Common pediatric surgical conditions and associated health-seeking behaviors in Pakistan: an urban and rural comparative assessment

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Abstract

Approximately five billion people do not have access to necessary surgical treatment globally and up to 85% of children in LMICs are affected with conditions requiring surgical care by the age of 15 years. It is crucial to identify common surgical conditions in children in Pakistan to inform healthcare professionals and policymakers for effective resource allocation. This is a representative cross-sectional household survey conducted on children aged 5-10 years. It is to assess existing surgical diseases and healthcare-seeking behaviors in the two largest provinces (Sindh and Punjab) of Pakistan. Data was collected through a validated cross-sectional survey tool [Surgeons OverSeas Assessment of Surgical Need (SOSAS)]. Caregivers were asked about their child's recent and past surgical conditions in six distinct anatomical regions and pictures were taken of identified conditions after appropriate consent for further diagnosis. Health-seeking behaviors including the kind of treatment sought, the nature of care received, and the reasons for not receiving care were noted. The study found that 13.5% of children with a surgical condition, had similar distribution across the urban (13.2%) and rural (13.7) areas. The greatest number of surgical conditions were found to be on the head and neck region (57.7%), while the back accounted for the least number of conditions (1.7%). Our results outline a need for organizing all entities (governmental, non-governmental, and private) involved in child health to ensure efficient resource allocation to cater to existing surgical problems.

Introduction

Conditions requiring surgical care are responsible for at least 11% of the overall global disease burden [1]. An estimated five billion people do not have access to basic surgical care, which makes the prevalence of surgical conditions in low- and middle-income countries (LMICs) particularly noteworthy [2]. In South Asia, more than 95% of the population lacks adequate access to medical care for conditions that require management through procedures [3]. Even more notable is the high surgical disease density in children, with 85% of children in LMIC's having conditions requiring surgical care by the age of 15 years [4]. Many of these conditions manifest during the formative years of childhood, hence carry the possibility of lifelong disability or an increased risk of mortality [5] if not managed correctly in time.

In LMICs, where children make up nearly half of the overall population, there is relatively low attention paid to surgical conditions as the focus remains on malnutrition, infectious diseases and newborn care [6]. According to the United Nations, to attain the Sustainable Development Goals (SDGs) which include "health system strengthening and universal health coverage", it is essential to have access to appropriate healthcare [7]. The infrastructure, personnel, and resources necessary for pediatric surgical care are distinct from those required for adults [8]. As a crucial aspect of healthcare in LMICs, the enhancement of surgical healthcare provision for children is currently under focus [9] and this carries great socioeconomic benefit, as unresolved surgical issues potentiate medical expenses, incapacity, and loss of productivity. Therefore, techniques for improving the standard of pediatric surgical care in low socio-economic areas can significantly lower childhood mortality and morbidity and decrease the associated psychosocial and financial stress [2] [10]. To achieve this goal, it is crucial to accurately identify the existing common

pediatric surgical conditions, that can assist healthcare professionals and policymakers in efficient allocation of budget, skilled personnel, and equipment.

A small scale study in rural Pakistan has shown a high demand for pediatric surgical care, with a staggering 14.3% unmet operative need [11], thus highlighting the importance for a larger scale assessment. According to the World Bank, Pakistan, an LMIC in South Asia, is amongst the five most populous countries in the world [12] and children below the age of 18 years account for more than 45% of the population [13]. There are small scale studies that describe pediatric surgical crises in Pakistan, however, a large scale population representative study had yet to be conducted to gauge Pakistan's common pediatric surgical conditions and their distribution [14] [15] in a systematic manner. This study aims to evaluate the prevalence of pediatric surgical conditions in school age children and comprehend the health-seeking patterns in rural and urban areas of the Punjab and Sindh provinces of Pakistan.

METHODOLOGY

Study design

This is a cross sectional household survey conducted on a population of children between the ages of 5-10 years, with the aim to outline the distribution of common surgical conditions and understanding the existing health seeking behavior.

Study setting

The survey was carried out in the two largest provinces of Pakistan, Sindh and Punjab, which comprised more than two-thirds of Pakistan’s population, in the year 2020-21. Punjab is the most densely populated province in Pakistan with a population of over 110 million [16] followed by Sindh with a population of approximately 47.9 million [17].

