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No healthcare coverage, big problem: lack of insurance for older population associated with worse emergency general surgery outcomes

Komal Abdul Rahim ,[1] Namra Qadeer Shaikh,[1] Maryam Pyar Ali Lakhdir,[2] Noreen Afzal,[1] Asma Altaf Hussain Merchant,[1] Saad bin Zafar Mahmood,[3] Saqib Kamran Bakhshi,[4] Mushyada Ali,[3] Zainab Samad,[3] Adil H Haider[2,5]

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[1]Medical College, The Aga Khan University, Karachi, Pakistan
[2]Department of Community Health Sciences, The Aga Khan University Medical College, Karachi, Pakistan
[3]Department of Medicine, The Aga Khan University Medical College, Karachi, Pakistan
[4]Section of Neurosurgery, Department of Surgery, The Aga Khan University, Medical College, Karachi, Pakistan
[5]Department of Surgery, The Aga Khan University, Medical College, Karachi, Pakistan

Correspondence to
Ms. Komal Abdul Rahim; komal.rahim@aku.edu

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ABSTRACT

Introduction Older populations, being a unique subset of patients, have poor outcomes for emergency general surgery (EGS). In regions lacking specialized medical coverage for older patients, disparities in healthcare provision lead to poor clinical outcomes. We aimed to identify factors predicting index admission inpatient mortality from EGS among sexagenarians, septuagenarians, and octogenarians.

Methods Data of patients aged ≥60 years with EGS conditions defined by the American Association for the Surgery of Trauma at primary index admission from 2010 to 2019 operated and non-operated at a large South Asian tertiary care hospital were analyzed. The primary outcome was primary index admission inpatient 30-day mortality. Parametric survival regression using Weibull distribution was performed. Factors such as patients' insurance status and surgical intervention were assessed using adjusted HR and 95% CI with a p-value of <0.05 considered statistically significant.

Results We included 9551 primary index admissions of patients diagnosed with the nine most common primary EGS conditions. The mean patient age was 69.55±7.59 years. Overall mortality and complication rates were 3.94% and 42.29%, respectively. Primary index admission inpatient mortality was associated with complications including cardiac arrest and septic shock. Multivariable survival analysis showed that insurance status was not associated with mortality (HR 1.13; 95% CI 0.79, 1.61) after adjusting for other variables. The odds of developing complications among self-paid individuals were higher (adjusted OR 1.17; 95% CI 1.02, 1.35).

Conclusion Lack of healthcare coverage for older adults can result in delayed presentation, leading to increased morbidity. Close attention should be paid to such patients for timely provision of treatment. There is a need to expand primary care access and proper management of comorbidities for overall patient well-being. Government initiatives for expanding insurance coverage for older population can further enhance their healthcare access, mitigating the risk of essential treatments being withheld due to financial limitations.

Level of evidence III.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Patients older than 60 years constitute a unique subset with distinct pathophysiology and healthcare outcomes pertinent to emergency general surgery (EGS).

WHAT THIS STUDY ADDS

⇒ Due to the paucity of literature from low-income and middle-income countries (LMICs), the burden, disease severity, and outcomes of EGS in the older population are poorly understood.

⇒ Our findings show that lack of healthcare insurance among older patients was associated with worse outcomes for EGS at one of the largest tertiary care centers in an LMIC.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Our study findings make the case for increasing healthcare insurance coverage for older patients, especially those requiring EGS, to increase their survival.

⇒ Attention from relevant stakeholders at the government level can advocate for increased healthcare coverage.

INTRODUCTION

The world is experiencing a demographic shift, with patients aged 60 years and above comprising over one billion of the global population.[1] Older adults form a unique subset of patients with differing and often worse disease patterns, pathophysiology, and healthcare outcomes.[2] As known and unknown comorbidities amplify the complexity of their care, these patients require special attention across the spectrum of healthcare conditions to achieve outcomes comparable with non-older populations. Healthcare systems were traditionally designed to care for acutely ill patients without focusing on specific cohorts with varied functional and psychosocial needs. However, recent efforts toward creating geriatrician-led care models have been shown to reduce the length of in-hospital stay, costs, and mortality rates.[3] This has led high-income countries to provide specialized healthcare coverage to older populations, thereby improving their healthcare outcomes.[4]

Now recognized as a distinct component of acute care surgery for nearly a decade, emergency general surgery (EGS) comprises 26% of all hospital admissions.[5] The top 11 EGS conditions reportedly result in a loss of 20 million life years and 25 million disability-adjusted life years globally,[6] posing a considerable global health burden. Patients requiring emergency surgical care also carry a higher risk of complications and overall mortality when compared with those undergoing elective surgeries.[7] Septuagenarians (people in their 70s) and older individuals account for over one-third of all EGS patients.[8] Although efforts toward benchmarking EGS and its related conditions have augmented the quality of care and outcome improvement,[9] older EGS patients present a unique set of management challenges for surgeons. A higher incidence of multimorbidity and polypharmacy in these patients is further aggravated by senescence and frailty, often resulting in increased procedural risk levels and mortality.[10]

With a growing proportion of older patients requiring acute surgical care,[11] research advocates for targeted efforts toward a better understanding of presentations and factors influencing EGS outcomes in this high-risk subset of patients. In the developed world, considerable work has been done toward quantifying the burden of EGS in the older population, identifying risk factors for readmissions and determinants of outcomes to improve survival.[12 13] Subsequently, efforts toward improving access to acute surgical care in older patients through specialized coverages and policies have resulted in an improved overall survival.[14] However, timely access to care is a privilege afforded by effective healthcare systems with the resources to sustain them.

