AIM OF THE WORK

This study will be conducted to fulfill the following objectives:

General objective:

To assess curative services utilization in the third intensive care unit in Alexandria Main University Hospital.

Specific objectives:

1. To determine admission and readmission rates to the studied unit during the period of the field work.
2. To identify the main causes of admission to the unit.
3. To identify the medical characteristics of admitted cases.
4. To calculate the bed occupancy rate during the period of the field work.
5. To calculate the length of ICU stay among studied patients.
6. To identify the outcome of studied patients.

SUBJECTS AND METHODS

I. Research Design:

In order to achieve the research objectives, a prospective survey design was used where each patient was followed from the point of admission up to the end of his admission whether died or discharged or transferred to a lower care unit.

II. Study Variables:

The study variables include the following operational definitions:

a) Average daily census:

It is the average number of inpatients treated during a given period of time.[106]

b) Inpatient bed occupancy rate:

It is the percentage of official beds occupied by ICU inpatients for a given period of time.[107]

c) Bed turnover rate:

It is a measure of ICU utilization. It includes the number of times each ICU bed changes occupants.[108]

d) Length of stay (LOS):

It is calculated for each patient after he or she is discharged from ICU. It refers to the number of calendar days from the day of patient admission to the day of discharge.[81,109]

e) Average length of stay (ALOS):-

It is the total length of stay (LOS) divided by the number of patients discharged.[81,109]

f) Gross death rate:-

It is the proportion of all ICU discharges that resulted in death. It is the basic indicator of mortality in a health care facility.[106]

g) Net death rate:-

It is an adjusted death rate. It is calculated in the belief that certain deaths should not "count against the hospital". It is an adjusted rate because patients who die within 48 hours of admission are not included in the net death rate. The reason for excluding them is that 48 hours is not enough time to positively affect patient outcome. In other words, the patient was not admitted to the ICU in a manner timely enough for treatment to have an effect on his or her outcome.[106]

h) ICU readmission rate:-

Readmission to the ICU within 24 hours of transfer during a single hospital stay. This is an indicator of post ICU care.[81,82]

III. Research Setting:

This study was conducted in the Third Intensive Care Unit of the Department of the Critical Care Medicine of Alexandria Main University Hospital. It is a medical-surgical intensive care unit serving all the medical and surgical departments of Alexandria Main University Hospital.

During the first month of the field work period, the third intensive care unit contained fifteen beds arranged in two wards. One ward contained eight beds and the other contained seven beds, each ward contains beds separated by either built in partition or curtains, and because of the renovation of the First ICU, the ward that contained eight beds was included to be the First ICU, while the Third ICU became the ward that contained the seven beds only for the rest of the field work period.

The medical staffing of the unit included the staff members of the department of the Critical Care Medicine, the resident physicians, and the nursing staff.

IV. Target Population and Sampling:

All records of patients admitted to the Third Intensive Care Unit of the Department of Critical Care Medicine of Alexandria Main University Hospital during the three months period of the field study- starting from the first of January 2014 to the end of March 2014- were enrolled in the study.

V. Research Tools: (Appendix)

A transfer sheet was designed by the researcher to collect relevant information from the medical records of the studied patients. One transfer sheet was completed for each patient and noted by a serial number. It included the following sections

Section 1:

Addressed patients' demographic characteristics; patient name, sex, age, and residence by governorate.

Section 2:

Included data about; admission date, discharge date, occurrence of readmission , and, in case of readmission: when and what are the causes of readmission.

Section 3:

Addressed the current health status indicated by the cause of admission to the ICU whether: road traffic accidents, cardiovascular diseases (ischemic heart disease [IHD], cardiogenic shock), cerebrovascular causes, toxicological causes, fall from height, surgical causes, shock, multiple organ dysfunction, acute respiratory distress syndrome (ARDS), or any other causes for admission. Also, it covered the medical history of the studied patients. It included the current presence of a chronic health problem as: diabetes mellitus[DM], hypertension, chronic heart, liver and/or renal disease, underlying lung disease (presence of bronchial asthma or chronic obstructive pulmonary disease [COPD]), connective tissue disorders or any other co-morbid conditions.

