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Surgical Capacity Assessment and Leverage in the Palestinian Land (SCALPEL-I) Study: The First Nationwide Plastic Surgery Capacity Evaluation in Palestine

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Background: Access to surgical care in low-to-middle-income countries (LMICs), especially in war-torn areas such as the occupied Palestinian territory (oPt), is a global health priority. The plastic surgical capacity in the oPt has not been evaluated. This study provides the first systematic evaluation of plastic surgical capacity in the oPt.

Methods: A cross-sectional study conducted between December 2022 and February 2023 included facilities providing plastic surgery services in the oPt, except private centers run by nonsurgeons. A modified PIPES (personnel, infrastructure, procedures, equipment, and supplies) tool was used. Data were analyzed for geographic and private/public disparities.

Results: Eleven facilities were included; 6 (54.5%) were in the West Bank and 5 (45.5%) in Gaza. The majority were private hospitals (n = 6, 54.5%). The mean PIPES score was personnel = 4.3 (4.03), infrastructure = 18.4 (2.4), procedures = 9.8 (3.8), equipment = 19.2 (3.6), and supplies = 22.4 (1.9). Hospital beds, operating rooms, and plastic surgeons per 100,000 people were 33.5, 1.0, and 0.5, respectively. There were 8 board-certified plastic surgeons. No facilities had a plastic surgery residency program. Key deficiencies included: 8 facilities (72.2%) not performing microsurgical free tissue transfers (none in Gaza), 5 (45.5%) lacking a system to identify complications, and 7 (63.3%) not offering regular educational courses. Average power supply was 8.0 hours/day in Gaza and 24.0 hours/day in the West Bank.

Conclusions: Plastic surgical capacity in the oPt shows significant deficiencies, especially in Gaza. These findings should inform stakeholders to address disparities, develop training programs, and improve access to safe plastic surgery. *(Plast Reconstr Surg Glob Open 2024; 12:e6265; doi: 10.1097/GOX.0000000000006265; Published online 20 November 2024.)*

INTRODUCTION

Plastic surgery is a dynamic, rapidly evolving specialty, with the most substantial tangible developments being seen in high-income countries (HICs). The positive impact of access to plastic and reconstructive surgery has been published extensively in the literature. Across all surgical disciplines, there are increasing recommendations for targeted efforts to bridge the gap between HICs and low-to-middle-income countries (LMICs) in providing safe access to surgical care. The Lancet Commission on Global

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Surgery in 2015 addressed this subject, and reported on the scale of surgical care inequity throughout the world.[1] As reported by that commission, there are significant and long-lasting human and financial costs associated with surgical conditions that go untreated in LMIC. The commission established significant measurable indices, such as workforce and surgical volume, which are broadly unknown, to describe the existing level of surgical capacity and delivery within LMICs globally.[1]

Alongside this report, the World Health Organization (WHO) has urged the rapid expansion of surgical services and training by pushing for the prioritization of surgery in public health planning.[2] To measure important metrics on surgical care in LMICs, the WHO developed a Situational Analysis Tool to Evaluate Emergency and Essential Surgical Services.[3] This WHO tool, which has now been implemented in more than 62 countries in Africa, Asia, and Latin America, is the first widely used standardized assessment of its kind. Building upon the WHO tool, the Surgeons OverSeas organization introduced modifications to create the personnel, infrastructure, procedures, equipment, and supplies (PIPES) survey tool. This adaptation was designed to enhance the tool's reliability and usability. Specifically, the PIPES tool simplifies data collection by reducing the total number of questions and adopting a dichotomous (yes/no) answer format for the majority of its items. These changes make it easier for healthcare facilities to complete the survey while ensuring the collected data is both comprehensive and precise.[4,5]

The WHO highlights the peculiar geopolitical situation in the occupied Palestinian territory (oPt), which is classified by the World Bank as an LMIC and has restrictions on access to healthcare as well as structural violence linked to the occupation. The Palestinian healthcare crisis, has made it difficult for the people in the oPt to receive safe surgical care, including plastic surgery services.[6,7] The State of Palestine is constituted by the West Bank (including East Jerusalem) and Gaza. Together, they are also referred to as the oPt. The population in the West Bank and Gaza was estimated to be 3,120,448 and 2,106,745 respectively, in 2021.[8] Despite several attempts at intra-Palestinian reconciliation, the West Bank and Gaza are politically divided, which has led to the establishment of 2 parallel systems of Palestinian governance. Israel has also enforced a land, sea, and air blockade on Gaza since 2005, with enormous consequent impact on the life of all Gazan residents: social, economic, and humanitarian.[9]

