Emergency vs Elective Surgery Ratio in the Cape Metro Area

Alana Stacey Heynes (MBBCH)

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Supervisor: Prof Andrew Nicol
Co-Supervisors: Prof Salome Maswime and Dr Shrikant Peters

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Abbreviations

GSH: Groote Schuur Hospital
VHW: Victoria Hospital Wynberg
LMIC: Low-and-Middle Income Countries
El:Em: Emergency to Elective Ratio

Acknowledgements & Contributions

Author contributions
Alana Heynes[1] - literature review, data collection & analysis, manuscript preparation & submission
Andrew Nicol[2] - manuscript revision
Salome Maswime[3] - manuscript revision
Shrikant Peters[4] - data collection, manuscript revision
Pierre Joubert[5] – data collection

[1] MBBCH, Division of General Surgery, Groote Schuur Hospital, Cape Town
[2] MBChB, FCS(SA), Director of Trauma Centre, Division of General Surgery, Groote Schuur Hospital, University of Cape Town.
[3] MBChB, (SA), FCOG(SA), MMED, PHD, Head of division of Global Surgery, Department of Surgery, University of Cape Town, Cape Town, South Africa
[4] MBChB, BA PPE, MMed (Public Health), FCPHM(SA), Executive Management, Groote Schuur Hospital, Division of Public Health Medicine, University of Cape Town
[5] MBChB, intern at New Somerset Hospital.

1. Abstract

Background

South Africa is classified as an upper middle-income country based on the World Bank classification. The access and delivery of surgical care in South Africa is only recently being investigated and understood. One study by Chu *et al* showed that while more than 80% of South Africans had two-hour access to district level hospitals, just over half of these hospitals had surgical capacity(1). The emergency to elective surgery ratio (Em:El), which measures the number of emergency surgeries per 100 elective surgeries has been used as a metric to assess the delivery of surgical care. This metric was based on a 2018 study, Emergency-to-Elective Surgery ratio: A global indicator of access to surgical care(2). In this study, the Em:El ratio was assessed pre- the COVID-19 pandemic, as a baseline of service delivery, as well as during the COVID-19 pandemic to assess how the ratio was affected as a result of the pandemic.

Methods

A retrospective audit of the computerised database (Clinicom) and the logbooks of Groote Schuur (GSH), a tertiary referral centre and Victoria Wynberg hospital (VWH), a medium district hospital. Data was captured for all patients who underwent elective and emergency surgeries from January 2019 to June 2019 (pre- pandemic) and January 2021 to June 2021(during the pandemic).

Results

Pre-pandemic GSH had an Em:El ratio of 60 emergency surgeries per 100 elective cases. During the phase out of lockdown restrictions in 2021 the Em:El ratio increased by 10% to 70 emergency cases per 100 elective cases, indicating the effect the pandemic had on the access to care. Excluding the trauma burden in South Africa and accounting for the positive effect of lockdown on the trauma rate in South Africa, the ratio would have been 28 per 100 cases in 2019 vs 56.9 per 100 cases in 2021, which better reflects the effects on access to surgical care during the Pandemic. VHW showed a doubling in the Em:El ratio when comparing pre-covid vs post-pandemic statistics.

Conclusion

Compared to comparative data in high income countries in Europe where the Em:El ratio was 5.5, South Africa has poor access to surgical care as evident by our high Em:El ratio of 60 and 73.2 at GSH and VHW respectively. It is also evident from this study that the Covid pandemic significantly decreased the access to surgical care by increasing this ratio to 70 and 146 at GSH and VHW respectively.

2. Introduction

Emergency Surgery has been highlighted as an area of surgical care that places a heavy burden on health care infrastructure. It is an area that has significant morbidity and mortality, which comes at a high cost to the healthcare system (2). Studies have been done in high income settings which describe this burden, however, there is very little data in low to middle income countries to quantify the ratio between emergency and elective surgery. The limited data available suggests that emergency conditions such as trauma, as well as in obstetrics, represent a significant proportion of the surgical needs that are currently unmet (3).

There have been numerous attempts to quantify the emergency vs elective ratio. Unfortunately, the data is mostly from high income countries and does not necessarily correlate with low to middle income settings. One such study was to use the emergency vs elective ratio (Ee) as an indicator of access to surgical care and assess its correlation with per capita spending (6). The ratio also suggests the ability of patients to access health care timeously and assesses the mortality risk of the region being studied (6). Other metrics looking into the ratio of elective vs emergency cases in order to extrapolate access to care included the use of the caesarean section elective vs emergency ratio (CSR) which would be higher in areas where antenatal care is limited, and emergent hernia repair ratio (EHR) which indicated that medical care was not timeously provided. A CSR 0.2 or EHR 0.1 was thought to highlight a setting with deficiencies in access to surgical care (6). Caesareans, as well as hernia repairs are performed in primary and tertiary settings worldwide and hence are strong indicators of access to care in both high and low income settings (6). Elective Surgical lists are important as many will become emergencies if not treated timeously and cause significant mortality and morbidity in any setting. It is important for district level hospitals to accommodate elective lists as well, to decrease the burden on tertiary hospitals, which should be reserved for more complex cases in need of superspecialist care