Sample Size and Sampling strategy

The study was part of a larger survey focusing on the overall health and nutrition of school age children (5-10 years of age). The sample size was estimated assuming the response rate of 90%, 95% confidence interval, 7% precision, 1.5% design effect, and the total minimum sample size required was 2055 individuals in Sindh and 3582 in Punjab. We took the Pakistan Bureau of Statistics framework and randomly selected enumeration blocks (clusters) form both the urban and rural areas (population proportionate), which were termed Primary Sampling Units (PSUs). Multistage sampling was done to select enumeration blocks and 20 households were randomly selected (Secondary Sampling Units) from each cluster. Households that refused to participate were replaced with the next house in the randomization process.

Survey Tool

Data was collected through a validated cross-sectional survey tool [Surgeons OverSeas Assessment of Surgical Need (SOSAS)]. SOSAS has evolved into a validated population-based household survey which evaluates the prevalence of conditions requiring surgical treatment [18] [19]. The SOSAS questionnaire is divided into two specific components; the first component focuses on demographic information and includes the age and gender of all the residents in a household (household members were defined as people living in the same residence) and the second component focuses on children's recent and past surgical conditions in six distinct anatomical regions: head, eyes, face, ears and neck; chest; back; abdomen; groin, genitals, and buttocks; arms, hands, legs, and feet. The nature of surgical condition whether acquired (example: wounds, hernia, renal stones, and bleeding per penis/rectum) or congenital (example: congenital

cardiac and eye problems) and health seeking behaviors, including the kind of treatment sought, the nature of care received, and the reasons for not accessing or receiving care were all noted.

Data collection

The survey was conducted in two rounds. Round one in Sindh was between (5th to 22nd March 2020) and round two was from (1st June - 17th July 2020). In Punjab round one was between (27th February-22nd March 2020) and round two from (19th September to 22nd October 2020). Data was collected from all the six divisions and 27 districts in Sindh, and all the nine divisions and 36 districts in Punjab. Households were line-listed and a total of 5,677 (rural: 3,531 and urban: 2,146) eligible houses were randomized **(Table 1)**. The survey was conducted by research personnel who were trained for data collection and were monitored by senior research personnel. A pilot study for initial assessment and improvements was conducted in 50 households. Information was recorded electronically via an application developed specially for this survey by the Data Management Unit (DMU). The application was developed for Android, and an IIS-10 webserver was set up with MySQL database to collect data in remote areas. The application was used on Samsung tab A7 tablet. To restrict inappropriate access to the application, authorized data collectors were required to authenticate using login credentials that were specifically generated for the use of this application on the server. Along with the survey, a set of 736 pictures were taken of surgical conditions, from a total of 1,536 (47.9%), after obtaining written informed consent from patients and caregivers. These pictures were shared with the relevant doctors at the Aga Khan University Hospital (AKUH) for further diagnosis, and reconfirmation. Pictures were taken through the same application and stored on the server under password protection.

Data Analysis

Surgical conditions in children, either present at the time of the survey or in the past were noted as conditions requiring surgical care. Unmet surgical need was defined as a surgical condition that requires active surgical care, for which the child did not access or receive surgical care. Sampling weights were added to the data at household and individual level, to account for unequal selection probabilities and non-response. A standard survey module was used to consider the multi-stage survey design including stratification, clustering, and sampling weights. Descriptive statistics for the subjects were estimated and reported as mean (±SD), median, ranges and frequencies as appropriate. The analyses estimated results at district level with population subgroups such as age, gender, school status (in-school or out-of-school) and geographical location (urban or rural), and districts of the region. Descriptive analysis was performed using STATA 16 (Stata Statistical Software: Release 16. College Station, TX: StataCorp LP) [20]. Chi squared tests were performed to determine the association between a child's school attendance and socioeconomic status of the family, and the nature of surgical condition. A p-value of less than 0.05 was considered statistically significant to conclude an association.

Ethics Statement

Ethical approval was granted by the Ethics Review Committee (ERC) of the Aga Khan University and the National Bioethics Committee (NBC). At every stage of the data handling process, protecting the privacy of all gathered information was ensured and every interview was conducted in a confidential setting and encrypted data was secured in password protected central database. The research participants were informed about the purpose, methods and benefits and intended use of the research. Informed consent was obtained from the parent/guardian of each participant under 18 years of age. Respondents were free to stop interview at any time or skip any questions they

did not want to answer. They had the right to ask questions at any point before, during or after the interview. All interviews were conducted by trained staff and in conditions of privacy.