Section 4:

It addressed the need for mechanical ventilation and its duration, as well as the prescription of antimicrobial treatment.

Section 5:

Covered the outcome of the admitted patients whether died or discharged from the hospital (with improvement or under family responsibility), or refered to another department in the hospital.

VI. Procedure of data collection:

1. Official agreement:

An official approval for the implementation of the study was obtained from the Community Medicine Department and the Critical Care Medicine Department in Alexandria Faculty of Medicine.

2. Pilot study:

- A pilot study was conducted prior to starting the field work in December 2013, in order to:
  a) Pretest the data collection tools.
  b) Pretest the procedure of data collection.
  c) Assess feasibility and duration of follow up.

- Feedback of the pilot study revealed the following:
  a) Determination of the number of visits required weekly in order to complete the patients' transfer sheets without missing any patient which revealed to be at least three visits weekly.
  b) Determination of the required time per visit for collection of data and completion of the transfer sheet which was one to two hours.

3. Plan for data collection:

Data was collected using the predesigned transfer sheet which was prepared by the researcher.

The researcher visits to the unit were carried out at least three times weekly. The majority of the visits were conducted during the morning shifts, while the others were carried out during the evening and night shifts.

The medical records of all enrolled patients were reviewed after admission to collect all relevant recorded data. Then, patients were followed three times weekly to complete their transfer sheets and to record the newly admitted patients. Each admitted patient was followed to identify the management procedures carried out in the studied unit including the need for mechanical ventilation and prescription of antimicrobial treatment, and also to identify the outcome for each patient.

VII. Ethical consideration:

Approval for this study was obtained from the Research Ethics Committee of Alexandria Faculty of Medicine. All study procedures was carried out in accordance with the Declaration of Helsinki regarding research involving human subjects.

VIII. Data processing and analysis:

The raw data were coded and entered into SPSS system files (SPSS package version 18, and IBM SPSS software package 20). Analysis and interpretation of data were conducted.

The following statistical measures were used:

- Descriptive statistics including either number and percent to describe qualitative data, or frequency distribution, minimum and maximum, arithmetic mean and standard deviation, median, and inter-quartile range used to describe quantitative data.
- Kolmogorov – Smirnov test was used to examine the normality of data distribution.
- Comparison between different groups regarding categorical variables was tested using Chi-square test. When more than 20% of the cells have expected count less than 5, correction for chi-square was conducted using Fisher's Exact test or Monte Carlo correction.
- For abnormally distributed data, comparison between two independent population were done using Mann Whitney test while Kruskal Wallis test was used to compare between different groups.
- Significance of the obtained results was judged at the 5% level.
- Calculation of Health services utilization indicators using the following equations:-

Health services utilization indicators:-

a) Average daily census =

Total number of inpatient service days in Third ICU during the field work period

---

Total number of days in the same unit and period

b) Inpatient bed occupancy rate (BOR)=

Total number of inpatient service days in Third ICU during the field work period

---×100

Total number of inpatient bed count days for the same unit and period

c) Bed turnover rate (BTR) =

Total number of discharges (including deaths) in the Third ICU during the field work period

---

Average bed count for the same unit and period

d) Length of stay& average length of stay:-

Length of stay (LOS) is calculated for each patient after he or she is discharged from the ICU. It refers to the number of calendar days from the day of patient admission to the day of discharge.

Average length of stay (ALOS)=

Total length of stay in the Third ICU during the field work period

---

Total number of discharges (including deaths) for the same unit and period

e) Gross death rate& net death rate:-

Gross death rate=

Total number of inpatient deaths in the Third ICU during the field work period

---×100

Total number of discharges (including deaths) for the same unit and period

Net death rate=

Total number of inpatient deaths - deaths≤48hours in the

Third ICU during the field work period

---×100

Total number of discharges - deaths≤48hours for the same unit and period

f) ICU readmission rate=

$$\frac{\text{Number of readmitted patients to the Third ICU during the first 24hours of discharge}}{\text{Total number of admitted patients to the Third ICU during the field work period}} \times 100$$

IX. Administrative design:

All procedures covering the present study were carried out entirely by the researcher under the guidance of the supervisors.