A study done across 198 hospitals in the United States of America (USA) looking at the 30-day outcome of emergency vs elective surgery recorded that of 473,619 cases, 14.2% were emergency and 85.8% were elective (7). It is highly unlikely that this would be the case in SA and it would be interesting to note if this ratio directly reflects the socioeconomic status of a given country in comparison to first world settings such as the USA. The study by Price *et al* (6) showed that in sub saharan countries the ratio was 62.6 compared to European countries of 5.5.

Approximately five billion people worldwide do not have access to surgical care, according to the Lancet commission. Understanding the surgical burden of disease in a

South African context is of pertinent value to provide knowledge of where we stand in terms of delivery of surgical care and access. Understanding the surgical burden may help us better understand the surgical services and improve the system. There is a noted maldistribution of surgical resources between high-income countries (HICs) and low- and middle-income countries (LMICs). HICs have approximately 14 operating rooms and 45 trained surgeons per 100,000 population; LMICs have fewer than 2 operating rooms and 1 trained surgeon per 100,000 population. Only 3.5% of the world's operations performed annually occur in poorer countries (5). A recent study predicted that over a 12-week period of disruption due to COVID-19 there could be a backlog of >150 000 cases in South Africa (8).

This study aimed to determine the Em:El ratio and to assess the burden of emergency cases in Cape Town, South Africa. This was done by assessing two different levels of care and obtaining an indication of access to surgical care at each level, in the Cape Metro West region, in the Western Cape Province. The objective of this study was to assess the baseline of this burden prior to the COVID-19 outbreak in order to create a starting point for further studies. A further comparison was made on the impact of the COVID pandemic on this ratio by assessing the corresponding time frame since the start of the pandemic.

There are currently no international recommendations as to what an Ideal Em: El ratio should be. The study by Prin *et al* (6) suggested that an Em:El ratio of 5.5 achieved by European countries is likely the ideal ratio.

3. Methods

This study was a retrospective audit in which data was extracted from the clinicom database, manual logbook entries as well as folders of patients who underwent emergency and elective surgery at Groote Schuur Hospital (GSH), which is classified as a tertiary level hospital where super-specialist services are provided. GSH has 17 theatres in total, two of which are allocated to emergency surgeries booked by all disciplines and triaged according to severity. Victoria Hospital Wynberg (VHW), is a medium district hospital, providing elective as well as emergency surgical care. There are 3 theatres which are used by orthopedics, gynaecology, ENT, urology and general surgery. Emergency cases are booked and done as required on those lists. Data was extracted from January 2019 to June 2019 as well as January 2021 to June 2021. Permission to obtain this data was provided by the Human Ethics and Research Committee at UCT (HREC number 118/2022) as well as the research committee at GSH and CEO at VHW.

All operations in the main complex of GSH were included, from all disciplines. Operations were filtered to include surgical operations and exclude those listed as procedures e.g gastroscopies, catheter laboratory, local procedures and colonoscopies. Obstetric procedures were also excluded. No patients under the age of 13 were included in this study.

Data collected from GSH was captured from the clinicom database and filtered out to exclude procedures. Each theatre was screened over the period of 6-months and elective cases were recorded as the cases done in the day shift on the booked elective slate. Cases done after 16h00 as well as those done on weekends were allocated as emergencies. GSH has two theatres allocated solely for emergency cases which services all cases from all disciplines booked on the emergency board via the Web surgibank program. All cases done in these theatres are classified as Emergencies and triaged as per the GSH triage system listed in Table 1.

Cases using vague descriptions such as “laparotomy” or “other operations in the abdomen” could not be allocated to a specific discipline. For the purpose of this study, those discrepancies were documented as General Surgery, where they may have been a trauma case or colorectal for example.

Colour Code	Urgency	Description	Recommended time to theatre
Red	Immediate	Life-saving operation, resuscitation simultaneous with surgical treatment	< 1 hour
Orange	Expedited	Limb/organ saving operation	< 2 hours
Yellow	Urgent	Non-critical, high possibility of early deterioration	< 6 hours
Green	Emergent	Non-critical, emergent	< 24 hours
Blue	Scheduled	Stable, non-elective. Cannot leave hospital without operation	< 72 hours

Table 1: Classifications of Emergency Surgery (9)

Victoria Hospital Wynberg data was captured as emergencies and elective surgeries per discipline per month, cases from logbooks of each individual theatres were extracted. Each case was clearly recorded as elective or an emergency in these logbooks by the scrub sister involved.