In low-income and middle-income countries (LMICs), two billion people fall below the poverty line and are deprived of timely surgical care.[15] With delays in reaching care, limited resources, and fragile healthcare systems without the means to provide specialized coverage for older populations, developing countries face worse healthcare outcomes for acute care conditions such as EGS, particularly in high-risk, older populations.[16] In Pakistan, the healthcare system is fragmented, and individual-based financial coverage is limited to people who can afford it. At our center, the hospital bills are given on a daily basis with continuous reminders. Although the care is not delayed if the patient is not able to pay the bill daily, clearance of bill is mandated as the patient leaves the hospital (either discharged or experiencing mortality). Due to the paucity of literature on financial coverage from this part of the world, the burden, disease severity, and outcomes of EGS in the older population are poorly understood. Hence, we conducted this study to assess the lack of financial coverage as a predictor for primary index admission inpatient mortality from EGS among sexagenarian, septuagenarian, and octogenarian populations in South Asia.

METHODOLOGY

Study population and data source

This secondary data analysis from hospital records was conducted at a large tertiary care hospital in South Asia. The institutional administrative database was queried for patients diagnosed with conditions encompassing EGS at index hospitalization, defined as first-time hospitalization due to an EGS condition, based on the American Association for the Surgery of Trauma (AAST) criteria.[5] Older patients (aged 60 years and above) with an EGS diagnosis, either operated or non-operated, were included. With the hospital's catchment population estimated at 15.5 million using hospital discharge data, serving as a referral center for over 900 hospitals and 4600 medical dispensaries across Pakistan, Iran, and Afghanistan,[16] the database allows representative estimates of the national population to generate a sample comparable throughout the South Asian region.[17–20] A data codebook consisting of diagnosis-related groups based on the International Classification of Diseases (ICD) - Ninth Revision - Clinical Modification codes specific to EGS conditions of interest and their corresponding procedures was created. Discharge data of patients admitted between January 2010 and December 2019 (10 years) corresponding to conditions as per the ICD codes of interest were obtained. ICD codes for primary and secondary diagnoses were retrieved. Initial patient records were then screened for their eligibility based on the study's inclusion criteria. Figure 1 shows a schematic diagram illustrating the patient selection process. We included a final cohort of 9551 patients after scrutinizing the data for entries with EGS as a primary diagnosis (figure 1). These patients, aged 60 years and above, were admitted through the emergency room (ER) or outpatient consulting clinic (CC) with EGS conditions.

The final patient cohort included those admitted with ICD codes corresponding to EGS conditions of interest, as defined by the AAST.[5] A detailed list of primary EGS diagnoses from 11 predefined surgical areas included in our study is as follows:

- General abdominal conditions: abdominal pain, abdominal mass, peritonitis, hemoperitoneum, retroperitoneal abscess.
- Intestinal obstruction: adhesion, incarcerated hernia, cancer, volvulus, intussusception.
- Upper gastrointestinal (GI) tract: upper GI bleed, peptic ulcer disease, fistula, gastrostomy, small intestinal cancer, ileus, Meckel's bowel perforation, appendix.
- Hepatic–pancreatic–biliary conditions: gallstones and related diseases, pancreatitis, hepatic abscess.
- Lower GI tract/colorectal: lower GI bleeding, diverticular disease, inflammatory bowel disease, colorectal cancer, colitis, colonic perforation, megacolon, regional enteritis, colostomy/ileostomy, hemorrhoid, perianal and perirectal fistula and infection, anorectal stenosis, rectal prolapse.
- Hernias: inguinal, femoral, umbilical, incisional, ventral, diaphragmatic.
- Cardiothoracic conditions: cardiac tamponade, empyema, pneumothorax, esophageal perforation.
- Vascular: ruptured aneurysm, acute intestinal ischemia, acute peripheral ischemia, phlebitis.
- Skin conditions and soft tissues: cellulitis, abscess, fasciitis, wound care, pressure ulcer, compartment syndrome.
- Resuscitation: acute respiratory failure, shock.
- Others: tracheostomy, foreign body, bladder rupture.

ICD codes for the EGS procedures are appended in online supplemental file 1.

Variables of interest

Information extracted from the database or otherwise calculated or retrieved included demographic data, details of index admission, coded diagnosis, length of inpatient stay following admission for coded conditions, comorbid conditions (as identified in the Charlson Comorbidity Index (CCI)),[21] operative interventions with coded procedures,[7 22 23] presence of a significant complication, and discharge status (alive or deceased).

