when the difficulty of flying in sufficient supplies and equipment in the immediate aftermath of the disaster hindered the MSF team's early response.

The kit includes medicines, dressings, anaesthetic equipment, surgical instruments and a triage kit, as well as logistical equipment such as plastic sheeting, notebooks, cables and chlorine to treat water. The entire kit can be unpacked and ready-to-use in less than two hours. With the kit, an MSF team of six people can carry out five major surgical interventions a day.



15M² TENT

"The tent can host a small emergency operating room," says MSF logistician Yannick Garbusinski. "It's pre-fabricated and is made of plastic, so it's easy to wash, and weighs only 29 kg. A team of four can have it up and ready in 20 minutes."

STRETCHER AND TABLE

These pieces of equipment come packaged in a rectangular crate. The separate parts can be assembled into a functioning operating table in 20 minutes. Separate shelves are included for both the surgeon and anaesthetist's equipment.

SURGICAL AND MEDICAL EQUIPMENT MODULES

"The surgical kit contains all the materials necessary to operate in the best possible conditions," says MSF surgeon Martial Ledecq. "Everything has been pre-sterilized with steam and wrapped three times and is ready for immediate use."

GRAPHIC: JENNY RIDLEY. Not drawn to scale.

Figure 3 MSF rapid intervention surgical kit. <https://www.doctorswithoutborders.ca/wp-content/uploads/2023/03/MSFs-risk-kit.pdf>.

condemn deliberate attacks on healthcare,¹⁶ which is a violation of international humanitarian law. Pediatric surgical care cannot be delivered when hospital infrastructure is destroyed and healthcare workers are targeted.

LONG-TERM IMPACTS OF WAR ON PEDIATRIC POPULATIONS

A review of 7505 pediatric patients in conflict zones of Afghanistan and Iraq, the largest review of pediatric casualties cared for in Afghanistan and Iraq, revealed that trauma, notably blast and penetrating injuries, accounts for a significant 79% of pediatric admissions, higher than in local and coalition groups. It is important to note that the military hospital's specialization in treating these cases might contribute to the higher percentage of admissions observed in this study. Pediatric patients suffered higher mortality rates and longer hospital stays compared with adults, especially children under 8 years old, emphasizing the lasting impact of trauma on younger victims in these conflict settings.¹⁷

Similarly, the MSF-supported hospital in Tal Abyad, Syria, served as the main trauma center during and after the Raqqa offensive. It primarily treated blast-wounded patients and observed a persistent high

injury burden from explosives. Despite the end of active combat, the hospital experienced a surge in patients, especially children, suggesting ongoing dangers in post-conflict zones. This study sheds crucial light on the persisting challenges faced in conflict zones even after the cessation of active combat. Despite the end of active fighting, the burden of injuries sustained from IEDs (improvised explosive devices) and explosive remnants of war remained alarmingly high, leading to a substantial influx of war-wounded patients in the post-offensive period.¹⁸ This phenomenon highlights a critical aspect often overlooked: the persistent need for trauma care and the prevalence of ongoing threats even after combat ceases. Moreover, the study emphasizes the challenges in providing timely surgical care in humanitarian settings, citing familiar barriers in Gaza such as security issues, limited access due to checkpoints, lack of transport, and the absence of prehospital stabilization for critical wounds. It also underscores the critical need for specialized care for pediatric patients, who suffer disproportionately higher mortality rates from trauma, especially in conflict settings.

ORTHOPAEDIC BONE WIRE, soft, coil 10m, 2mm 76-01-20
KIRSCHNER WIRE, trocar point, 23 cm Ø 1.8 mm 76-11-68
KIRSCHNER WIRE, trocar point, 23 cm Ø 2.5 mm 76-11-75
SURGICAL INSTRUMENTS SETS
DENTAL SET, 20 instruments
OMEGA 3 DHS INSERTION SET, instruments with racks
OMEGA 3 COMPRESSION SCREW & HIP PLATE SET, sterile
OMEGA 3 LAG SCREWS SET
OMEGA 3 CORTICAL SCREWS SET
GAMMA 3 NAILING INSTRUMENT SET, 35 instruments + 2 wires
GAMMA 3 SPARE INSTRUMENTS, 7 intruments + 20 wires
GAMMA 3 INTRAMEDULLARY REAMER SET
GAMMA 3 IMPLANTS SET, sterile