Since the COVID-19 pandemic, the status of healthcare in the oPt has declined across all fields.[10] Furthermore, for Palestinians in Gaza, COVID-19 increased the inequality in access to healthcare and resulted in high levels of uncertainty, anxiety, and social isolation.[11] The effect of the pandemic on plastic surgical provision has also been reported on from HICs such as the United Kingdom, and significant operational capacity limitations, restricted outpatient services, and alterations in reconstructive methods were observed across all subspecialties.[12] In the oPt, the unstable political situation and the frequent escalation of military activity in the region further burden the already strained healthcare system, and continue to exacerbate the challenges faced by frontline healthcare workers. Additionally, these circumstances create access limitations to essential medical services including specialized reconstructive procedures offered by plastic surgeons, such as flap reconstruction for limb salvage.[13] This additional layer of difficulty for Palestinians in Gaza and the West Bank has been observed to intensify the chronic long-standing healthcare crisis in the region.

No previous observational study of plastic surgical capacity in the oPt could be identified by the authors of this article, who therefore adopted a data-driven approach to determine the current baseline for provisions of plastic and reconstructive care. This study aimed to conduct a systematic, comprehensive, and nationwide assessment of plastic surgical capacity within the oPt. Additionally, it sought to identify differences in plastic surgery capacity by geographical location and facility type within the territory.

Takeaways

Question: How do the availability and quality of plastic surgery services vary across healthcare facilities in the occupied Palestinian territory, and what are the main deficiencies in this region?

Findings: Our cross-sectional study evaluated 11 healthcare facilities across the West Bank and Gaza. It revealed significant shortages in plastic surgery personnel, equipment, and training, with pronounced deficits in Gaza compared to the West Bank, including disparities in power supply and surgical capabilities.

Meaning: Our study highlights crucial gaps in plastic surgery services across the occupied Palestinian territories, prompting the urgent need for enhanced surgical training and infrastructure improvements.

METHODS

Study Design and Setting

This cross-sectional study was conducted between December 2022 and February 2023 across the oPt, which is composed of Gaza and the West Bank. We first compiled a comprehensive list of all healthcare facilities in the oPt that offer plastic and reconstructive surgery services. These hospitals were selected based on the presence of a dedicated plastic surgery department or a significant number of regular plastic surgery cases. This list was created by collecting information from the Palestinian Ministry of Health and the Palestinian Medical Association in both Gaza and the West Bank. The study focused on healthcare facilities that offer plastic surgery services and excluded

Disclosure statements are at the end of this article, following the correspondence information.

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private centers operated by nonsurgeons. We differentiated between geographic regions within the oPt, comparing Gaza with the West Bank (including East Jerusalem as part of the West Bank), and evaluated differences in plastic surgery capacity based on the type of healthcare facility (public versus private).

Sampling and Data Collection

A team of trained researchers (medical students and junior doctors) conducted either in-person or telephone interviews using a structured questionnaire. Telephone interviews were scheduled in cases where physical access was constrained due to movement restrictions by the Israeli occupation or logistical reasons. The primary respondents were either the chief of the department of surgery or the director of the hospital.

The questionnaire was created based on a modified version of the validated PIPES tool, which was specifically adapted to evaluate plastic surgical capacity. (**See table, Supplemental Digital Content 1,** which displays the modified PIPES assessment tool, **http://links.lww.com/PRSGO/D580**.) This modification was necessary to accurately assess the unique aspects of plastic surgery in the challenging context of the healthcare system in the oPt. It included questions falling under 5 major categories: personnel (eg, the number of plastic surgeons [board-certified and nonboard-certified]); infrastructure (eg, electricity availability and the number of operating rooms); procedures (eg, microsurgery and craniofacial procedures); equipment (eg, availability of microsets or sterilizers); and supplies (eg, protective gear and microscopes).

The scoring system involves giving 1 point to each survey item that was consistently available (referred to as "always available"), and 0 points to items that were not always available. The overall performance of each hospital was evaluated based on the total scores from all categories.

Data Analysis

We used descriptive statistics to report the study outcomes. For continuous data, mean and SD were used. PIPES scores were computed for each facility as described above. Univariable analyses were conducted to identify disparities across regions or facility types. We used the Student *t* test or the Mann-Whitney-Wilcoxon test to compare continuous variables, whereas the $\chi 2$ test or Fisher exact test was used to compare categorical variables between the groups. Statistical significance was set at 0.05.