Demographic data included patients' age, sex, city of residence, and insurance status (self-paid or privately insured). We categorized age into three categories: (1) sexagenarians (60–69 years), (2) septuagenarians (70–79 years), and (3) octogenarians (80 years and older). Due to a lack of documented indicators for the patient's financial status, we used payor status as a proxy, categorized into privately insured and self-paid. Admission details included admission source, admission year, length of stay, and admission status. Sources of admissions included ER and

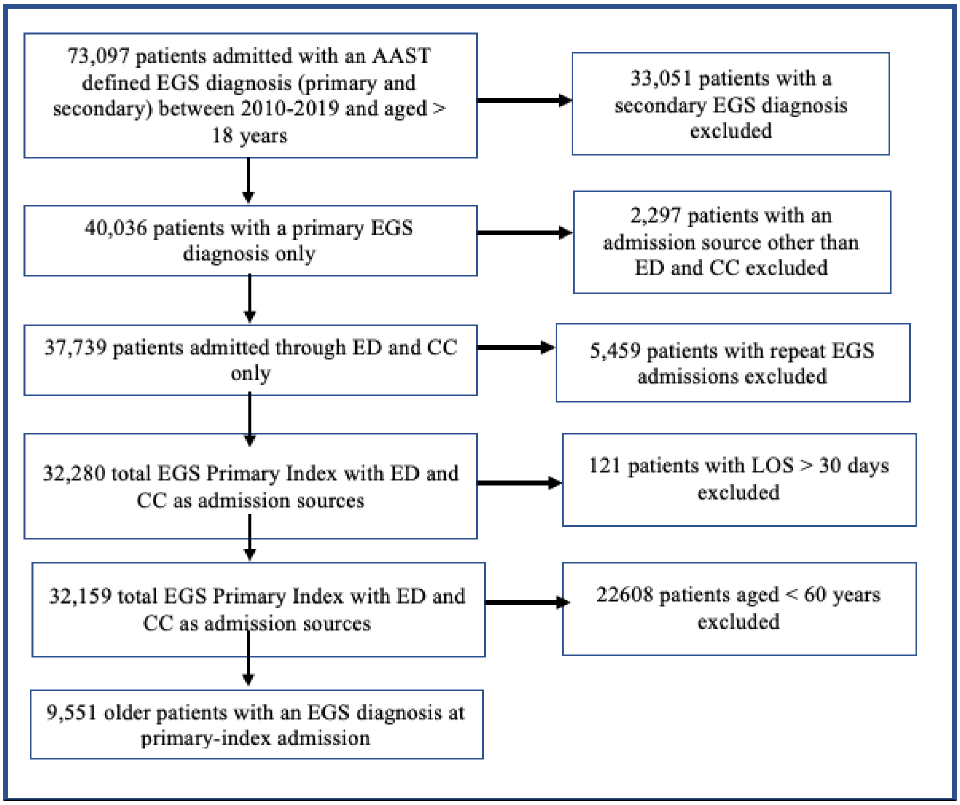


Figure 1 Schematic inclusion and exclusion criteria. Definitions: consulting clinic is defined as an outpatient clinic; index admission is defined as first-time admission to the hospital. AAST, American Association for the Surgery of Trauma; CC, consulting clinics; ED, emergency department; EGS, emergency general surgery; LOS, length of stay.

CC. The CCI with its corresponding 17 conditions was coded and used as a weighted risk prediction index for mortality for the presence or absence of specific comorbid conditions.[24] The CCI score was stratified based on comorbidity severity, with a CCI score of 0 corresponding to no comorbidity, 1 to 2 corresponding to mild comorbidity, 3 to 4 corresponding to moderate comorbidity, and ≥5 corresponding to severe comorbidity. The primary outcome measured was primary index admission inpatient 30-day mortality. We considered all patients who died during their hospital stay on their primary index admission as "time to event." All patients who survived the hospital stay on their primary index admission or were discharged in between were considered censored. The secondary outcome was the presence of a major complication/complication status during primary index admission hospital stay.

Major complications were defined as adverse outcomes resulting in a high risk of mortality. They encompassed myocardial infarction, cerebrovascular accident/stroke, deep vein thrombosis (DVT)/pulmonary embolism (PE)/thrombophlebitis, acute renal failure (ARF), pneumonia, pulmonary failure, urinary tract infection (UTI), sepsis, septic shock, pseudomembranous colitis, peripheral nerve injury, coma, and hemorrhage.

Statistical analysis

All statistical analyses were performed using Stata statistical software (2018, V.15.1 Mac; StataCorp, College Station, TX). Categorical variables such as sex, age categories, and insurance status were represented as frequencies and percentages, whereas all continuous variables such as the mean survival time were represented as means and standard deviations (SD). Patient demographic and clinical characteristics included in the analysis were age categories (60–69 years, 70–79 years, and ≥80 years), sex (male, female), area of residence (outside Karachi/Karachi), financial status (privately insured/self-paid), CCI scores, surgical intervention (operated and non-operated), and source of admission (ER or CC). We calculated the primary index admission inpatient mortality for 10 complications from EGS procedures. These complications included surgical site infections, pulmonary complications, ARF, UTI, DVT/PE/thrombophlebitis, acute myocardial infarction, sepsis, septic shock, cardiac arrest, pneumonia, stroke, coma, hemorrhage, and GI bleeding. Adjacent to the mortality rate, we calculated the mean survival time of patients based on their demographic and clinical characteristics through Kaplan-Meier product limit estimates. For stratification purposes, patient characteristics were compared for insurance status (privately insured vs. self-paid) and surgical intervention (operated vs. non-operated).