4. Results

The total number of surgeries was 13 889. At GSH, which is a tertiary hospital, there were 11367 surgeries (82%) compared to VHW, a district hospital where there were 2522 surgeries (18%).

The data collected across the two levels of care is represented in Table 2. At the Groote Schuur Hospital, a tertiary hospital, the total number of surgeries in 2019 was 6085 and in 2021 was 5282. In 2019 the total number of emergencies were 2284 (37.5%) and electives were 3801 (62.5%). The Em:El ratio was 60. In 2021, when surgical services were affected by the pandemic, the total number of emergency surgeries was 2221 (42%) and electives was 3061 (58%) and the Em:El ratio was 70. On comparing the Em:El ratio between 2019 and 2021, A proportional test of successes was used to get the p-values - success vs total from the one group is compared to the success vs total from the second group. The p- value was 0.001 at GSH. The number of emergencies between 2019 and 2021 remained similar; however the number of electives was reduced significantly in 2021 due to the lockdown period during the pandemic.

Graph 1 represents the total number of elective and emergency cases per discipline in 2019. The discipline with the highest number of emergency cases was trauma surgery. A large number of plastics and maxillofacial cases are trauma related, for example hand injuries and hand sepsis. General surgery also had more emergency than elective cases. This is representative of the socioeconomic environment in the Cape metro area, which is that trauma is a major burden on the health care system. Trauma surgery alone, excluding plastics, accounted for 28.6 % of emergency surgeries done at Groote Schuur Hospital.

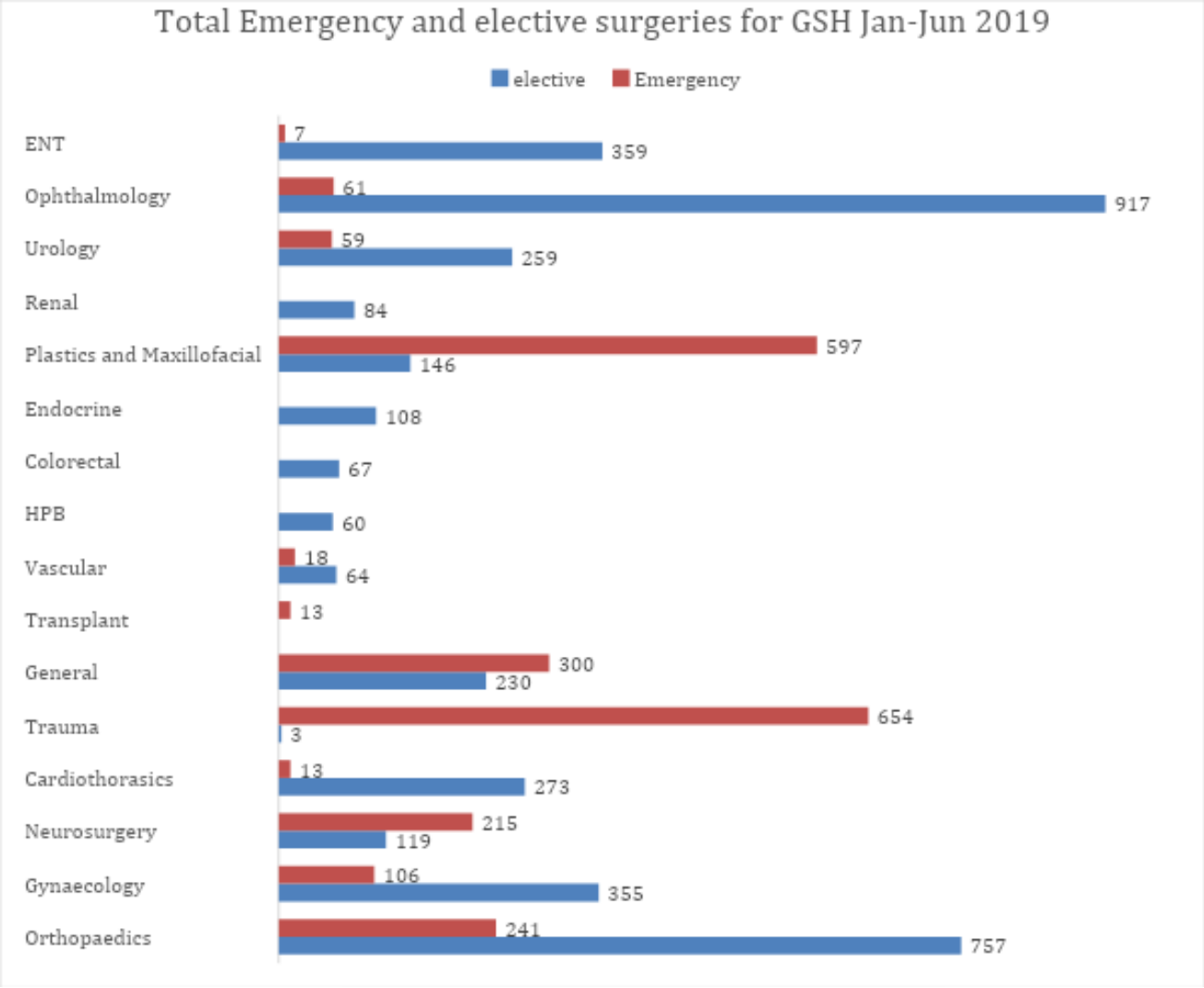
Graph 2 represents the total numbers of emergency and elective cases per discipline during the Covid pandemic. During this time there was a slow phasing in of more elective work, Compared to previous months where there was a complete shutdown of almost all elective surgeries