Ethical Approval

Ethical approval for the study was obtained from the Ministry of Health in both Gaza Strip (referred to as the Helsinki Ethical Approval Committee) and the West Bank. Verbal consent was sought from all participants before the interviews. Confidentiality and anonymity of the facilities and respondents were maintained throughout the study.

Funding

This study was completed without external funding from any governmental, commercial, or private sources.

RESULTS

This study included 11 hospitals across the oPt, including 6 in the West Bank and 5 in Gaza. Notably, the majority of these facilities were in the private sector, with 6 private hospitals and medical centers accounting for 54.5%. The overall mean (SD) PIPES score for all centers was 74.0 (11.5), with the scores across the subsections averaging at 4.3 (4.03) for personnel, 18.4 (2.4) for infrastructure, 9.8 (3.8) for procedures, 19.2 (3.6) for equipment, and 22.4 (1.9) for supplies. Total PIPES scores across each governorate in the oPt are shown in Figure 1.

Detailed characteristics of these hospitals, including their size, capabilities, and specific challenges, are presented in Table 1. The following sections provide an in-depth analysis of the surgical capacity across these facilities, as assessed by the modified PIPES tool.

Personnel (P) Score

Within the domain of personnel, our study found that board-certified plastic surgeons were present in only 7 of the 11 facilities. Additionally, 18 general surgeons were providing basic plastic surgery service in facilities without board-certified specialists. A notable gap identified was the absence of a nationwide residency program for plastic surgery. The average bed capacity across the centers was 208.8.

Infrastructure (I) Score

Most of the hospitals and centers had generally a reasonable basic infrastructure, being well-equipped with the most basic resources, with running water, laboratory tests, back-up generators, and medical records being available across all facilities. However, the study identified several important gaps in infrastructure. Notably, only 7 centers (63.6%) had a structured referral system for complex cases. The same number of centers (63.6%) also featured an intensive care facility. Even fewer centers, 6 (54.5%), had a system in place to identify complications, and only 4 centers (36.4%) offered regular plastic surgery courses for staff development. Supplemental Digital Content 2 presents a comprehensive overview including the percentage of centers with essential services and the presence of regular plastic surgery courses. (**See table, Supplemental Digital Content 2,** which displays infrastructure score elements of plastic surgery centers in Palestine [n = 11], **http://links.lww.com/PRSGO/D581**.)

Procedures (Pr) Score

The most commonly available plastic surgery procedures across the surveyed centers were wound debridement and flap surgery, both offered by 10 facilities (90.9%). In contrast, certain procedures such as microvascular surgery, amputations, and craniofacial surgery were less prevalent, available in only 6 centers (55%). Craniofacial surgery and cleft lip/palate repair were available in 5 (54.5%) and 8 (72.7%) of the centers, respectively. (**See table, Supplemental Digital Content 3,** which displays the procedures score elements of plastic surgery centers in Palestine [n = 11], **http://links.lww.com/PRSGO/D582**.)