A parametric survival regression with Weibull distribution was used to calculate hazard ratios (HRs) to predict the risk of primary index admission inpatient 30-day mortality in the study population after meeting the proportional hazard assumption. Univariate analysis using simple parametric survival regression with Weibull distribution was performed to obtain unadjusted HRs with a screening p value of ≤0.25. Variables with p values less than the screening value were entered in the stepwise model to obtain adjusted HRs. Patients aged 60 to 69 years, male sex, lowest CCI score (i.e. none), residing within Karachi, admissions from CCs, non-operated management, and absence of complications were used as reference groups for their respective categories in the model. We also made a Kaplan-Meier survival function plot for insurance status with a log-rank test to assess any

Table 1 Demographic case mix and outcomes stratified by insurance status (N=9551)

Variable	Total n (%)	Privately insured patients (n=1134, 11.87%) n (%)	Self-paid patients (n=8417, 88.13%) n (%)	P value
Sex				
Male	5147 (53.89)	615 (54.23)	4532 (53.84)	0.908
Female	4403 (46.10)	519 (45.77)	3884 (46.14)	
Age (years)				0.181
60–69	5230 (54.76)	643 (56.70)	4587 (54.50)	
70–79	3147 (32.95)	369 (32.54)	2778 (33.00)	
≥80	1174 (12.29)	122 (10.76)	1052 (12.50)	
Residency				<0.001**
Outside city	1524 (15.96)	94 (8.29)	1430 (16.99)	
Within city	8027 (84.04)	1040 (91.71)	6987 (83.01)	
Admission source				<0.001**
Consultant clinics	4468 (46.78)	588 (51.85)	3880 (46.10)	
Emergency room	5083 (53.22)	546 (48.15)	4537 (53.90)	
Charlson Comorbidity Index categories				0.001*
0 (none)	3027 (31.69)	424 (37.39)	2603 (30.93)	
1 (mild)	4291 (44.93)	490 (43.21)	3801 (45.16)	
2 (moderate)	1044 (10.93)	103 (9.08)	941 (11.18)	
3 (severe)	1189 (12.45)	117 (10.32)	1072 (12.74)	
Surgical intervention				0.003*
Operated	6134 (64.22)	773 (68.17)	5361 (63.69)	
Non-operated	3417 (35.78)	361 (31.83)	3056 (36.31)	
Presence of complications	4039 (42.29)	412 (36.33)	3627 (43.09)	<0.001**
Pulmonary complications	384 (1.02)	37 (3.26)	347 (4.12)	0.166
Surgical site infections	1197 (12.53)	130 (11.46)	1067 (12.68)	0.247
Acute renal failure	1249 (13.08)	118 (10.41)	1131 (13.44)	0.004*
Urinary tract infections	485 (5.08)	51 (4.50)	434 (5.16)	0.343
Deep vein thrombosis/pulmonary embolism/thrombophlebitis†	85 (0.89)	3 (0.26)	82 (0.97)	0.011*
Acute myocardial infarction	320 (3.35)	30 (2.65)	290 (3.45)	0.160
Sepsis	3289 (34.44)	348 (30.69)	2941 (34.94)	0.005*
Septic shock	1385 (14.50)	130 (11.46)	1255 (14.91)	0.002*
Cardiac arrest	339 (3.55)	33 (2.91)	306 (3.64)	0.215
Pneumonia†	313 (3.28)	29 (2.56)	284 (3.37)	0.147
Stroke†	32 (0.34)	4 (0.35)	28 (0.33)	0.787
Coma†	27 (0.28)	2 (0.18)	25 (0.30)	0.764
Hemorrhage	340 (3.56)	28 (3.35)	302 (3.59)	0.686
Gastrointestinal bleeding	319 (3.34)	36 (3.17)	283 (3.36)	0.741
Deaths	376 (3.94)	35 (3.09)	341 (4.05)	0.117
Mean survival time (days)	–	22.60	23.65	0.04*

χ^2 test for independence applied.
For simplicity of the table, frequencies of the category "without complication" are not presented.
*P<0.05, **P<0.001.
†Fisher exact test applied.

significant differences in the survival functions of privately insured and self-paying individuals. Statistical significance was defined as a p-value less than 0.05 (two-tailed).

Ethical considerations

The Health Information Management Services de-identified all patients' personal information, and the primary research team only received encrypted medical record numbers for each patient. Data were stored in a password-encrypted file, and access was only provided to those members of the team directly involved in data analysis.

RESULTS

Of the 9551 patient visits identified for EGS conditions among the older population, 5147 (53.89%) were male, 4403 (46.10%) were female, whereas the sex of one patient was not reported. The mean age of our study population was 69.55±7.59 years, with 8027 (84.04%) patients being residents of Karachi and 8417 (88.13%) self-paying for their expenses in the hospital. The admission source of the patients was comparable between CC (46.78%) and ER (53.22%). The mortality and complication rates were 3.94% and 42.29%, respectively.

Of all the surgical areas at primary index admissions for EGS, hepatic biliary tract disease was the most prevalent EGS condition,

Table 2 Demographic case mix stratified by outcome and surgical intervention (N=9551)