X. Time table:

Table (1): time-table for conduction of the research work.

Activity	January - March	April – June	July - September	October - December	January - March	April – June	July - September	October - December
	2013				2014			
Literature review								
Preparation of study tools								
official agreements								
Exploratory visits								
Pilot study								
Data collection								
Data analysis								
Final report writing & submission of thesis for evaluation								

RESULTS

Results of the present study are presented in the following sections:-

Section 1:

The demographic characteristics of the studied patients (age, sex, and residence).

Section 2:

The medical characteristics of the studied patients including the presence of comorbid conditions, as well as, the cause of admission.

Section 3:

Description of ICU admission of studied patients including the following:

1. Length of ICU stay.
2. Need for mechanical ventilation.
3. Duration of mechanical ventilation.
4. Prescription of antimicrobial treatment.

Section 4:

The outcome of studied patients.

Section 5:

Health services utilization indicators including:

1. Average daily census.
2. Bed occupancy rate.
3. Bed turnover rate.
4. Average length of stay.
5. Death rate& net death rate.
6. Readmission rate.

Section 1: Demographic characteristics of studied patients:

Table (2) shows that slightly more than half (51.2%) of studied patients were females (figure 1). The age of studied patients ranged from one to 85 years with a mean age of 39.1±24.67 years, and a median of 36.0(18.0-60.5). Those below five years represent 11.6%, and more than one third (36.4%) of studied patients were at or above 55 years of age (figure 2). As regard residence of studied patients, about three quarters (76%) of patients were living in Alexandria governorate, patients from El-Behira constituted 17.4% of the total admitted patients. The rest (6.5%) of admitted patients during the period of the field work were inhabitants of Cairo, El-Gharbia, Matrouh, and Kafr El-Sheikh, (figure 3).

Table (2): Distribution of studied patients according to demographic data

Demographic data	Studied patients (n=121)	
	No.	**%**
sex		
Male	59	48.8
Female	62	51.2
Age (years)		
1 -	14	11.6
5 –	11	9.1
15 –	13	10.7
25 -	20	16.5
35-	8	6.6
45-	11	9.1
55-	22	18.2
65-	15	12.4
75 - 85	7	5.8
Min-Max.	1.0 – 85.0	
Median(IQR).	36.0 (18.0 – 60.5)	
Mean ±SD	39.10 ± 24.67	
Residence (governorate)		
Alexandria.	92	76.0
El-Behira.	21	17.4
Cairo	4	3.3
El-Gharbia	2	1.6
Matrouh	1	0.8
Kafr El-Sheikh	1	0.8
Total	**121**	**100.0**

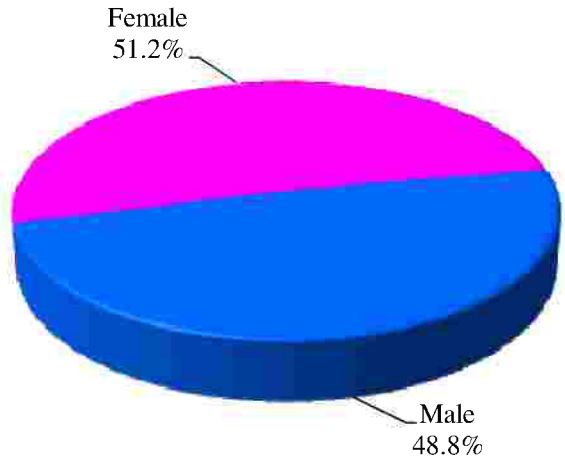

Figure (1): Distribution of studied patients in the Third ICU according to their sex