RESULTS

Demographics

Of the 5,677 households, we surveyed a total of 8,026 children, of which 935 children were noted to have surgical conditions that required attention. **(Table 1).**

Surgical conditions identified

Lesions

A total of 585 (11.5%) children in rural, and 350 (11.9%) children in urban areas were identified to have a total of 1,536 surgical conditions. A few children were found to have more than one type of surgical condition. An overview of the surgical conditions noted is presented in **Table 1**. From the total identified conditions, pictures were taken of 736, after appropriate consent, for further diagnosis and review. Majority of the pictures were of conditions on the head and neck region (n = 328, 44.6%). More information on lesion pictures can be found in **S1 Table**.

Through a head-to-toe survey via the SOSAS tool, the head and neck region (comprising of the head, eye, ear, face, and neck) was found to be the most frequently affected region in both rural (54.3%) and urban (65.9%) areas. The common conditions noted were mostly wounds secondary to trauma. **Table 2a.**

Table 1: Details of children with lesions

	Rural	Urban
Clusters in Sindh	51	57
Clusters in Punjab	123	67
Total households	3531	2146
Total number of children	5,073 (63.2%)	2,953 (36.8%)
Total number of children with surgical lesions	585 (11.5%)	350 (11.9%)

Total number of surgical lesions		1,020 (66.4%)	516 (33.6%)
Socioeconomic status of family	High income	222 (38.1%)	265 (75.9%)
	Low income	362 (62%)	84 (24.1%)
School attendance	Yes	454 (77.7%)	302 (86.5%)
	No	130 (22.3%)	47 (13.5%)
Age	5 years	166 (16.3%)	82 (15.9%)
	6 years	238 (23.4%)	115 (22.3%)
	7 years	212 (20.8%)	124 (24.0%)
	8 years	218 (21.4%)	106 (20.5%)
	9 years	185 (18.2%)	89 (17.2%)
Gender of the child	Male	2,616 (51.6%)	1,503 (50.9%)
	Female	2,457 (48.4%)	1,450 (49.1%)

Head and neck

A sum of 886 surgical conditions were identified in this region. The most affected area was the face (27.7%), followed by the head (25.8%), ears (20.9%), eyes (20.9%), and neck (4.7%). Conditions noted on the head, eyes and face were mostly secondary to trauma, while conditions on ears and neck were consistent with acquired conditions such as mass or growth or congenital deformities.

A total of 328 pictures were taken of the surgical conditions from this region, which identified scars/keloids (n = 76) and scarring alopecia (n = 47) as the most common conditions on the head, and post-traumatic disfiguring scars (n = 42) as most common condition of the face. Growths, comprising of hemangiomas (n = 4) and mass/cyst/swellings (n = 4), were the most common conditions on the neck as diagnosed through pictures. Percentage of surgical conditions on the head and neck region for which no surgical care was sought was found to be 6.7% in rural areas, and 11.7% in urban settings. **(Table 2a).**

Table 2a: Lesions on head and neck

Region	Eyes (n = 185)	Ears (n = 185)	Face (n = 245)	Head (n = 229)	Neck (n = 42)