Variable	Operated patients (n=6134, 64.22%)			Non-operated patients (n=3417, 35.78%)		
	Total n (%)	Deaths n (%)	Mean survival time (days)	Total n (%)	Deaths n (%)	Mean survival time (days)*
Sex						
Male	3358 (54.74)	96 (2.86)	25.32†	1789 (52.36)	95 (5.31)	21.13†
Female	2775 (45.24)	95 (3.42)	23.18	1628 (47.64)	90 (5.53)	21.47
Age (years)						
60–69	3631 (59.19)	88 (2.42)	24.93†	1599 (46.80)	80 (5.00)	22.30†
70–79	1915 (31.22)	68 (3.55)	24.98	1232 (36.06)	74 (6.01)	19.40
≥80	588 (9.59)	35 (5.95)	18.14†	586 (17.15)	31 (5.29)	19.42
Residence						
Outside Karachi	1046 (17.05)	40 (3.82)	24.45†	478 (13.99)	26 (5.44)	24.15†
Karachi	5088 (82.95)	151 (2.97)	24.33†	2939 (86.01)	159 (5.41)	20.20†
Insurance status						
Privately insured	773 (12.60)	22 (2.85)	23.49†	361 (10.56)	13 (3.60)	17.57†
Self-paid	5361 (87.40)	169 (3.15)	24.60†	3056 (89.44)	172 (5.63)	21.06†
Admission source						
Consultant clinics	3686 (60.09)	32 (0.87)	25.91†	782 (22.89)	20 (2.56)	21.77†
Emergency room	2448 (39.91)	159 (6.50)	23.04†	2635 (77.11)	165 (6.26)	20.84†
Presence of complication	2097 (34.19)	177 (8.44)	22.94†	1942 (56.83)	171 (8.81)	20.15†
Pulmonary complications	226 (3.68)	84 (37.17)	18.33†	158 (4.62)	63 (39.87)	14.51
Acute renal failure	512 (8.35)	100 (19.53)	21.18†	737 (21.57)	115 (15.60)	18.27†
Urinary tract infections	166 (2.71)	16 (9.64)	25.76†	319 (9.34)	28 (8.78)	23.09†
Deep vein thrombosis/pulmonary embolism/thrombophlebitis	26 (0.42)	2 (7.69)	21.90†	59 (1.73)	10 (16.95)	16.43
Acute myocardial infarction	124 (2.02)	20 (16.13)	22.79†	196 (5.74)	33 (16.84)	15.17†
Sepsis	1761 (28.71)	166 (9.43)	22.40†	1528 (44.72)	141 (9.23)	20.39†
Septic shock	600 (9.78)	141 (23.50)	19.79†	785 (22.97)	133 (16.94)	17.58†
Cardiac arrest	214 (3.49)	128 (59.81)	12.70	125 (3.66)	123 (98.40)	5.20
Pneumonia	177 (2.89)	45 (25.42)	20.24	136 (3.98)	26 (19.12)	19.13
Stroke	14 (0.23)	1 (7.14)	17†	18 (0.53)	4 (22.22)	20.48
Coma	14 (0.23)	2 (14.29)	27.66†	13 (0.38)	2 (15.38)	17.71†
Hemorrhage	184 (3.00)	12 (6.52)	21.37	156 (4.57)	12 (7.69)	14.87†
Gastrointestinal bleeding	164 (2.67)	9 (5.49)	19.99	155 (4.54)	12 (7.74)	14.86†

For simplicity of the table, frequencies of the category "without complication" are not presented.
*Mean survival time calculated using Kaplan-Meier product limit estimates.
†Extended means.

with 2959 (30.98%) admissions. Other common EGS conditions included upper GI tract conditions (n=1593, 16.68%), soft tissue conditions (n=1300, 13.61%), and colorectal conditions (n=1264, 13.23%). The diagnosis distribution between self-paid and insured individuals was nearly similar. Overall, the highest mortality was from hepatic–pancreatic–biliary tract diseases (21.81%), upper GI tract (20.74%), colorectal conditions (12.50%), and intestinal obstruction (11.97%). From all the complications, majority were from soft tissues (27.61%), upper GI tract (22.90%), and hepatic–pancreatic–biliary tract (22.75%) diseases.

Table 1 shows the demographic case mix stratification and EGS outcomes based on patients' insurance status. Most patients (51.85%) admitted through clinics were privately insured; conversely, patients admitted through ER (53.90%) were self-paid. The surgical intervention was affected by the insurance status; 68.17% of privately insured and 63.69% of self-paid patients were operated; the p-value indicates a difference in patients undergoing surgical intervention based on their insurance status. An association between comorbidity index and insurance status was also seen, where a significantly higher comorbidity index (CCI of 2 and 3) was observed in 23.92% of self-paid patients compared with privately insured patients (19.4%).

Table 2 shows the number of deaths and the mean survival time of patients up to 30 days. Among operated older patients, a considerably lower mean survival time was observed in women, ≥80 years, privately insured, and patients admitted through the ER. Among non-operated older patients, a considerably lower mean survival time was observed in patients aged ≥80 years, residing in Karachi, privately insured, and admitted through the ER.

Our results showed that the mean survival time was lower in non-operated patients developing complications than operated patients (20.15 days vs. 22.94 days). Of all the complications, non-operated patients with cardiac arrest had the lowest mean survival time (5.20 days). Non-operated patients had a lower mean survival time for all complications except stroke, for which operated older patients had a lower mean survival time when compared with non-operated patients (17 days vs. 20.48 days).