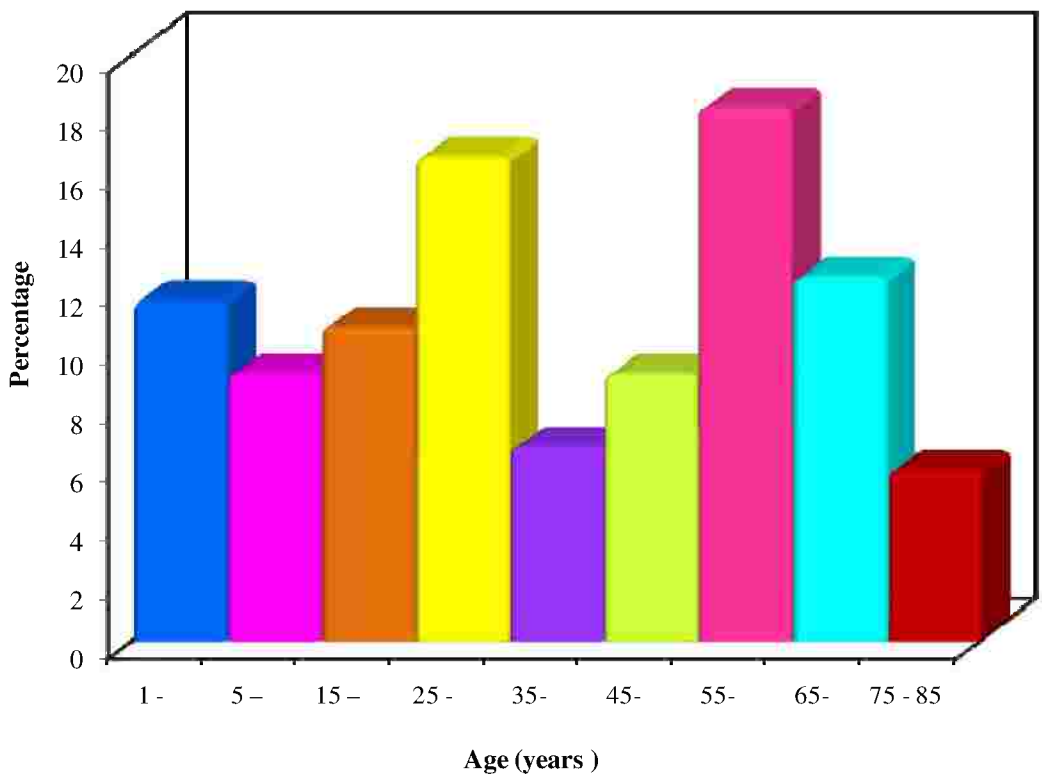

Figure (2): Distribution of studied patients in the Third ICU according to their age