Médecins Sans Frontières

III-29

MEDICAL ARTICLES MSF 2021

LABEL SURGICAL INSTRUMENTS
SET complementary THORACIC
ABDOMINAL SET, 61 instruments
ABDOMINAL RETRACTOR RING SET (Münster), 21 pieces
AMPUTATION SET, 36 instruments
BONE SET, inferior limbs, 40 instruments
BONE SET, superior limbs, 40 instruments
CAESAREAN SECTION SET, 23 instruments
CRANIOCLASY CRANIOTOMY SET, 10 instruments
CURETTAGE SET, 11 instruments + 8 double dilators
CERVICOVAGINAL TEAR SET, 9 instruments
DELIVERY & EPISIOTOMY SET, 7 instruments
DRESSING SET, 3 instruments, w/o box
ENUCLEATION SET, 18 instruments
EXTERNAL FIXATOR SET, GexFix, complete 2013
EXTERNAL FIXATOR SET, Orthofix Galaxy, 2020
OPEN FRACTURE SET, instruments + external fixator GexFix
OPEN FRACTURE SET, instruments + external fixator Orthofix
I.U.D. FITTING SET, 7 instruments
MANUAL VACUUM ASPIRATION SET autocl. syr., 8 instr. + 5 dil.
OBSTETRIC FISTULA SET, 48 instruments
PAEDIATRIC SET, supplementary, 14 instruments
BONE PINING AND WIRING SET, 7 instruments + wires
SET, PLASTIC SURGERY, 55 instruments
BASIC SURGERY SET, 25 instruments
ABSCCESS SUTURE SET, 7 instruments, w/o box
TRACHEOTOMY SET, 11 instruments
TREPANATION SET, 18 instruments + Gigli wires
TRACTION SET 13 instruments + 16 Nails of Steinmann
VASCULAR SET, BASIC, 18 instruments + basket
VASCULAR SET, AORTA, 5 instruments + basket
SURGICAL CONSUMABLES

Figure 4 Components of MSF RISK kit surgical instrument sets. https://www.msf.org/sites/default/files/2022-02/MSF-Medical_devices-2021.pdf.

The collective weight of evidence derived from these circumstances emphasizes the pressing need for immediate intervention strategies aimed at mitigating the profound and enduring consequences endured by pediatric patients affected by conflict. There arises an urgent call to mobilize concerted efforts in delivering specialized and prompt pediatric surgical interventions in Gaza.

BARRIERS TO HUMANITARIAN PEDIATRIC SURGICAL CARE

There are also indirect hinderances to pediatric surgical services in the region. The Palestine Children's Relief Fund (PCRF) stood as a vital source of free medical care for children in the region, particularly those lacking local access within the strained healthcare system before the recent escalation in conflict. To help with the pediatric surgical needs in Gaza, the Palestine Children's Relief Fund (PCRF) created a Pediatric Cardiac Surgery Program in Gaza as well as the Gaza Amputee Project. These initiatives help provide cardiac surgery and treatment for Palestinian children, as well as surgery and prostheses for child amputees.¹⁹ These programs are not possible now.

According to the founder of PCRF, the situation is dire for at least 500 babies in Gaza born annually with congenital heart disease. He explains that the 500 babies born in Gaza each year with congenital heart disease, that cannot be treated locally, were being treated by teams brought in by the PCRF each month. Now those teams cannot come in to perform these life-saving surgeries and these children will go untreated. This stark revelation sheds light on the grim reality facing these infants who are unable to receive the necessary local treatment and are now left without access to crucial medical teams that were previously brought in monthly for lifesaving surgeries. Moreover, he emphasizes the grave impact of the cancellation of a planned pediatric neurosurgery mission to Gaza in November to treat kids with brain and spine deformities. These children will also not be operated on. His words underscore the critical need to address both direct and indirect barriers obstructing access to essential pediatric surgical interventions, urging a concerted effort to ensure that these vulnerable children receive the life-saving care they desperately need. The plight of vulnerable children in Gaza, relying on external medical teams for life-saving surgeries, highlights the need to overcome both direct and indirect barriers to pediatric surgical care. Also, the chronic pressing challenge of obtaining approval for children to leave Gaza, particularly through Israeli channels, stands as a major hurdle in securing timely life-saving medical care for these vulnerable children. This amplifies the need for capacity building initiatives within Gaza's healthcare system in ensuring timely and accessible life-saving medical care for these vulnerable children, reducing their dependence on external assistance.