The unadjusted HRs for mortality are appended in online supplemental file 2. Briefly, patients aged ≥80 years were

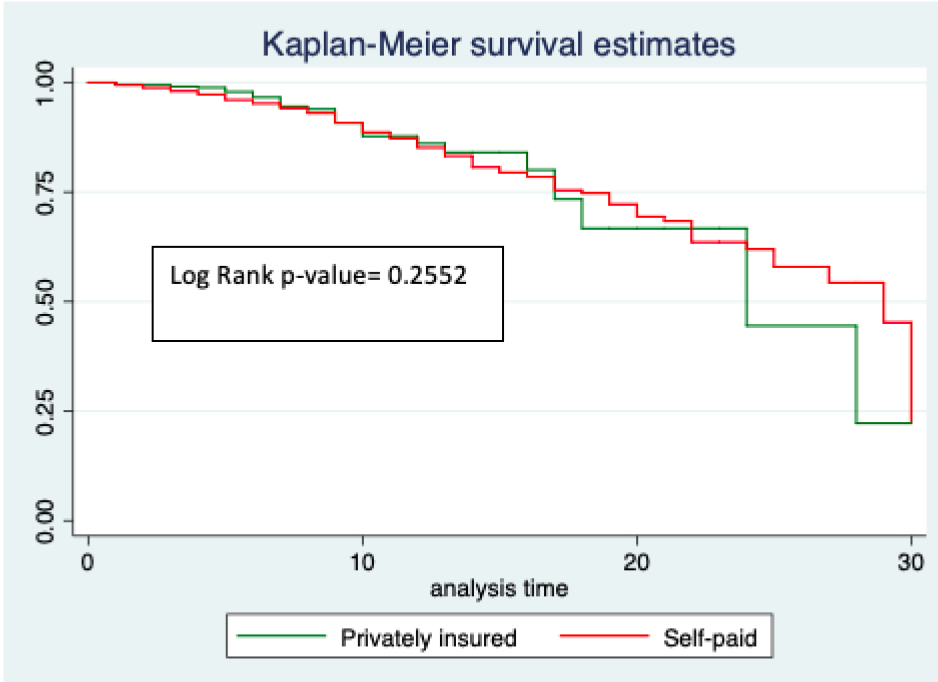
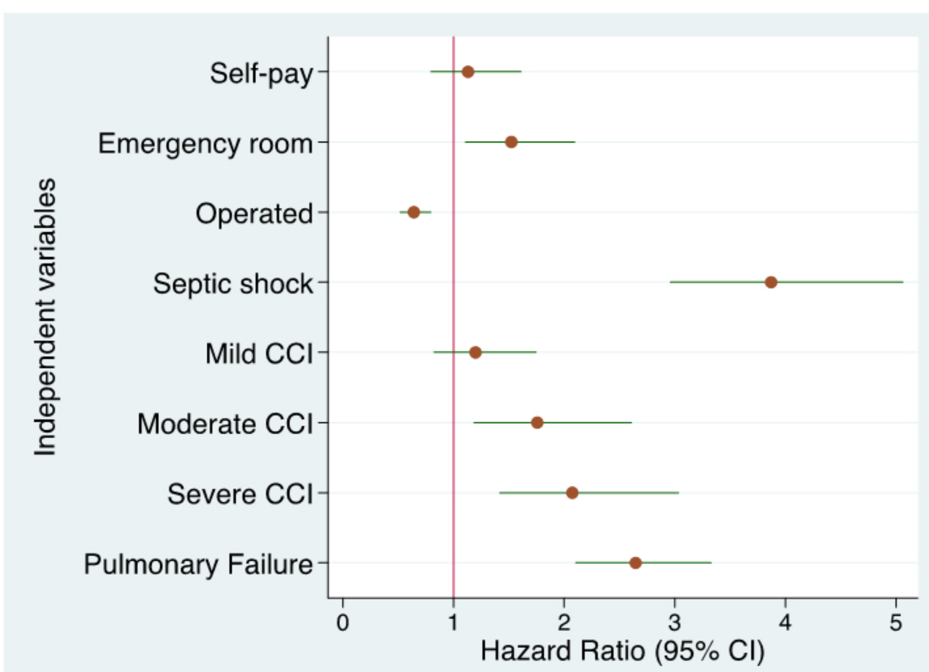


Figure 2 Kaplan-Meier 30-day survival plot of patients' financial status.

associated with a higher hazard of mortality than patients aged 60 to 69 years (HR 1.66; 95% CI 1.24, 2.23). Cardiac arrest (HR 23.21; 95% CI 18.47, 29.16), septic shock (HR 6.81; 95% CI 5.35, 8.68), and pulmonary complications (HR 4.78; 95% CI 3.82, 5.98) showed higher hazard of mortality. Other variables significantly associated with mortality were CCI, presence of a complication, admission source, surgical intervention, SSI, ARF, DVT/PE, acute myocardial infraction, sepsis, pneumonia, and GI



Parametric survival regression with Weibull distribution
Reference Categories:
Insurance Status: Privately insured; Admission Source= Consulting clinic; Operation status= non-operated; Septic Shock= Without Septic shock; CCI= Score 0 (none); Pulmonary Complication= Without Pulmonary Complication

Figure 3 Adjusted HR for emergency general surgery-associated 30-day primary index admission inpatient mortality. CCI, Charlson Comorbidity Index.

Table 3 Unadjusted and adjusted odds of developing complications using simple logistic regression (N=9551)

Variables	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Insurance status		
Self-paid	1.32 (1.16, 1.50)	1.17 (1.02, 1.35)
Age categories (years)		
70–79	1.23 (1.12, 1.35)	1.04 (0.94, 1.16)
≥80	1.53 (1.35, 1.74)	1.16 (1.01, 1.34)
Sex		
Female	1.03 (0.95, 1.12)	–
Admission source		
Emergency room	4.22 (3.86, 4.61)	2.77 (2.51, 3.07)
Surgical intervention		
Operated	0.39 (0.36, 0.43)	0.52 (0.48, 0.58)
Length of stay	1.19 (1.18, 1.21)	1.15 (1.13, 1.17)
Charlson Comorbidity Index		
1 (mild)	2.18 (1.97, 2.41)	1.79 (1.60, 1.99)
2 (moderate)	6.06 (5.20, 7.07)	3.93 (3.35, 4.64)
3 (severe)	3.75 (3.26, 4.32)	2.28 (1.95, 2.66)
Residence		
Outside city	1.33 (1.19, 1.49)	1.33 (1.18, 1.51)