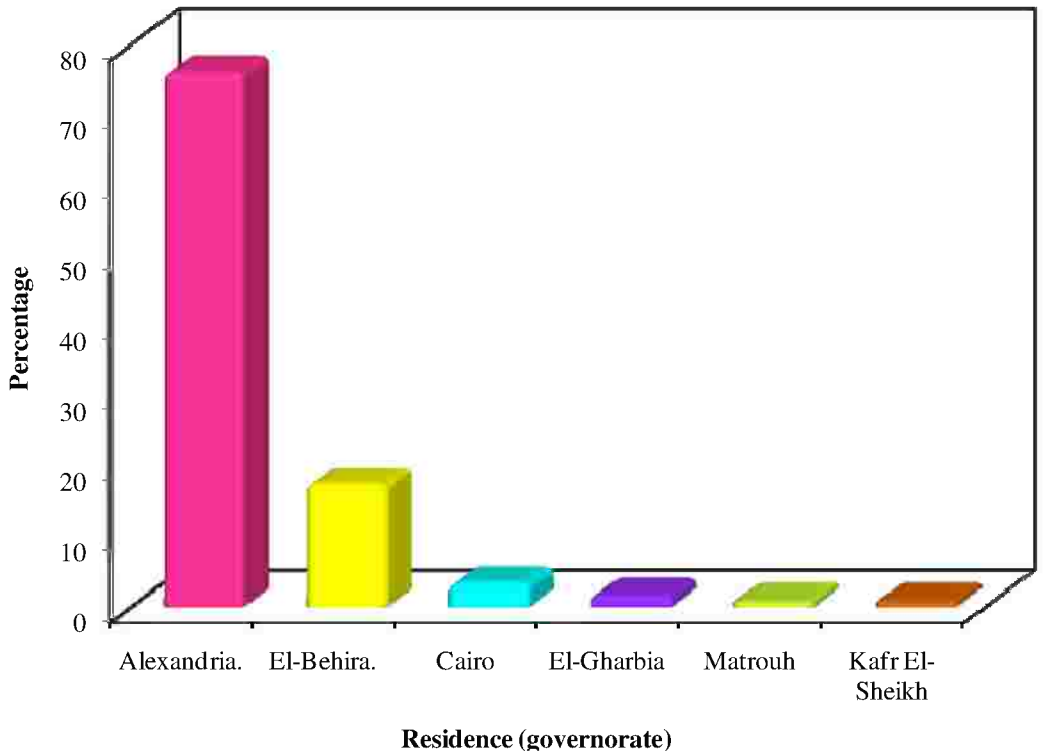

Figure (3): Distribution of studied patients in the Third ICU according to their governorate of residence.

Section 2:-medical characteristics of studied patients:

a. Cause of ICU admission:

Table (3) and figure (4) portray the causes of admission to ICU, the toxicological causes constituted about one third of admitted cases (32.2%), followed by acute respiratory distress (14.9%), road traffic accidents (12.4%) and cardiovascular diseases (10.7%).

Table (3):- distribution of studied patients according to the cause of ICU admission.

Causes of admission	Studied patients (n=121)	
	No.	%
Toxicological cause	39	32.2
Acute respiratory distress syndrome [ARDS]	18	14.9
Road traffic accident	15	12.4
Cardiovascular diseases	13	10.7
Cerebrovascular stroke	11	9.0
Shock	8	6.6
Fall from height	4	3.3
postoperative causes	4	3.3
Multiple organ dysfunction syndrome	3	2.5
Others*	6	5.0
Total	**121**	**100.0**

*others include: acute kidney impairment (AKI), hepatic encephalopathy, diabetic ketoacidosis (DKA), epilepsy, idiopathic thrombocytopenic purpura (ITP), trauma.

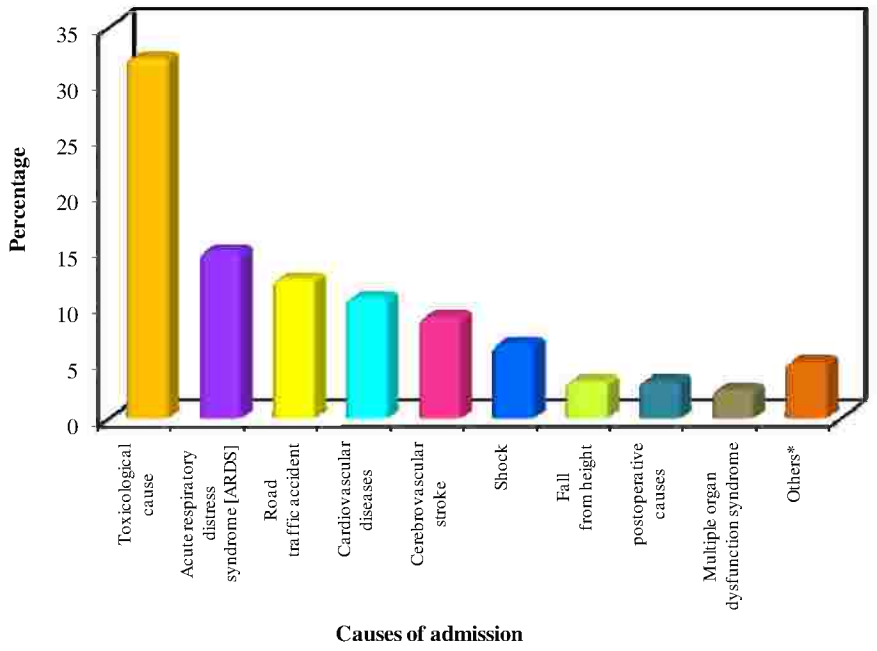

Figure (4): Distribution of studied patients according to the cause of ICU admission.