Surgical problem	Lesions n (%)		Lesions n (%)		Lesions n (%)		Lesions n (%)		Lesions n (%)	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Wound (Secondary to accident)	10 (12.6)	30 (28)	4 (7.0)	8 (4.8)	75 (75.8)	117 (76.5)	65 (64.4)	89 (60.0)	1 (9.6)	2 (4.4)
Wound (Others)	13 (20.8)	18 (12.6)	41 (64.6)	74 (58.5)	7 (11.4)	20 (15.3)	9 (15.9)	29 (23.3)	2 (9.4)	9 (30.0)
Burn	1 (0.8)	4 (4.1)	1 (0.8)	0 0	2 (2.3)	2 (1.2)	2 (1.9)	1 (0.7)	2 (13.9)	1 (5.6)
Mass or growth (Solid)	5 (5.6)	5 (4.2)	2 (2.7)	3 (2.2)	1 (0.6)	1 (0.9)	4 (3.3)	9 (9.6)	4 (33.3)	12 (48.0)
Deformity congenital	16 (20.4)	29 (24)	13 (21.2)	19 (14.9)	5 (5.7)	5 (2.5)	1 (0.7)	2 (1.3)	4 (28.6)	3 (10.2)
Deformity acquired	2 (2.7)	3 (3.0)	1 (2.5)	7 (9.5)	3 (4.2)	7 (3.7)	11 (13.8)	7 (5.1)	1 (5.4)	1 (1.8)
Blindness	0 (0)	1 (0.8)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Reduced Vision	23 (37.1)	25 (23.5)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Hearing loss	N/A	N/A	1 (1.3)	11 (10.1)	N/A	N/A	N/A	N/A	N/A	N/A

(The percentages in the table below are a result of a weighted analysis)

Chest

A total of 48 conditions requiring surgical attention were noted on this region, majority of the conditions in rural areas were secondary to traumatic injury (20.4%), closely followed by non-injury-related wounds (19.8%), such as congenital deformities, more details in **Table 2b**. Falls were identified as one of the main reasons leading to traumatic surgical conditions in both urban (81.3%) and rural (75.8%) areas.

A total of 11 pictures were taken of the conditions on the chest which identified pectus excavatum (n = 5) and lymphangioma (n = 3) as the most commonly present conditions.

Back

We identified 26 conditions on the back, of which majority consisted of non- traumatic lesions, such as congenital deformities and acquired mass or growths, more details in **Table 2b**.

The 12 pictures obtained highlighted hemangiomas (n = 4) and other soft tissue swelling (n = 2) as common conditions of the back that required surgical evaluation. In urban localities, burn injury (25.3%) was found as the most common condition. The survey identified a high percentage of population that did not receive surgical care for conditions on the back, amounting to 14.5% in rural and 38.6% in urban areas.

Abdomen

Of the 106 surgical conditions noted in the abdomen, most consisted of abdominal distention with pain and children's inability to urinate appropriately, more details in **Table 2b**.

A set of 40 lesion pictures taken identified abdominal hernia (n = 22) as the most common surgical condition of the abdomen. Most wounds secondary to trauma resulted from burns, in both urban (50.8%) and rural (48.4%) areas.

Buttocks/ Groin/ Genitalia

Among a total of 49 surgical conditions identified in this region, most consisted of non- traumatic lesions, in both urban and rural areas. Congenital deformities and mass/swellings were also noteworthy conditions noted that required a surgeon's evaluation (**Table 2b)**.

A total of 19 pictures were taken of the surgical conditions on buttock/groin/genitalia, which identified inguinal hernia (n = 7) and gluteal abscesses (n = 6) as common conditions. Of the wounds secondary to trauma, falls were noted as the most common cause in both urban (48.8%) and rural (72.5%) areas.

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229 **Table 2b: Lesions on chest, back, abdomen, buttocks/groin/genitalia**

Region	Chest (n = 48)		Back (n = 26)		Abdomen (n = 106)		Buttocks/Groin/Genitalia (n = 49)	
Surgical problem	Lesions (%)		Lesions (%)		Lesions (%)		Lesions (%)	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Wound (Secondary to accident)	2 (14.4)	7 (20.4)	0 (0)	4 (19.5)	1 (3.0)	3 (3.1)	1 (5.3)	1 (2.7)
Wound (Other)	3 (12.1)	6 (19.8)	2 (38.6)	7 (39)	3 (8.6)	4 (7.2)	4 (20.1)	12 (29.2)
Burn	1 (3.3)	1 (3.0)	2 (25.3)	1 (2.7)	2 (11.3)	5 (7.1)	0 (0)	2 (9)
Mass or growth (Solid)	3 (18.1)	0 (0)	1 (15.7)	3 (11.8)	1 (1.3)	2 (6.5)	3 (22.7)	2 (3.4)
Mass or growth (Reducible)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (1.8)	1 (15)	2 (10.4)
Deformity congenital	4 (29.5)	4 (14)	1 (20.4)	4 (22.4)	0 (0)	4 (5.6)	2 (9.1)	6 (16.3)
Deformity acquired	0 0	3 (10.8)	0 (0)	1 (4.6)	0 (0)	0 (0)	1 (2.4)	3 (12.1)
Foreign body	2 (6.2)	5 (17.7)	0 (0)	0 (0)	0 (0)	1 (1.4)	0 (0)	0 (0)
Cardiac (Congenital)	3 (16.4)	4 (14.1)	0 (0)	0 (0)	1 (2.6)	2 (3.2)	N/A	N/A
Abdominal distention or pain	N/A	N/A	N/A	N/A	10 (33.2	16 (21.1)	N/A	N/A
Inability to urinate	N/A	N/A	N/A	N/A	10 (25.7)	27 (34)	0 (0)	0 (0)
Renal stone	N/A	N/A	N/A	N/A	2 (11.2)	2 (1.6)	0 (0)	0 (0)
Bleeding (Per Rectum)	N/A	N/A	N/A	N/A	1 (3.1)	7 (7.5)	2 (10.3)	3 (11.8)
Bleeding (Per Penis)	N/A	N/A	N/A	N/A	N/A	N/A	1 (15)	2 (5.3)