Logistic regression applied.
Reference categories from top to bottom: insurance status=privately insured; age categories=60–69 years; sex=male; admission source=consulting clinics; surgical intervention=non-operated; Carlson Comorbidity Index score=0 (none); residence=within Karachi.

bleeding. Self-paid individuals were not significantly associated with mortality (HR 1.20; 95% CI 0.84, 1.72). This was equivalent to the log-rank test, which also showed an insignificant difference in the survival function between self-paid and insured individuals (p=0.2552). Figure 2 shows the Kaplan-Meier survival plot of insurance status and 30-day survival.

Findings from the multivariable model showed that insurance status was not significantly associated with increased mortality (adjusted HR 1.13; 95% CI 0.79, 1.61) when adjusted for admission source, surgical intervention, septic shock, CCI, and pulmonary failure. The model also highlighted that older patients undergoing an operation for an EGS condition were 36% at lower risk of experiencing mortality than non-operated older patients. Individuals who developed septic shock during their hospitalization were 3.87 times more likely to experience mortality than patients who did not (95% CI 2.95, 5.06). In addition, with increasing comorbidities, the hazard for time to primary index admission inpatient 30-day mortality also increased. Refer to figure 3 for details on the variables included in the final multivariable analysis.

Table 3 shows the unadjusted and adjusted ORs for developing complications in older patients. Patients with a self-paid status had 17% higher odds of developing complications than insured patients after adjusting for age, admission source, surgical intervention, length of stay, CCI, and residence. Older patients admitted through the ER had significantly higher odds of developing complications (adjusted OR 2.77; 95% CI 2.51, 3.07) than those admitted through clinics. For every 1-day increase in hospital stay, the odds of developing complications significantly increased by 15%. Also, older patients who were operated had 48% lower odds of developing complications than non-operated older patients.

DISCUSSION

This secondary analysis of 9551 older patients with EGS conditions showed that age ≥80 years, admission through the ER, higher CCI scores, and developing complications were associated with primary index admission 30-day inpatient mortality. Older patients admitted through ERs had a lower mean survival time than those admitted through CCs. Among the various complications, patients with cardiac arrest and septic shock had the lowest 30-day mean survival time. Moreover, self-paid patients had higher odds of morbidity, but no significant association with mortality compared with privately insured older patients. Pre-existing comorbidities also increased the risk of mortality. Furthermore, surgical intervention for an EGS diagnosis significantly decreased complications and mortality. Surgical intervention was also influenced by insurance status, where self-paid older patients were operated less frequently compared to privately insured older patients.

Our study showed that patients aged ≥80 years were associated with a higher mortality risk than those aged 60 to 79 years. This finding is consistent with literature showing an increasing risk of post-EGS mortality with age.[25] Furthermore, older age in EGS patients is correlated with worse health outcomes, owing to a higher prevalence of comorbid conditions in this age group.[26] An estimated 40% of all EGS index admissions comprise the older population with multiple comorbidities, frailty, and social vulnerabilities such as financial issues. These factors have been shown to amplify poor health outcomes.[7 22 23] Additionally, 40% of deaths in such cases occur within 30 days after EGS, 50% develop postoperative complications, and 20% of patients are readmitted within 30 days of the initial discharge.[13 27 28]

Older patients admitted through ERs had a reduced survival time compared to those admitted through clinics in our study. Patients admitted through clinics have optimal time to undergo a comprehensive assessment and management of comorbidities before admission.[29] In contrast, patients admitted from the ER leave little to no time for presurgical evaluation, including data collection of pertinent variables such as area of residence, financial status, and CCI index, which are strong predictors of surgical and overall healthcare outcomes.[30] As a result, the lack of comprehensive preoperative information increases vulnerabilities in the older population to known and unknown insults during their hospital stay. This underscores the need for focusing on improving the quality of life alongside addressing life-threatening conditions. Subsequently, the measurable health benefits derived from increased access to surgical care will underscore the value of insurance expansion for such care, particularly for uninsured patients.[31]

Although pre-existing health conditions are an important predictor of mortality, it is also significantly influenced by complications. Our study highlights that patients experiencing cardiac arrest during hospitalization had the least survival time for both operated and non-operated patients. Research also suggests cardiac arrest to be the leading cause of mortality globally in EGS.[32] In such situations, younger patients receive more preference for cardiopulmonary resuscitation and aggressive medical care compared to older patients.[33] This might cause increased mortality in older patients with cardiac arrest after general surgery.[34] Other reasons could be attributed to increasing age and characteristics of the cardiac arrest itself.[35] Furthermore, contrary to our results, a prospective study conducted in Finland concluded septic shock as one of the insignificant causes of in-hospital mortality in older patients who underwent emergency GI surgery. However, septic shock was the common cause of mortality among older patients who died.[36]