For VHW the total number of elective cases in 2019 was 812 and 453 cases in 2021. A proportional test of successes was used to get the p-values - success vs total from the one group is compared to the success vs total from the second group. The emergency cases were 595 in 2019 compared to 662 in 2021 (p-value <0.001). The Em:El ratio was 0.732 pre-pandemic and doubled to 1.46 intra-pandemic due to the drop in elective cases and increased number of emergency surgeries during the COVID-19 pandemic (Graph 6). VHW was the only hospital of the two that showed an increased number of emergency cases being done during the pandemic.

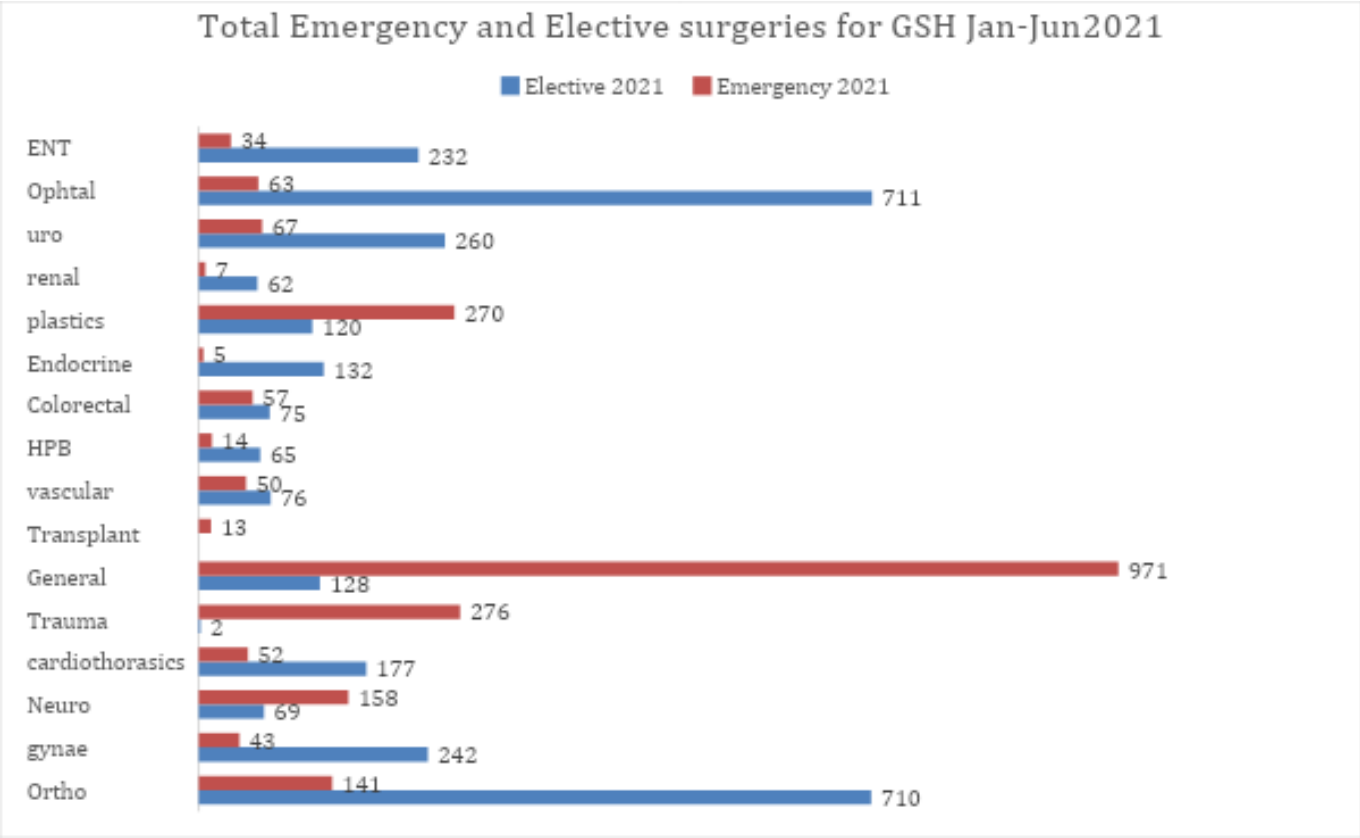
Hospital	Department	Emergency surgeries 2019	Elective surgeries 2019	Emergency surgeries 2021	Elective surgeries 2021
Groote Schuur Hospital	Orthopaedics	241	757	141	710
	Gynaecology	106	355	43	242
	Neurosurgery	215	119	158	69
	Cardiothoracics	13	273	52	177
	Trauma	654	3	276	2
	General	300	230	971	128
	Transplant	13	0	13	0
	Vascular	18	64	50	76
	HPB	0	60	14	65
	Colorectal	0	67	57	75
	Endocrine	0	108	5	132
	Plastics and Maxillofacial	597	146	270	120
	Renal	0	84	7	62
	Urology	59	259	67	260
	Ophthalmology	61	917	63	711
	ENT	7	359	34	232
	Total	**2284**	**3801**	**2221**	**3061**
	Em:El Ratio	60		70	
	Gynae	83	75	87	56
	Urology	22	124	43	55
	Orthopaedics	148	234	191	164
	General	335	290	333	133