b. Medical history (co-morbid conditions):-

Figure (5):- reveals that 55 out of the 121 studied patients (45.5%) were suffering from comorbid conditions. Table (4) and figure (6) show that less than half (47.3%) of those patients were suffering from multiple comorbid conditions, while about (16.3%) of them were suffering from hypertension and chronic heart disease. Hypertension only was a comorbid condition representing 5.5% of admitted patients during the period of the field work, while coronary heart disease only represent 1.8%of studied patients, diabetes mellitus represent 5.5% of studied patients, while slightly less than one tenth (9.1%) of studied patients were suffering from either renal diseases or bronchial asthma/COPD.

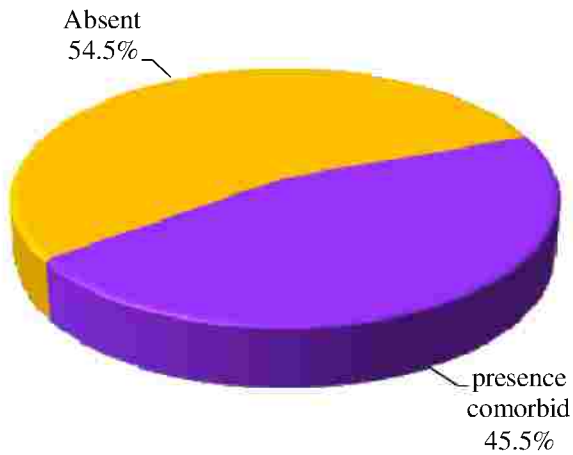

Figure (5): Distribution of studied Patients according to presence of comorbid condition

Table (4):- distribution of studied patients according to their co-morbid condition.

Co-morbid conditions	Studied patients	
	No.	%
With co-morbid conditions		
Diabetes mellitus.	3	5.5
Hypertension.	3	5.5
Coronary heart disease (CHD).	1	1.8
Bronchial asthma/ COPD.	5	9.1
Renal disease.	5	9.1
Chronic hepatic disease.	1	1.8
Diabetes and hypertension	2	3.6
Hypertension and CHD	9	16.3
Multiple co-morbid conditions*	26	47.3
subtotal	**55**	100% **(45.5%)**
No comorbid conditions	**66**	**(55.5%)**
Total	**121**	**100.0%**

*multiple comorbid conditions include some combinations of the previously mentioned diseases, as well as, other comorbid conditions such as: hypothyroidism, cancer, deep vein thrombosis(DVT), epilepsy and psychiatric disorders.