230 (The percentages in the table below are a result of a weighted analysis)

231 *Extremities*

232 Out of the total 202 conditions identified on the upper limb, proximally to distally; 11.9% were on

233 the upper arm, 36.1% on the lower arm, and 39.6% on the thumb/hand, and fingers. Majority

conditions, in both rural and urban areas were secondary to trauma. Falls were noted as the most common cause of injury in the upper arm, lower arm, and hand. Of the 156 pictures taken of the upper limb conditions, post-burn severe depigmentation (n = 12) and lacerations/big scars (n = 12) were identified as common surgical conditions.

Out of the 219 surgical conditions noted on the lower limbs proximally to distally, 10.6% were on upper leg, 33.3% on lower leg, and 55.7% on feet and lesions were mostly due to trauma. A total of 170 pictures of the lower extremities noted lacerations and scars (n = 16) as the most common conditions requiring surgical review. A high percentage (26.5% in rural and 28.1 % in urban) of population did not access surgical care for their upper and lower limb (extremities) lesions. (**Table 2c)**.

Table 2c: Lesions on extremities

Region	**Fingers (n = 32)**		**Thumb/Hand (n = 48)**		**Upper arm (n = 49)**		**Lower arm (n = 73)**		**Upper leg (n = 24)**		**Lower leg (n = 73)**		**Foot (n = 122)**	
Surgical problem	**Lesions (%)**		**Lesions (%)**		**Lesions (%)**		**Lesions (%)**		**Lesions (%)**		**Lesions (%)**		**Lesions (%)**	
	Urban	**Rural**	**Urban**	**Rural**	**Urban**	**Rural**	**Urban**	**Rural**	**Urban**	**Rural**	**Urban**	**Rural**	**Urban**	**Rural**
Wound (Secondary to accident)	5 (70.5)	17 (69.9)	6 (29.5)	11 (30.5)	4 (25.7)	18 (45.7)	10 (73.7)	34 (54.2)	2 (42.4)	6 (26)	11 (48.5)	21 (42.3)	17 (48.1)	40 (41.8)
Wound (Other)	0 (0)	2 (10.7)	1 (6.1)	8 (25.7)	0 (0)	12 (39.5)	0 (0)	11 (22.6)	1 (21.1)	3 (13.3)	2 (10.2)	12 (26.6)	3 (8)	19 (23.4)
Burn	0 (0)	1 (1.9)	2 (19.4)	6 (19.7)	1 (13.9)	2 (3.9)	1 (5)	2 (2.9)	2 (36.5)	2 (14.4)	8 (21.2)	3 (6.6)	5 (15.3)	12 (15.2)
Mass or growth (Solid)	0 (0)	0 (0)	2 (8.4)	0 (0)	0 (0)	1 (3)	1 (4.3)	1 (3.6)	0 (0)	1 (3)	0 (0)	0 (0)	0 (0)	0 (0)
Deformity congenital	0 (0)	2 (9.4)	2 (22.5)	1 (5.8)	0 (0)	0 (0)	1 (7.1)	1 (1.7)	0 (0)	2 (12.1)	0 (0)	3 (4.5)	2 (5.4)	10 (12.1)