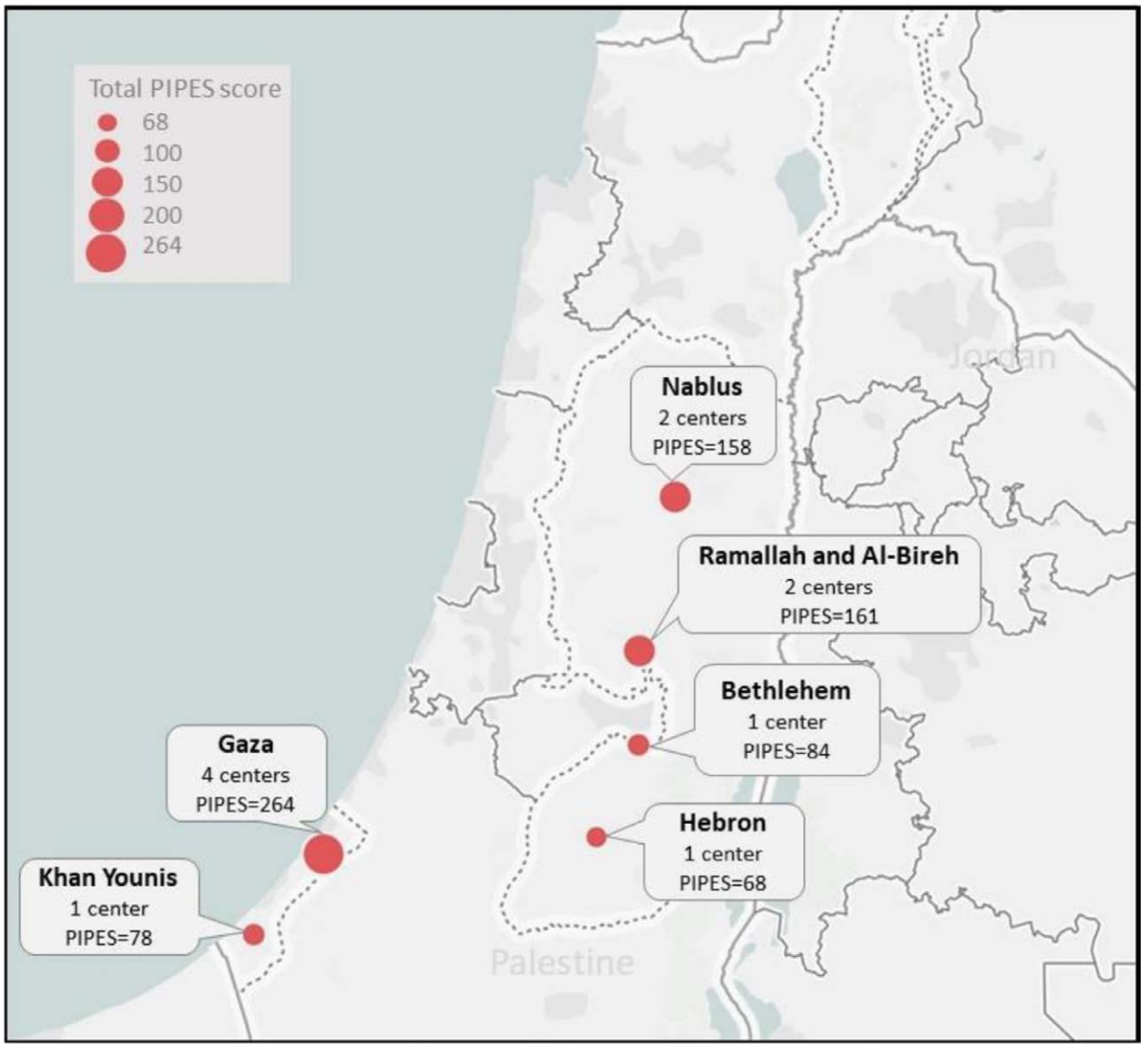

Fig. 1. Map showing the total PIPES scores across the governorates in the occupied Palestinian territories.

Table 1. Characteristics of Healthcare Facilities Providing Plastic Surgery Services in Palestine

Variable	N (%)
Region	
West Bank	6 (54.5)
Gaza	5 (45.5)
Type of facility	
Secondary (district) hospital	3 (27.3)
Tertiary (referral) hospital	2 (18.2)
Private hospital/center	6 (54.5)
Administration type	
Governmental	5 (45.5)
Private	6 (54.5)

Equipment (E) Score

The majority of surveyed equipment was continuously accessible across the facilities. However, specific critical items were intermittently unavailable. Two centers (18.2%) reported limited availability of oxygen concentrators, resuscitator bags (both adult and pediatric), oropharyngeal airways (adult and pediatric), endotracheal tubes (adult and pediatric), anesthesia machines, and micro sets. Pulse oximeters, oxygen masking, and tubing maintained a slightly higher availability, being present in 10 centers (90.9%). (**See table, Supplemental Digital Content 4**, which displays the equipment score elements of plastic surgery centers in Palestine [n = 11], **http://links.lww.com/PRSGO/D583**.)

Supplies (S) Score

The assessment of supplies within plastic surgery centers indicated that while basic supplies were universally available, more specialized tools such as microscopes and loupes were not as accessible, being available in only 6 (54.5%) and 8 (72.7%) centers, respectively. (**See table,**