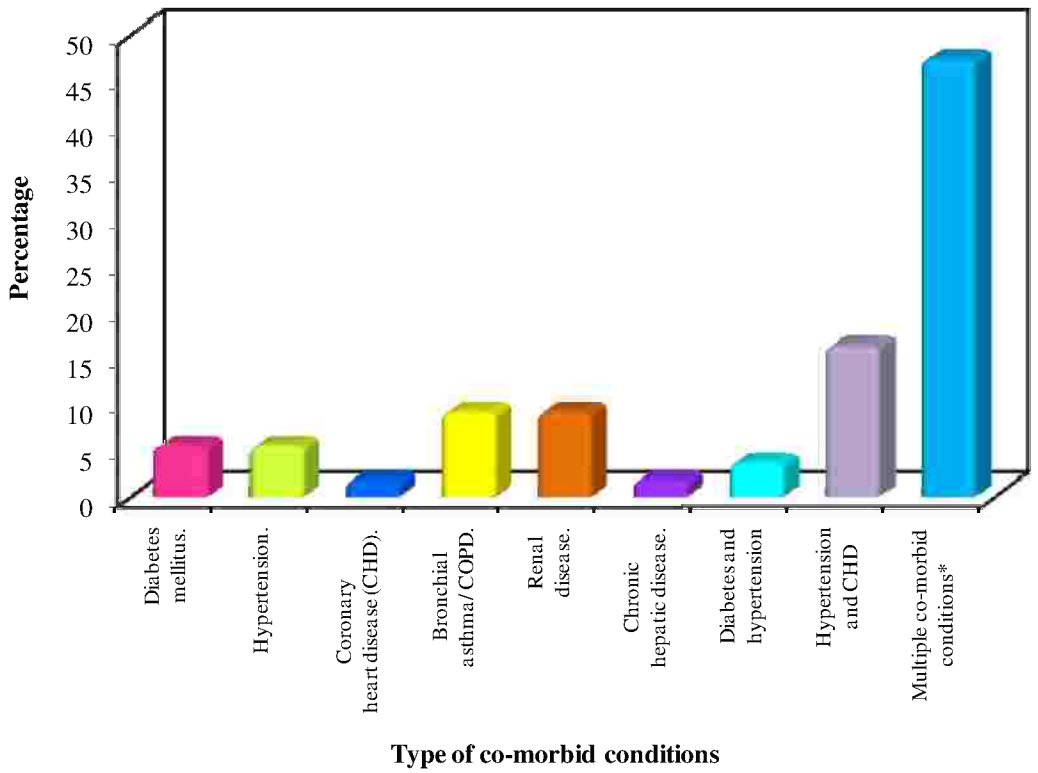

Figure (6): Distribution of studied patients with chronic illnesses according to their co-morbid condition.

Section 3: description of ICU admission:

a. Length of ICU stay:

The length of stay for admitted patients in the Third ICU ranged from one to 66 days with a mean duration of 7.17±10.83 days and a median of 3 days. Table (5) and figure (7) portray that about one third (33.9%) of studied patients stayed for a period less than 48 hours, lesser percentage stayed in the studied ICU for either a duration ranged from two to less than five days (27.3%), or a duration ranged from five to less than ten days (18.1%). Those stayed for a period at or above 15 days constituted (11.6%).

Table (5):- distribution of studied patients according to the length of stay in ICU.

Duration of stay in ICU (days)	Studied patients (n=121)	
	No.	%
1-	41	33.9
2 -	33	27.3
5-	22	18.1
10-	11	9.1
15-	2	1.7
20-	12	9.9
Min - max.	1 - 66	
Median (IQR).	3 (1-7)	
Mean ± SD	7.17 ± 10.83	
Total	**121**	**100.0**