Deformity acquired	3 (29.5)	2 (8.1)	1 (14.2)	6 (13.8)	8 (60.4)	3 (7.8)	2 (9.9)	9 (15)	0 (0)	4 (23.8)	4 (20.1)	6 (10.1)	4 (18.7)	8 (7.7)
Recurrent drainage / discharge	0 (0)	0 (0)	0 (0)	2 (4.6)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (7.4)	0 (0)	3 (10.1)	2 (4.4)	0 (0)

(The percentages in the table below are a result of a weighted analysis)

Health Seeking Behavior

Approximately 86.8% of surgical conditions in urban, and 86.3% in rural areas were managed at a health care facility, ranging from private, government, and NGO-based health facilities. The remaining 13.7% surgical conditions in rural and 13.2% in urban areas received no surgical care, or were managed by a traditional healer. A small fraction of surgical conditions identified received only medical management despite visiting a health care facility (4.7% in rural areas and 3.5% in urban areas).

The main reasons identified for not seeking surgical care included the caregiver's perception of the condition being non-surgical [rural areas (48.5%), and urban areas (55.4%)], followed by an inability to afford health care. Approximately 33.6% patients and their families in rural areas could not afford health services, which was 8.9% higher than the patient population in urban areas. (**Table 3).**

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268 **Table 3: Lesion management and impact**

			By area of residence		By Income status	
			Rural	Urban	Low-income	High-income
Total number of children with surgical conditions			585	350	435	500
Total number of surgical conditions			602 (100%)	312 (100%)	451 (100%)	463 (100%)
Lesion managed at Health care facility	Managed at Health facility		492 (82.0%)	267 (83.5%)	367 (81.1%)	392 (83.9%)
	No		110 (18.0%)	45 (16.5%)	84 (18.9%)	71 (16.1%)
	Reasons for not visiting health facility	No money for health care	39 (28.9%)	15 (30.1%)	40 (39.2%)	14 (18.2%)
		No money for transportation	3 (2.2%)	0 (0.0%)	3 (3.0%)	0 (0.0%)
		No time (Died before arrangements)	4 (3.8%)	1 (4.1%)	2 (2.8%)	3 (5.1%)
		Fear / No trust	5 (4.1%)	3 (3.3%)	2 (2.0%)	6 (6.0%)
		Not available (Facility/personnel/equipment)	7 (4.4%)	3 (4.6%)	4 (3.0%)	6 (6.1%)
		No need (Condition is not surgical)	61 (54.5%)	25 (52.0%)	36 (45.8%)	50 (62.6%)
		Other	3 (2.3%)	2 (5.5%)	3 (4.3%)	2 (2.1%)
Where were these conditions managed?	At home		33 (6.2%)	7 (2.5%)	16 (4.1%)	24 (5.8%)
	Government health facility		214 (45.6%)	119 (43.9%)	170 (47.4%)	163 (42.7%)
	Private health facility		190 (38.3%)	118 (45.7%)	135 (37.4%)	173 (43.9%)
	NGO health facility		3 (1.4%)	2 (0.9%)	4 (2.0%)	1 (0.4%)
	Hakeem/Traditional Healer		52 (8.6%)	21 (6.9%)	42 (9.0%)	31 (7.2%)
Type of treatment received for surgical conditions	None/No surgical care		12 (2.7%)	4 (1.3%)	6 (1.9%)	10 (2.6%)
	Only medical treatment		251 (53.2%)	125 (50.1%)	187 (53.5%)	189 (51.3%)
	Major procedure (A procedure which requires regional or general anesthesia)		22 (4.8%)	18 (6.7%)	16 (4.3%)	24 (6.5%)
	Minor procedure (Dressings, wound care, punctures, suturing and I&D)		153 (28.9%)	93 (31.1%)	114 (29.0%)	132 (30.2%)
	Manipulation / casting / sling		43 (8.4%)	25 (9.8%)	36 (9.7%)	32 (8.0%)
	Traction		11 (2.0%)	2 (0.7%)	8 (1.7%)	5 (1.5%)
Does this problem (Disability) still impact on child's daily life (Multiple response)	The condition is not disabling		530 (87.4%)	276 (88.7%)	395 (87.7%)	411 (88.0%)
	He/she feels ashamed		39 (6.6%)	13 (3.3%)	31 (7.0%)	21 (4.0%)
	He/she not able to work like he/she used to		21 (3.5%)	11 (3.5%)	14 (2.9%)	18 (4.1%)
	He/she needs help with transportation		24 (4.0%)	7 (2.3%)	20 (4.4%)	11 (2.6%)
	He/she needs help with daily living		21 (4.2%)	15 (5.4%)	16 (4.1%)	20 (5.0%)