Furthermore, our study showed higher odds of complications in self-paid individuals compared with privately insured patients after an EGS admission. This suggests that the presence of insurance with healthcare service utilization is also strongly associated with inpatient morbidity. However, healthcare coverage was not associated with mortality. This is inconsistent with a recent study conducted in the USA which showed that Medicare (a government national health insurance program) was associated with similar odds of EGS-related mortality as that of medical patients and 30% lower hospitalization rates.[37] Another cross-sectional study highlighted that Medicare beneficiaries had fewer deaths, even for the sickest patients in the ER.[38] This shows that Medicare-insured beneficiaries had better outcomes. For context, the average cost of outpatient consultation at our institution is US$18. The costs of other procedures are as follows: laparoscopic cholecystectomy is US$1056.43, hernia repair is US$704.29, exploratory laparotomy is US$1056.43, and excisional wound debridement is US$528.22. Our results also highlighted a 13% higher risk of mortality in self-paid individuals. Having insured healthcare is a privilege in LMICs, where most people end up paying out of pocket for their healthcare expenses,[39] leading to an increased risk of catastrophic financial losses. This disparity results in self-paid older EGS patients presenting with more complex diseases in the ER, ultimately resulting in greater morbidity and mortality rates.[40] Older patients are neglected when it comes to healthcare coverage since there is no financial support provided to them by third-party payors, and younger patients are given preference over elderly patients, which makes the latter at high risk and vulnerable to poor clinical outcomes.[41] Our findings also showed that older self-paid patients had significantly higher odds of developing complications than insured patients. These findings are consistent with another study from the USA that showed Medicare self-paid patients had 24% higher odds of developing complications.[42] In this regard, working toward attaining universal health coverage is imperative for reducing financial risk and ensuring the provision of essential healthcare services for all, including vulnerable populations.[39]

Our results showed that the CCI score was associated with mortality in EGS patients. A retrospective study conducted in Massachusetts showed that for patients undergoing high-risk EGS procedures, the odds of mortality with increasing CCI scores increased by 15%.[43] The odds remained 17% higher in patients who underwent low-risk procedures for EGS. Another study showed that multiple comorbidities present additional survival risks for older patients than a single comorbidity.[44] This is because acute surgical disease and pre-existing conditions/diseases interact and increase the risk of poor patient outcomes, especially in the older population. Our data highlighted that, although the documentation of comorbidities provides an insight about the presence of diseases, it does not give insight into how well they are managed. This in turn leads to in-hospital and post-discharge complications. Literature highlights that the best way to improve outcomes in patients is to increase access to primary care and better manage comorbidities to mitigate emergencies and improve overall patient outcomes.[45]

Surgical intervention in patients requiring EGS reduced our cohort's odds of complications and mortality risk. Literature suggests that non-operative management of EGS patients directly increases the risk of mortality at 30 days and 1 year.[46] A possible explanation is that the baseline frailty in non-operated patients leads to higher Surgical Risk Calculator scores, outweighing the benefits of undergoing a surgical intervention.[47] In contrast, managing high-risk EGS patients operatively does not guarantee their full recovery, and they may also be at risk of long-term functional decline, dependency, and mortality.[48 49] Our findings also highlighted a significant difference between patients undergoing surgical interventions and their insurance status. Self-paid individuals are less operated on compared with insured individuals due to the financial pressure on patients without insurance. A study from the USA highlighted that self-paid patients are charged 2.5 times higher for all hospital services as compared to insured patients, resulting in worse outcomes.[50]

This study presents data on diverse EGS conditions in the older population. It correlates the findings with various complications, providing a holistic view of EGS-related outcomes in this population. However, there are a few limitations to this study. First, the study used data from a single healthcare center in Pakistan, which may impact the generalizability of the findings. However, since this is one of the largest tertiary care hospitals in the country, catering to a vast network of referral hospitals and national and international patients, the sample can be deemed nationally representative. In addition, patients who were alive at the time of discharge but may have passed away in other hospitals within 30 days were not captured in the analysis. However, since our findings corroborate with already published literature from various regions, the results from this study can potentially be extrapolated to similar low-resource settings. Due to the retrospective nature of the study design, our analysis was limited by the number of preoperative variables available. Therefore, variables such as patients' ethnicity, nutritional assessment, functional status, transfer information, frailty, and addictions could not be assessed. In addition, our data did not provide information on mortality that occurred after 30 days, suggesting that long-term mortality could not be measured, which is a better measure to assess difference in access to care. Furthermore, we used diagnostic codes that do not account for disease severity apart from comorbidities influencing the prediction of primary index admission inpatient mortality. Moreover, the CCI appears quite consistent across groups, exhibiting statistical differences primarily driven by large sample sizes and category combinations. In clinical terms, these distinctions are minimal. It is plausible, although not discernible from this data set, that the management of these comorbidities significantly varies when insurance coverage is absent.

In conclusion, there is considerable variability in EGS procedures; they occur unexpectedly, require urgent medical care, and present minimal opportunity to ensure presurgical care optimization. Pre-existing comorbidities, specific patient characteristics, and the occurrence of complications strongly predict the overall health outcomes in older EGS patients. To improve the overall outcomes of older patients admitted to the hospital following an EGS condition, there is a need to improve access to primary care and manage comorbidities alongside presenting complaints. Given the increasing vulnerabilities in the neglected and high-risk elderly population, there is a dire need to deploy tailored initiatives for older patients undergoing EGS in LMICs. Government efforts to broaden insurance coverage for the elderly can have a positive impact on their healthcare accessibility, thereby reducing the likelihood of essential medical interventions being denied because of financial constraints.

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ORCID iD
Komal Abdul Rahim http://orcid.org/0000-0002-0790-6644

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