VHW	ENT	7	89	8	45
	Total	**595**	**812**	**662**	**453**
	Em:El Ratio	73.2		146	

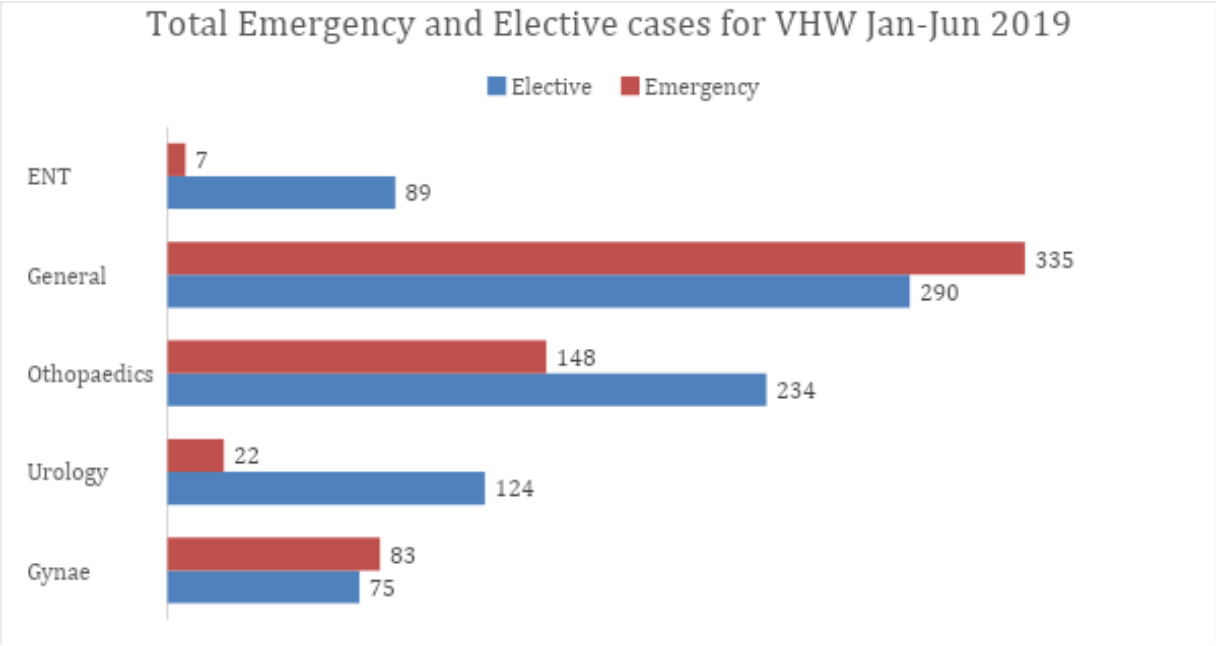
Table 2: Total cases done for the period of Jan-Jun 2019 and 2021 across three levels of care