LONG-TERM PEDIATRIC SURGICAL PARTNERSHIPS IN PALESTINE, TRAINING, AND CAPACITY BUILDING

Establishing long-term partnerships with local healthcare providers and organizations in Gaza is essential. This ensures that pediatric surgical care can be consistently delivered, even in challenging circumstances. The global pediatric surgical community can contribute to facilitating access to surgical care for children in Gaza and similar conflict-affected regions. The community's expertise and commitment can help save lives and improve the long-term outlook for these vulnerable children. By forging bilateral partnerships with local healthcare providers and organizations in Gaza, the global pediatric surgical community can ensure consistent and resilient pediatric surgical care delivery in the region. In addition, collaborating on research projects related to pediatric surgical care in conflict zones can help identify best practices and innovations for more effective care delivery. This research can inform future policies and strategies. Further work is needed to examine long-term outcomes of pediatric operations in these settings and to guide context-specific surgical program development.¹

In addition, the global pediatric surgical community can organize virtual training programs and workshops for local healthcare providers and humanitarian aid workers in Gaza. This not only enhances the skills of local teams but also helps build long-term surgical capacity in the region. A notable precedent in this regard was provided by the American College of Surgeons (ACS), which supported educational efforts in Ukraine trauma zones in 2022. ACS supported efforts to help people in Ukraine learn the basics of the STOP THE BLEED course following the start of the Russia Ukraine war.²⁰ ACS also worked to provide access to bleeding control materials to enable implementation of these life-saving techniques. The international pediatric surgical community must come together to lead similar efforts, ensuring that training and resources reach Gaza to support children in dire need of pediatric surgical care.

CONCLUSION

The adversity faced by children in all conflict zones necessitates an urgent and comprehensive response from the global pediatric surgical community. The devastation wrought by the ongoing conflict in Gaza has left a profound mark on the pediatric population, resulting in dire polytraumatic injuries that demand immediate specialized pediatric surgical interventions. Addressing the urgent surgical needs of these vulnerable children requires multifaceted solutions, starting with the integration of tailored pediatric adaptations within the WHO Trauma and Emergency Surgery Kits and MSF Rapid Intervention Surgical Kits. The current inadequate, and limited, inclusions of pediatric-specific tools poses a significant challenge in providing precise surgical care to the injured pediatric patient population.

Collaborative efforts among pediatric surgeons, health-care providers, and humanitarian organizations are imperative to develop, include, and deploy these crucial pediatric surgical instruments and resources. Moreover, advocating for ceasefires and the establishment of humanitarian corridors stands as a fundamental measure to ensure the uninterrupted flow of essential pediatric surgical supplies into Gaza. The current restrictions and shortages of vital medical supplies have left hospitals in a precarious state, compelling pediatric surgeons to provide care under severe resource constraints. Efforts to bolster pediatric surgical care in Gaza necessitate the establishment of long-term partnerships with local healthcare providers and organizations. Consistent support, training programs, and workshops facilitated by the global pediatric surgical community for local health-care providers in Gaza are vital to fortify surgical capacity and enhance skills amidst challenging circumstances.

Together, through unwavering commitment, collaborative action, and a steadfast dedication to the ethical principles of our profession, we must rise to this urgent call to protect and heal the innocent victims of conflict—children.

Acknowledgements I am deeply grateful to Dr Doruk Ozgediz, Dr Kent Garber, Dr John Lawrence, and Dr Russell Jennings for their invaluable guidance and mentorship in the specialized realms of global pediatric surgery and trauma surgery. Their expertise and support have been instrumental in shaping my understanding and growth within these critical fields.

Contributors I, AM, am the sole author of this research paper.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not applicable.

Ethics approval Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution 4.0 Unported (CC BY 4.0) license, which permits others to copy, redistribute, remix, transform and build upon this work for any purpose, provided the original work is properly cited, a link to the licence is given, and indication of whether changes were made. See: <https://creativecommons.org/licenses/by/4.0/>.