Table 2. Comparison of PIPES Scores between Centers in West Bank Versus Gaza

Variable	West Bank N = 6	Gaza N = 5	*P*
Total No. hospital beds (average)	217.8	198	0.715
No. plastic surgeons board-certified	5	3	0.609
No. plastic surgeons not board certified	5	13	0.923
No. plastic surgeons subspecialists, eg, specialized (formal fellowship) in microsurgery, and burn	2	0	0.174
At your facility, is there a formal residency training program?	0	0	0.999
No. Plastic surgery residents (if any)	0	0	0.999
No. medical doctors (nonspecialized also known as GPs) in the department of plastic surgery	12	5	0.388
No. plastic surgeons (board/nonboard certified) from this facility who left the oPt (without returning until now) in the last 5 y?	2	0	0.174
P-score (average)	**4.3**	**4.2**	**0.352**
Running water?	6	5	0.999
External electricity?	6	5	0.999
Average hours of external electricity per day over the last month	24	8	0.002*
Functioning back-up generator?	6	5	0.999
Incinerator?	4	5	0.179
Medical records?	6	5	0.999
System to identify complications?	4	2	0.827
Referral system for complex cases?	4	3	0.41
Emergency department?	5	3	0.409
Postoperative care area (PACU/recovery room)?	6	3	0.156
Intensive care unit?	5	2	0.156
Pretested blood available (blood bank)?	6	4	0.273
laboratory to test blood and urine?	6	5	0.999
Functioning x-ray machine?	6	3	0.102
Functioning ultrasound machine in this facility (radiology/surgery/emergency department)?	6	3	0.102
Functioning CT scan?	6	3	0.102
No. functioning operating rooms (ORs)? (average)	5.2	5	0.999
Staff at this facility receive specific plastic surgery courses?	3	1	0.327
I score (average)	**18.5**	**18.2**	**0.925**
Burn management	5	3	0.409
Skin grafting	6	3	0.102
Contracture release	6	3	0.102
Wound debridement	6	4	0.273
Negative pressure wound therapy	4	3	0.827
Flap surgery (of any type)	6	4	0.273
Free flaps	3	0	0.102
Microvascular surgery	5	0	0.008*
Amputation	6	2	0.034*
Craniofacial surgery	5	1	0.045*
Cleft lip/cleft palate repair	4	4	0.637
Breast reconstruction surgery	4	2	0.409
Cosmetic surgery	5	3	0.326
Pr-score (average)	**11.8**	**7.4**	**0.075**
Oxygen: compressed (cylinder)	6	5	0.999
Oxygen: concentrator	6	3	0.102
Resuscitator bag valve and mask (adult)	6	3	0.102
Resuscitator bag valve and mask (pediatric)	6	3	0.102
Oropharyngeal airway (adult size)	6	3	0.102
Oropharyngeal airway (pediatric size)	6	3	0.102
Endotracheal tube (adult)	6	3	0.102
Endotracheal tube (pediatric)	6	3	0.102
Pulse oximeter	6	4	0.273
Oxygen masking and tubing	6	4	0.273
Stethoscope	6	5	0.999
Blood pressure measuring equipment	6	5	0.999
Thermometer	6	5	0.999
Kidney dish stainless steel	6	5	0.999
Sterilizer (autoclave)	6	5	0.999

(*Continued*)

Table 2. *Continued*

Variable	West Bank N = 6	Gaza N = 5	*P*
Suction pump (manual or electric)	6	5	0.999
Electrocautery machine	6	5	0.999
Microsets	5	4	0.892
Operating room lights	6	5	0.999
Functioning electric generator	6	5	0.999
E score (average)	**20.8**	**17.2**	**0.112**
Gloves	6	5	0.999
GT	6	3	0.102
IV fluid infusion sets	6	5	0.999
IV cannulas	6	5	0.999
Syringes	6	5	0.999
Disposable needles	6	5	0.999
Tourniquet	6	2	0.034*
Sterile gauze	6	5	0.999
Sterile bandages	6	5	0.999
Adhesive tape	6	5	0.999
Suture (absorbable)	5	5	0.361
Suture (nonabsorbable)	5	5	0.361
Urinary catheter	6	3	0.102
Sharp disposable container	6	5	0.999
Scalpel blades	6	5	0.999
Face masks	6	5	0.999
Eye protection (goggles/safety glasses)	6	5	0.999
Aprons (partial body coverage)	6	5	0.999
Gowns (full body coverage)	6	5	0.999
Boots (theater shoes)	6	5	0.999
Drapes (for sterile procedures)	5	5	0.361
Loupes	5	3	0.409
Microscopes	5	1	0.045*
S score (average)	**23.2**	**21.4**	**0.054**
Total score (average)	**78.7**	**68.4**	**0.273**

Asterisks (*) signify statistical significance.
Boldface values indicate the overall score for each of the categories within the PIPES (Personnel, Infrastructure, Procedures, Equipment, and Supplies) scoring system.
CT, computed tomography; GP, IV, intravenous; NGT, nasogastric tube; oPt, occupied Palestinian territory; PACU, post-anesthesia care unit.

Supplemental Digital Content 5, which displays supplies score elements of plastic surgery centers in Palestine [n = 11], **http://links.lww.com/PRSGO/D584**.)

Comparative Analysis

Statistical analysis indicated no significant disparities in the total PIPES score when comparing hospitals between the West Bank and Gaza ($P = 0.273$) or between governmental and private healthcare facilities ($P = 0.361$). Detailed comparisons, which are subsequently presented in Tables 2 and 3, were made to discern the disparities based on regional location (West Bank versus Gaza) and the type of each center (governmental versus private), respectively.