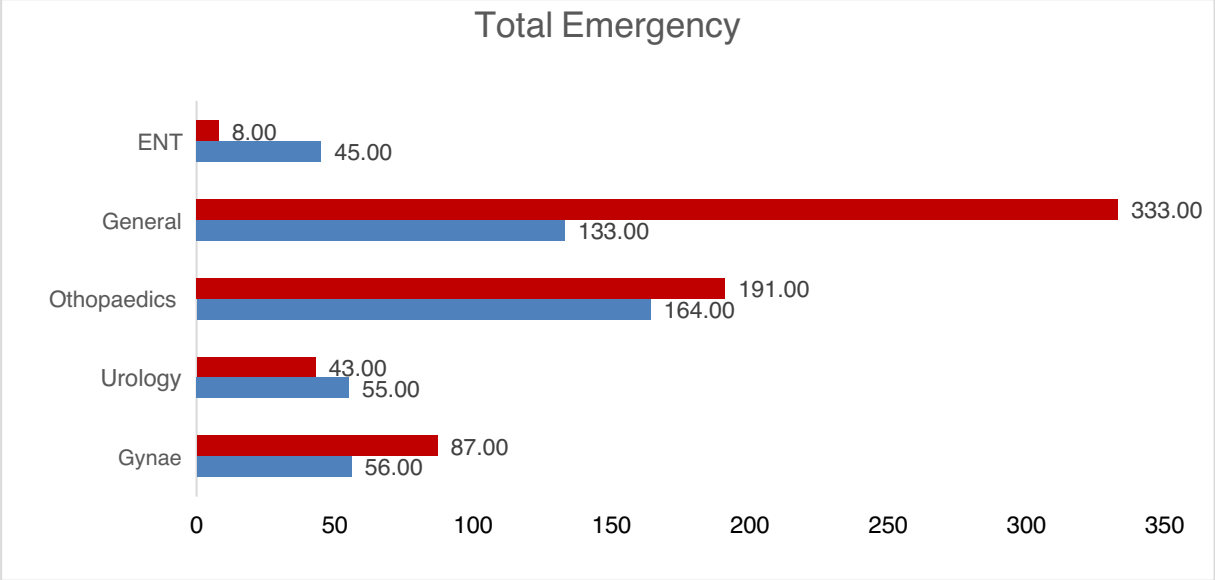
Graph 1: Total emergency and elective cases done per discipline Jan-June 2019 for GSH



Graph 2: Total emergency and elective cases done per discipline Jan-June 2021 for GSH



Graph 3: Total emergency and elective cases done per discipline Jan-June 2019 for VHW



Graph 4: Total emergency and elective cases done per discipline Jan-June 2021 for VHW

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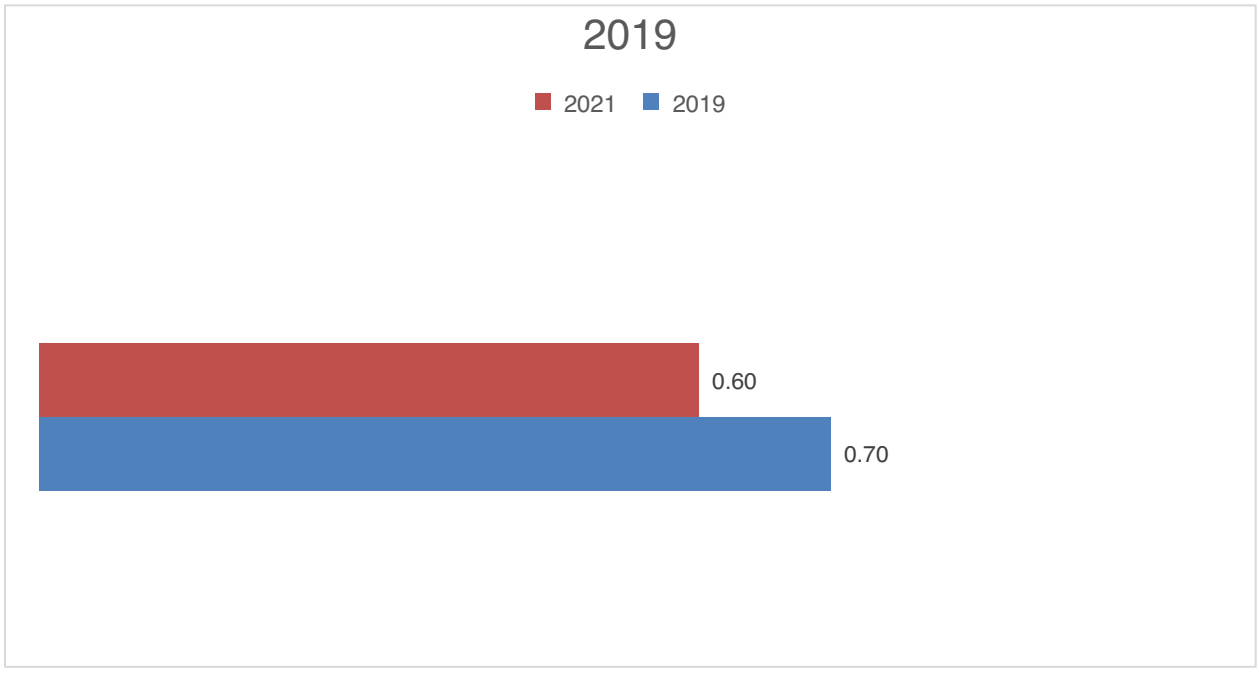
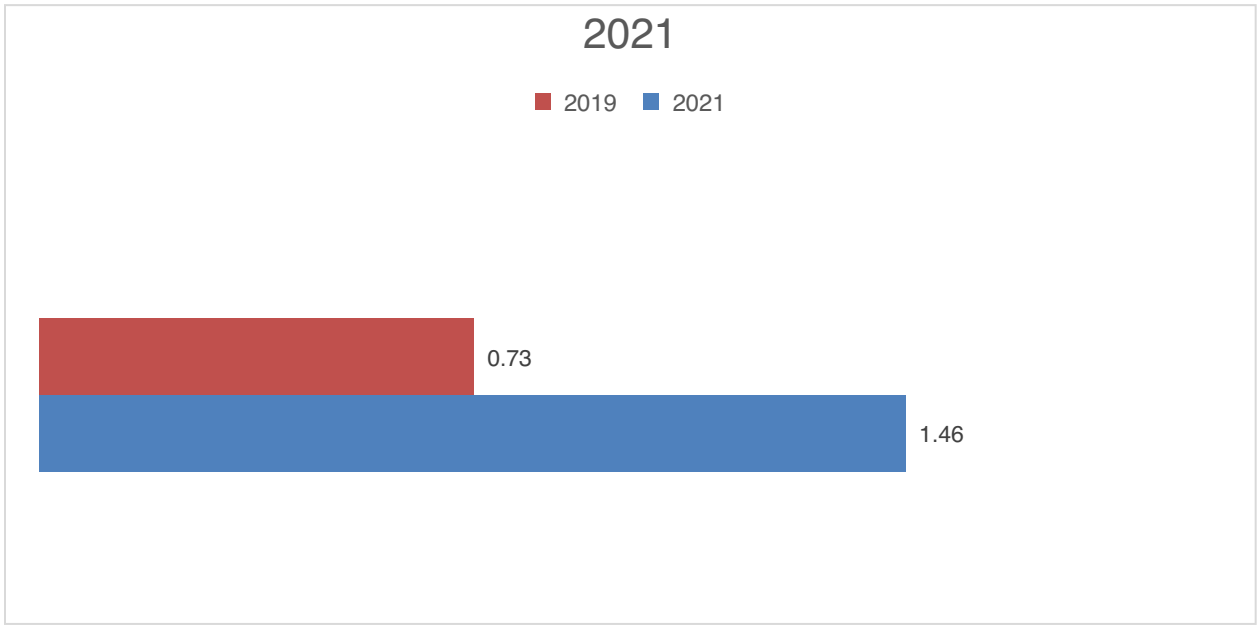