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270 Comparison of the type of surgical injuries and regions of the body affected was done between

271 children who attended school and those who did not attend school. We found that children who

272 did not attend school were more likely to have surgical wounds as a result of falls (P-value 0.02)

and there was no statistically significant difference in the region of the body affected between school going and non-school going children, more details in **Table 4.**

A comparison was done between children belonging to low and high income socioeconomic groups for the type of wounds which required surgical care, and the region of the body affected. Children belonging to low socioeconomic groups were found to be affected more by traumatic wounds secondary to stab/slash/cut/crush (P-value 0.00), bite or animal attacks (P-value 0.02) and falls (P-value 0.02). The face (P-value 0.04) was the most affected region, more details in **Table 4.**

Table 4: Subgroup analysis according to school attendance and socioeconomic status

Surgical problem type	Children attending school (%)				Socioeconomic status (%)			
	Yes (n = 4632)	No (n = 945)	Total	P-value	Low (n = 3358)	High (n = 4668)	Total	P-value
Injury/accident-related wound								
I. Car, truck, bus crash	0.036	0	0.03	0.55	0.047	0.015	0.028	0.32
II. Motorcycle crash	1.06	0.62	0.99	0.27	0.99	0.79	0.88	0.37
III. Pedestrian, bicycle crash	0.15	0	0.12	0.30	0.14	0.1	0.12	0.65
IV. Gunshot/firearm	0.033	0	0.028	0.66	0.046	0.014	0.027	0.36
V. Stab/slash/cut/crush	0.88	1.16	0.92	0.45	1.2	0.48	0.78	0.00*
VI. Bite or animal attack	0.26	0.052	0.22	0.09	0.44	0.17	0.28	0.02*
VII. Fall	3.17	5.06	3.48	0.02*	4.08	2.9	3.39	0.02*
VIII. Open fire/explosion	0.14	0.062	0.13	0.45	0.082	0.15	0.12	0.41
IX. Hot liquid / hot object	0.24	0.17	0.23	0.66	0.25	0.18	0.21	0.51
Region of surgical problem								
Head	2.56	2.85	2.6	0.63	2.96	2.44	2.66	0.27
Eyes	2.87	2.36	2.78	0.48	2.47	2.72	2.61	0.53
Ears	2.1	2.72	2.2	0.26	2.61	1.81	2.15	0.06
Face	2.96	3.47	3.05	0.43	3.46	2.41	2.84	0.04*
Neck	0.66	0.53	0.64	0.65	0.54	0.53	0.54	0.93
Chest	0.67	0.71	0.68	0.91	0.65	0.72	0.69	0.74
Back	0.38	0.51	0.4	0.57	0.34	0.33	0.34	0.94
Abdomen	1.35	1.85	1.43	0.25	1.4	1.43	1.42	0.91
Buttocks/Groin/Genitalia	0.58	0.97	0.65	0.18	0.68	0.59	0.63	0.65
Extremities	0.022	0	0.019	0.64	0.016	0.02	0.013	0.34

Discussion

This large-scale survey identifies common surgical conditions and the care received in children between the ages of 5-10 years, in the two most densely populated provinces of Pakistan. It is a crucial step in understanding the surgical disease burden, and helps note the nature, site distribution and severity of the conditions, along with variance by urban and rural divide and socio-economic status in Pakistan.