ORCID iD

Abirami Muthumani <http://orcid.org/0009-0005-7420-879X>

REFERENCES

- Trudeau MO, Baron E, Hérard P, *et al*. Surgical care of pediatric patients in the humanitarian setting. *JAMA Surg* 2015;150:1080.
- Administrator. WHO appeals for protection of the health system from further attacks and degradation of its capacity [World Health Organization - Regional Office for the Eastern Mediterranean]. 2023. Available: <https://www.emro.who.int/media/news/who-appeals-for-protection-of-the-health-system-from-further-attacks-and-degradation-of-its-capacity.html> [Accessed 5 Dec 2023].
- Waterston T, Nasser D. Access to healthcare for children in palestine. *Bmjpo* 2017;1:e000115.
- Pain & suffering engulfs children in the state of Palestine & Israel. 2023. Available: <https://www.unicef.org/press-releases/pain-suffering-engulfs-children-state-palestine-israel> [Accessed 26 Oct 2023].
- UNICEF USA. No place is safe for children in Gaza. 2023. Available: <https://www.unicefusa.org/stories/no-place-safe-children-gaza#:~:text=In%20all%20wars%2C%20it%20is> [Accessed 20 Oct 2023].
- Doctors Without Borders-USA. Hospitals at breaking point in Southern Gaza as bombing intensifies. Available: <https://www.doctorswithoutborders.org/latest/hospitals-are-breaking-point-southern-gaza-bombing-intensifies> [Accessed 4 Dec 2023].
- Becker J. Israel/Gaza hostilities take horrific toll on children [Human Rights Watch]. 2023. Available: <https://www.hrw.org/news/2023/11/22/israel/gaza-hostilities-take-horrific-toll-children> [Accessed 23 Nov 2023].
- Kay RM, Skaggs DL. Pediatric Polytrauma management. *Journal of Pediatric Orthopedics* 2006;26:268–77.
- Euronews. UNICEF: Gaza strip most dangerous place in the world for children. 2023. Available: <https://www.euronews.com/2023/12/02/unicef-gaza-strip-most-dangerous-place-in-the-world-for-children> [Accessed 3 Dec 2023].
- Trauma and emergency surgery kit (TESK). 2019. Available: <https://www.who.int/emergencies/emergency-health-kits/trauma-emergency-surgery-kit-who-tesk-2019> [Accessed 29 Nov 2023].
- Palestine. WHO delivers trauma kits to the Ministry of health in Gaza [World Health Organization - Regional Office for the Eastern Mediterranean]. 2018. Available: <https://www.emro.who.int/opt/news/press-statement-who-delivers-trauma-kits-to-the-ministry-of-health-in-gaza-august-2018.html> [Accessed 29 Nov 2023].
- Reuters. First aid trucks enter Rafah crossing to Gaza since truce collapses. 2023. Available: <https://www.reuters.com/world/middle-east/first-aid-trucks-enter-rafah-crossing-gaza-since-truce-collapses-2023-12-02/> [Accessed 25 Oct 2023].
- MSN. 2023. Available: <https://www.msn.com/en-gb/news/world/it-s-carnage-we-had-to-use-soap-instead-of-antiseptic-says-british-surgeon-at-gaza-s-biggest-hospital/ar-AA1i2CtH> [Accessed 12 Oct 2023].
- Doctors Without Borders - USA. "We dread nightfall": voices from Gaza. Available: <https://www.doctorswithoutborders.org/latest/we-dread-nightfall-stories-gaza> [Accessed 26 Oct 2023].
- Delivering medical care to Palestinians living under occupation and as refugees in the Palestinian territories and in Lebanon. Available: <https://www.map.org.uk/> [Accessed 20 Oct 2023].
- MSF. MSF convoy attacked in Gaza: all elements point to Israeli army responsibility [Médecins Sans Frontières (MSF) International]. Available: <https://www.msf.org/msf-convoy-attacked-gaza-all-elements-point-israeli-army-responsibility> [Accessed 18 Nov 2023].
- Borgman M, Matos RI, Blackbourne LH, *et al*. Ten years of military pediatric care in Afghanistan and Iraq. *J Trauma Acute Care Surg* 2012;73:S509–13.
- OKeeffe J, Vernier L, Cramond V, *et al*. The blast wounded of Raqqa, Syria: observational results from an MSF-supported district hospital. *Confl Health* 2019;13:28.
- PCRF. Pediatric surgery for children in Gaza. Available: <https://www.pcrf.net/information-you-should-know/pediatric-surgery-for-children-in-gaza.html> [Accessed 20 Oct 2023].
- ACS STOP THE BLEED® program expands training and resources for the people of Ukraine [ACS]. Available: <https://www.facs.org/for-medical-professionals/news-publications/news-and-articles/press-releases/2022/stb-ukraine/> [Accessed 15 Oct 2023].