Graph 5: Em:El ratio for GSH 2019 vs 2021



Graph 6: Em:El ratio for VHW 2019 vs 2021

5. Discussion

The key findings from this study was that the surgical volume was reduced in both the tertiary and district hospitals during the year affected by the pandemic. The number of electives was reduced significantly in both hospitals. The number of emergencies was higher in the district hospital during the pandemic, and the Em:El ratio went up significantly in both hospitals, While the emergency cases between pre pandemic and during the pandemic remained similar, the elective cases significantly reduced due to various reasons, such as the cutting down of the elective slates during the peak of the pandemic, patient fear of presenting to hospital during this time as well as the lack of transport, proving that the access to care was significantly affected. Patients could not receive their surgeries due to the cutting of elective theatre slates in lock down.

During the data collection process of this study challenges were identified in the capturing and recording of surgical operations. There are certain cases on the elective slates which we know to be emergency procedures. This may be due to the fact that the emergency board was occupied and the case was accommodated on an elective slate. Although these were corrected during the data extraction, if obvious, there may be a few surgeries incorrectly categorized. In future data capturing it would be advisable to include a column on clinicom to indicate whether a case is an emergency or an elective. It would be a suggestion that on the theatre sheet it is documented and that the surgeon involved is asked to confirm whether it was an elective vs emergency.

The results over the six month period in 2019 show that pre-pandemic GSH had an Em:El ratio of 60. The USA data from 2010-2014, comparatively, had a ratio of 3.1 which indicates a significant deficiency in access to surgical care in South Africa compared to a high income country. The likely ideal ratio proposed by Prin *et al* (6) was 5.5 as per European standards, but was noted to be 62.6 in sub Saharan countries. This is in keeping with the ratio of 60 at GSH. During the phase out of Lockdown restrictions in 2021 the Em:El ratio increased by 10%, indicating the significant effect the pandemic had on the access to care (P-value <0.05).

The effect of the pandemic on the access to general surgical care is more than what the total number indicates as part of the lockdown restrictions there was a ban on alcohol and movement restrictions which significantly reduced the rate of trauma and maxillofacial/plastics emergency cases. Excluding the trauma burden in South Africa and accounting for the positive effect of lockdown on the trauma rate in South Africa, the ratio would have been 28 per 100 cases in 2019 vs 56.9 per 100 cases in 2021, which better reflects the negative impact on the access to surgical care during the pandemic.