Comparison of Plastic Surgery Capacity between Gaza and the West Bank

Healthcare facilities in Gaza were found to have an average of 8 hours of electricity daily, contrasting with the 24 hours observed in the West Bank ($P = 0.002$). The total infrastructure score did not significantly differ between the 2 regions ($P = 0.925$). The availability of certain procedures such as microvascular surgery, amputations, and craniofacial surgery was notably lower in Gaza compared with the West Bank ($P = 0.008$, $P = 0.034$, $P = 0.045$), respectively. Despite these disparities, the overall procedures and equipment scores did not reveal significant differences between regions. However, specific shortages, such as the significantly lower availability of tourniquets in Gaza ($P = 0.034$) were noticed. Table 2 displays comparison of PIPES scores between centers in West Bank versus Gaza.

Comparison of Plastic Surgery Capacity between Private and Governmental Hospitals

In the comparison between private and governmental hospitals, significant disparities were observed in several aspects of plastic surgical capacity in Palestine. Private centers exhibited a higher number of board-certified plastic surgeons ($P = 0.011$) and offered greater bed capacity ($P = 0.018$). Governmental centers were more likely to have systems for identifying complications, intensive care units, and regular plastic surgery training courses (P values: 0.045, 0.029, and 0.009), respectively, as shown in Table 3. The availability of cosmetic surgery was notably higher in private centers ($P = 0.009$).

Table 3. Comparison of PIPES Scores between Governmental versus Nongovernmental/Private Centers

Variable	Private Centers N = 6	Governmental Centers N = 5	*P*
Total No. hospital beds (average)	91	350.2	0.018*
No. plastic surgeons board-certified	7	1	0.011*
No. plastic surgeons not board-certified	2	16	0.052
No. plastic surgeons subspecialists, eg, specialized (formal fellowship) in microsurgery, and burn	1	1	0.892
At your facility, is there a formal residency training program?	0	0	0.999
No. plastic surgery residents (if any)	0	0	0.999
No. medical doctors (nonspecialized aka GPs) in the department of plastic surgery	6	11	0.178
No. plastic surgeons (board/nonboard certified) from this facility who left the oPt (without returning until now) in the last 5 y?	2	0	0.174
P-score (average)	**3**	**5.8**	**0.137**
Running water?	6	5	0.999
External electricity?	6	5	0.999
Average hours of external electricity per day over the last month	16	17.6	0.752
Functioning back-up generator?	6	5	0.999
Incinerator?	6	3	0.102
Medical records?	6	5	0.999
System to identify complications?	5	2	0.045*
Referral system for complex cases?	4	3	0.827
Emergency department?	4	4	0.637
Postoperative care area (PACU/recovery room)?	4	5	0.174
Intensive care unit?	2	5	0.029*
Pretested blood available (blood bank)?	6	4	0.361
Laboratory to test blood and urine?	6	5	0.999
Functioning x-ray machine?	4	5	0.174
Functioning ultrasound machine in this facility (radiology/surgery/emergency department)?	4	5	0.174
Functioning CT scan?	4	5	0.174
No. functioning operating rooms? (average)	4.8	5.4	0.999
Staff at this facility receive specific plastic surgery courses?	0	4	0.009*
I-score (average)	**18.2**	**18.6**	**0.778**
Burn management	4	4	0.637
Skin grafting	4	5	0.174
Contracture release	46	5	0.174
Wound debridement	5	5	0.361
Negative pressure wound therapy (vacuum-assisted closure)	3	4	0.326
Flap surgery (of any type)	5	5	0.361
Free flaps	2	1	0.273
Microvascular surgery	3	2	0.752
Amputation	3	5	0.077
Craniofacial surgery	3	3	0.752
Cleft lip/cleft palate repair	4	4	0.637
Breast reconstruction surgery	2	4	0.637
Cosmetic surgery	6	1	0.009*
Pr-score (average)	**8.7**	**11.2**	**0.454**
Oxygen: compressed (cylinder)	6	5	0.999
Oxygen: concentrator	5	4	0.892
Resuscitator bag valve and mask (adult)	4	5	0.174
Resuscitator bag valve and mask (pediatric)	4	5	0.174
Oropharyngeal airway (adult size)	4	5	0.174
Oropharyngeal airway (pediatric size)	4	5	0.174
Endotracheal tube (adult)	4	5	0.174
Endotracheal tube (pediatric)	4	5	0.174
Pulse oximeter	5	5	0.361
Oxygen masking and tubing	5	5	0.361
Stethoscope	6	5	0.999
Blood pressure measuring equipment	6	5	0.999
Thermometer	6	5	0.999