The survey highlights a high surgical burden, with a similar distribution across both urban and rural areas of Pakistan. The highest number of surgical conditions were found on the head and neck region (57.7%) while the back region accounted for the least number of surgical conditions (1.7%). The survey identified a high percentage of surgical conditions for which children did not receive any surgical care. Calculated as an average of urban (13.2%) and rural (13.7%), this amounted to a staggering 13.5%. Across both rural and urban areas, the extremities were identified to have the highest percentage of surgical conditions for which care was not received (26.5% and 28.1% respectively) due to multiple reasons. Of the caregivers who did not seek healthcare services for their child's lesion, approximately half believed that the condition did not require surgical attention. This is high in comparison to a recent smaller scale study in a rural district of Pakistan, where the unmet operative need was calculated as 14.3% [11]. This study conducted at a larger scale highlights a similar pattern of high pediatric surgical disease burden in Pakistan. In

comparison to other South Asian countries including Nepal (unmet surgical need of 5%) [21] and our neighboring country India (unmet surgical need of 6.5%) [22] the surgical lesions having not received appropriate care in Pakistan is more than double (13.5%), pointing towards the urgent need for attention by policy makers. Pakistan faces a higher current unmet operative need, even with a greater proportion of doctors (1.1 per 1000 people) when compared to India (0.7 per 1000 people) [23]. This brings to notice the need for improvement measures in resource allocation, capacity building, community engagement and policy development to improve surgical care access in especially the rural areas of Pakistan.

This study provides evidence that majority of the surgical conditions noted affect the head, face and neck region of children, which not only requires timely surgical treatment but also needs to be followed up for post-trauma psychosocial effects [24]. Community programs, similar to existing programs for communicable diseases like diarrhea and pneumonia, are required [25]. However, work needs to be done in expansion and incorporation of surgical disease awareness, to increase the local population's knowledge of common operative conditions and promote capacity building of health facilities at the district level. It is vital to spread a better understanding of the various types of surgical conditions and when to seek timely care, in order to reduce the associated morbidity and mortality in children. In an effort to prevent possibly disabling problems in children, awareness and training campaigns on preventative strategies for common causes of injuries like burns, falls and electrocution should be undertaken. Policies for health care subsidies are required in rural areas where most families are unable to afford health care for their children, especially as this study highlighted the inability to afford health care services as the second most common reason for not seeking care. Additionally, a large percentage of surgical conditions were secondary to trauma, so investing in lay-person training [26] for pre-hospital basic and preventive care can help

reduce the burden on local health care facilities and can also provide the critical extra time needed for transportation of patients to hospitals.

Efforts towards establishing a link between tertiary care centers and local health facilities can assist in efficient resource allocation with respect to the patient population visiting those centers. Along with this, effective patient referral systems need to be set up for surgical cases to be transferred from one center to another for further care after stabilization. Follow-up visits may be set up through calls to avoid transportation costs, which can lead to a reduction in the number of patients lost to follow up, and an improvement in patient monitoring. Implementation of trauma care guidelines [27] can help streamline the process of health care delivery, in effect assisting emergency staff in making quicker decisions leading to effective surgical care delivery. Regular assessments of resources and trained personnel, and intercommunication systems between local community hospitals may allow for efficient and timely redistribution of limited resources as per need and in an efficient manner.

Potential limitations of this study include the sample size possibly not representing the overall national picture of surgical burden; however, it does offer significant representation of any rural and urban setting in Sindh and Punjab. Another limitation is the survey's in-built definition of surgical conditions, as the count of operative conditions in this survey relied upon caregiver's report of the condition in a verbal interview. Hence, the numbers identified via this survey serve as proxies in estimating the burden of surgical conditions. The survey also does not directly take into account chronic diseases such as visceral malignancies, which could require surgical care, thus underestimating the true surgical burden of disease. Despite these limitations, operative conditions recognized by the SOSAS survey provides an estimate for the urgent need to improve surgical consultations and care in Pakistan.

Conclusion

The common surgical conditions and the associated high percentage of lesions not receiving appropriate surgical care requires attention of government policy makers. Our results have outlined the urgent need for organizing all entities (governmental, non-governmental and private) involved in pediatric surgical care delivery in both urban and rural areas. Policies at the federal, provincial and district government level are required for the efficient allocation of budget, and skilled personal (doctors and nurses) with respect to disease burden. Additionally, awareness programs on surgical diseases and urgent care should be planned, implemented, and assessed for effectiveness at the community level.

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Manuscript tables:

Table 1: Details of children with lesions
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Table 2c: Lesions on extremities
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Table F in S1 text chest

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Table H in S1 text abdomen

Table I in S1 text buttocks/groin/genitalia

Table J in S1 text extremities

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