The main concern with the GSH data was that due to the extensive emergency lists with only two theatres serving emergencies, there were often cases taken off the emergency board and accommodated on the elective slates. There was no indication of which cases these were and how many. Not all cases are booked on the emergency slate and are instead added directly onto the elective slates. All operations on the emergency board were allocated to the appropriate discipline, however, cases that were named as Laparotomy or debridement, it was not clear to which discipline they belonged and were therefore allocated to general surgery. ICD 9 coding was unhelpful in such cases and there may be inaccuracies in allocation of emergency cases for each discipline due to this.

VHW showed a doubling in the Em:El ratio when comparing pre covid vs post pandemic statistics. As mentioned it is unclear if some electives were converted to emergencies in order to assist patients in need during the pandemic. This is likely the case, as it was noted that the trauma numbers declined during lockdown and there was no reason for the total number of general surgical cases in 2021 to be more than that of the pre covid era, unless there was an unwillingness of patients to present to hospital timeously due to fear of contracting covid, resulting in them becoming emergency cases.

Overall, the baseline Em:El ratio of 60 and 73.2 at GSH and VHW respectively in 2019 compared to international ratios reflects numerous issues in the access to surgical care in the Western cape Cape metro area. The significant increase in this ratio during the Covid pandemic proves that the access to surgical care was severely reduced and would be in keeping with the conclusion by Chu *et al* that during a 12-week period of lock down there could be a greater than 150 000 case backlog across South Africa.

An estimate has been made that up to $12.3 trillion could be lost by 2030 without improved surgical systems in low-and-middle-income countries. This is according to the 2015 Lancet Commission on global surgery. “Conditions amenable to surgical care account for more annual deaths than HIV/AIDS, malaria, and tuberculosis combined” (9).

We would have to look further into the factors affecting the access to surgical care in South Africa. While poor access is easily explained during the COVID-19 pandemic, we would need to look into why we have such poor access to care. There are a number of possibilities that stand out. Some examples include a lack of theatre time and access to elective theatre slates. Most elective cases will become an emergency and complicate if delayed for too long. Another reason could be due to the mismanagement of surgical patients at the primary care level resulting in delayed referral or patient factors resulting in delayed presentation. During the pandemic a National Framework was developed and implemented, based on available literature and international standards, with an aim to

prioritize surgical urgency and individualize the risks to proceed with elective cases based on need in an equitable and ethical manner (11). There were six recommendations made pertaining to the safe reintroduction of surgical services with the concurrent pandemic with the aim to address the poor access to surgical care, which were widely accepted.

The strengths of this study are that large data sets were used, which is reflective of the current status of elective and emergency surgeries. It is pertinent to know how each facility functions at a baseline to allocate services effectively and to recognise shortfalls within our system. The Em: El ratio is a good reflection of the current state of our facilities and comparisons can be made internationally to assess where we stand as a country and look into how this can be improved.

The limitations of the study are that certain cases may have been recorded incorrectly as emergency or elective. The human error factor in recording this still remains and would need to be corrected in future data capturing. Due to the high trauma burden in South Africa, this significantly increases the emergency ratio and reflects the trauma burden, This is a separate issue in that the high trauma burden does affect the emergency slates and saturates the surgical lists, resulting in the delay of surgical cases being done, but does not give insight to the pure surgical pathologies not presenting due to the lack of surgical access.

Recommendations of the study are to use this information to assess the current shortfalls in our facilities and to address future issues in accurate data capturing to improve insight into our current issues. The results of this data can be further interpreted per discipline to allocate resources appropriately and to look into why we have such a high Em:El ratio compared to international means. Another recommendation would be to look into how having separate trauma, caesarean and gynaecological lists would affect the general surgical Em:El ratio and if this would improve the surgical access to general surgery patients.There are currently no guidelines as to what an Ideal Em:-El ratio should be, but with further data collection internationally this could be assessed globally and recommendations could be made in order to set a standard of service delivery.

6. Conclusions

Access to surgical care remains a concern including in upper middle-income countries like South Africa. The pandemic further reduced access to surgical across the world, resulting in backlogs for elective lists. In this study there are two main observations made. The Em:El ratio in the Metro area compared to the global average is significantly higher, showing that pre-COVID, the Cape metro area already had deficiencies in the access to surgical care. The second observation was that the number of elective surgeries was reduced with higher than expected Em:El ratio in both hospitals, confirming that access to surgery declined in the two Cape Metro West hospitals during the pandemic. This Study provides a database which could be used for further research and deductions on the current delivery of surgical services in order to assess and improve current shortfalls.

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