(*Continued*)

Table 3. ***Continued***

Variable	Private Centers N = 6	Governmental Centers N = 5	*P*
Kidney dish stainless steel	6	5	0.999
Sterilizer (autoclave)	6	5	0.999
Suction pump (manual or electric)	6	5	0.999
Electrocautery machine	6	5	0.892
Microsets	5	4	0.999
Operating room lights	6	5	0.174
Functioning electric generator	6	5	0.999
E-score (average)	**18**	**20.6**	**0.832**
Gloves	6	5	0.999
NGTs	4	5	0.174
IV fluid infusion sets	6	5	0.999
IV cannulas	6	5	0.999
Syringes	6	5	0.999
Disposable needles	6	5	0.999
Tourniquet	3	5	0.077
Sterile gauze	6	5	0.999
Sterile bandages	6	5	0.999
Adhesive tape	6	5	0.999
Suture (absorbable)	6	4	0.273
Suture (nonabsorbable)	6	4	0.273
Urinary catheter	4	5	0.174
Sharp disposable container	6	5	0.999
Scalpel blades	6	5	0.999
Face masks	6	5	0.999
Eye protection (goggles/safety glasses)	6	5	0.999
Aprons (partial body coverage)	6	5	0.999
Gowns (full body coverage)	6	5	0.999
Boots (theater shoes)	6	5	0.999
Drapes (for sterile procedures)	6	4	0.273
Loupes	6	2	0.034*
Microscopes	3	3	0.752
S-score (average)	**22.3**	**22.4**	**0.923**
Total score (average)	**70.2**	**78.6**	**0.361**

CT, computed tomography; GP, general practitioner; IV, intravenous; NGT, nasogastric tube; oPt, occupied Palestinian territory; PACU, post-anesthesia care unit.

DISCUSSION

The significant role of plastic surgery in the context of global surgery is widely recognized.[14] Although plastic surgery is frequently misconceived as being only focused on aesthetic outcomes, in reality, it plays a vital role in addressing a wide range of conditions, improving all aspects of life, from trauma reconstruction and burn treatment to congenital defects and cancer reconstruction.[15,16] In many LMICs, such as the oPt, access to specialized plastic surgery care is limited, impacting the quality of life and the overall health outcomes of patients. Several studies have demonstrated how the lack of such specialized services can have detrimental effects on morbidity and long-term impairment across the population served. As such, it is critical to adopt a thorough approach to surgical care that actively involves both basic and advanced plastic surgery procedures.[17] The "Plastic Surgery at War" study, which covered conflicts and countries since 2001 across various regions such as the United States, England, France, Palestine, Turkey, and Lebanon, showed how in the context of conflict, plastic surgeons play a critical role in managing complex reconstructions, especially for craniofacial trauma and wound management.[18]

Our study represents the first nationwide, systematic, and comprehensive analysis of plastic surgical capacity across healthcare facilities in the West Bank and Gaza. The findings echo similar challenges faced by other LMICs, underscoring a global challenge in the delivery of surgical care. Lebanon, neighboring the oPt and listed as an LMIC by the World Bank in 2022, is one example.[19] The surgical capacity (not specialty-specific) in Lebanon was evaluated using the PIPES survey tool, and a thorough quantitative analysis revealed significant surgical capacity gaps and disparities affecting refugee populations.[20] Nevertheless, the unique circumstances of the oPt, which include the siege on Gaza, military checkpoints and settlements in the West Bank, and political divisions in both regions, further exacerbate these challenges.

Despite our findings indicating no notable differences in terms of regional or administrative analysis, the overall situation in the oPt's healthcare infrastructure prompts urgent attention. This is due to significant variations within specific elements of the PIPES categories, which is concerning given the constrained resources and diverse challenges in the region. These challenges include political instability, restrictions on health facility construction, limitations on medical supplies, movement constraints

for health workers, and barriers to establishing a national medical strategy.[21]

One key finding was that of the 11 centers examined, only 7 had board-certified plastic surgeons. Additionally, the oPt lacks a nationwide residency program for plastic surgery. The situation in the oPt mirrors the scarcity of specialized plastic surgeons in other LMICs as well. A study conducted to quantify the plastic surgery workforce in LMICs revealed that only 63 surgeons considered themselves plastic surgeons across 15 LMICs, with no surgeons identified in the remaining 16 LMICs.[16]

One of the most critical challenges in Gaza was the limited availability of electricity, further prompting the need to address these global concerns in the oPt and other LMICs.[22] The Lancet Commission lists reliable electricity and adequate infrastructure among the 10 essential needs for the provision of safe surgical and anesthesia care globally.[23]

Our study uncovered a significantly lower availability of certain procedures, such as microvascular surgery, amputations, and craniofacial surgery, between Gaza and the West Bank. Such findings may stem from larger systemic challenges that could be due to unequal resource allocation and access to healthcare training and education. These challenges are even more pronounced in areas affected by recurrent conflict. The aforementioned "Plastic Surgery at War" study reported that microsurgical reconstruction was a primary focus in 40% of the published articles. It also emphasized that 40% of the surgical care provided was mainly for managing significant upper/lower extremity injuries, while craniofacial surgery accounted for 16.4% of the cases.[18] Additionally, traumatic amputations remain one of the most frequent and disturbing wounds of conflicts of a similar nature, with most amputees developing residual and phantom limb pain that significantly impacts their quality of life.[24,25]

A review by the WHO emphasizes that healthcare systems in fragile and conflict-affected states often struggle with resource allocation, impacting the provision of specialized medical services.[2] The situation in the oPt, marked by ongoing military aggressions by Israel and economic constraints, mirrors these global findings and exemplifies how geopolitical instability and resource scarcity can yield unequal access to healthcare services and significantly affect the availability of advanced medical procedures. The occupation of the oPt has had detrimental effects on determinants of health and healthcare provision. There have been multiple reports documenting the imposed challenges concerning the chronic shortage of health workers, equipment, medicines, and supplies, in addition to movement restrictions and a permit regime that prevents access to timely and urgent health services.[26] These, in addition to many other challenges, become even more evident in the context of recurrent military offensives. For example, Gaza has suffered from several Israeli military aggressions in 2008, 2012, 2014, 2021, 2022, May 2023, and October 2023 resulting in a collapsed healthcare infrastructure.[27] The most recent military aggression (October 2023) has compromised the healthcare system even more; of the 36 hospitals, only 12 are partially functioning, one minimally, and 23 are nonfunctional.[28,29] Furthermore, of the 80 primary healthcare facilities, only 20 remain operational.[30] The ongoing attacks have not only affected the infrastructure but also yielded severe losses to the healthcare workforce. As of March 11, 2024, the conflict has tragically resulted in the deaths of 337 healthcare workers.[31] Among those lost was Dr. Medhat Sedim, a distinguished participant in this study and one of the very few board-certified plastic and burn surgeons in Gaza.[13]

It is important to highlight that many healthcare facilities in the region are often unable to operate at full capacity, particularly in areas such as Gaza and certain regions of the West Bank, due to the ongoing military occupation and intermittent military operations targeting healthcare facilities and healthcare workers.[32] These facilities largely function through the combined efforts by local governance and international nongovernmental organizations. The WHO, International Committee of the Red Cross, and charitable organizations such as the Palestine Children's Relief Fund and Medical Aid for Palestinians are the main sources of nongovernmental support for plastic surgery capacity building through providing training and medical supplies.[33,34] These combined efforts are crucial in maintaining continuous medical services in this challenging environment.

In summary, this study revealed notable gaps in plastic surgical care in the oPt, and highlights the nationwide scarcity of board-certified plastic surgeons and the complete absence of residency programs. Additionally, the study's comparative analysis on regional and type-of-facility basis showcases significant disparities in the allocation of resources and surgical capacity, with significantly critical challenges (such as electricity) being more pronounced in Gaza. The aforementioned deficits prompt the pressing need for strategic policy change and targeted global collaboration at a systematic level. This may entail the establishment of residency and training programs to build sustainable local capacity. Future research could build upon our findings by focusing on the volume of surgical cases, access to plastic surgery services, and surgical outcomes. There is also a need for updated assessments to reflect the current realities and challenges faced by the region. This study will contribute further to the global discourse on healthcare dynamics in conflict zones with the hopes of providing insights and strategies that can be applied in similar settings around the world.

Our study has several limitations. First, the unstable nature of healthcare facilities in the oPt, a setting challenged by ongoing conflicts and resource limitations, means that changes in surgical infrastructure and resources may have occurred during the study period. Second, the self-reported approach in completing the questionnaires could potentially introduce variations in reporting and recall bias. Finally, our modified PIPEs tool (like the original version) does not take into account the volume of surgical procedures performed annually, the population's access to plastic surgery services, or the outcomes of these procedures.

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DISCLOSURE

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