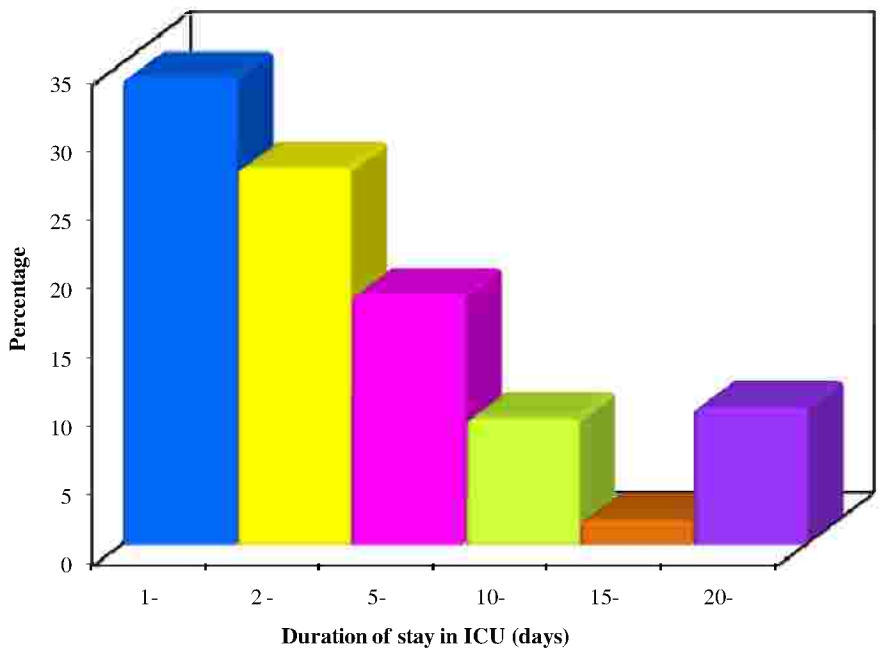

Figure (7): Distribution of studied patients according to the length of stay in ICU.

Relation between age and length of stay:

Table (6) shows that the highest mean length of stay was (15.43±17.02) days and was observed among the eldest age group (75-85) years, and the lowest mean length of stay was (2.92 ± 3.48) and was observed among the age group (15 to less than 25) years, while the mean length of stay at the age less than 5 years was (3.71±6.32) days. This represents a significant relationship where the mean length of stay increased with increasing age, with $^{KW}\chi^2$=19.408 and p=0.009.

Table (6): Relation between age and length of stay (n = 121)

Age (years)	N	Length of stay		
		Min. – Max.	Mean ± SD	Median
1 -	**14**	1.0 – 20.0	3.71 ± 6.32	1.0
5 -	**11**	1.0 – 8.0	3.27 ± 2.53	2.0
15 -	**13**	1.0 – 13.0	2.92 ± 3.48	2.0
25 -	**20**	1.0 – 66.0	8.80 ± 16.86	2.0
35-	**8**	1.0 – 51.0	10.0 ± 17.08	3.0
45-	**11**	1.0 – 23.0	5.55 ± 6.27	4.0
55-	**22**	1.0 – 35.0	9.05 ± 9.51	6.0
65-	**15**	1.0 – 25.0	7.80 ± 6.56	6.0
75 - 85	**7**	1.0 – 45.0	15.43 ± 17.02	9.0
1-85	**121**	1.0 – 66.0	7.17±10.83	3.0 (1.0–7.0)
$^{KW}\chi^2$		19.408*		
(p)		(0.009*)		

$^{kw}\chi^2$: Chi square for Kruskal Wallis test
*: Statistically significant at $p \leq 0.05$

Relation between length of stay and presence of co morbid conditions:

Table (7) reveals that admitted patients with comorbid conditions have a significant longer stay in the ICU with a mean length of stay of (9.24±11.43) days, and a median of 6 days, compared to patients without comorbid conditions found to have a mean length of stay of (5.44±10.07) days, and a median of 2 days, with Z= 3.838 and P<0.001.

Table (7): Relation between length of stay and presence of co morbid conditions

Comorbid condition	Length of stay		
	Min-max	**Mean± SD**	**Median**
Yes (n=55)	1.0 – 66.0	9.24 ± 11.43	6.0
No (n=66)	1.0 – 51.0	5.44 ± 10.07	2.0
Total (n=121)	1.0 – 66.0	7.17±10.83	3.0 (1.0–7.0)
Tests of significance	**Z** =3.838* **P** <0.001*		

Z: Z for Mann Whitney test
*: Statistically significant at $p \leq 0.05$

b. Mechanical ventilation:

62 out of 121 representing slightly more than half (51.2%) of studied patients needed mechanical ventilation (figure 8). Of those less than half (45.2%) were on mechanical ventilation for a period less than five days, while 24.2% of those patients needed mechanical ventilation for a period from five to less than ten days. Those who needed mechanical ventilation for a period at or above 20 days represent 14.5% (figure 9) , with a minimum duration of one day and a maximum of 61 days and a mean duration of 9.56±11.43 days, and a median duration of five days (table 8).

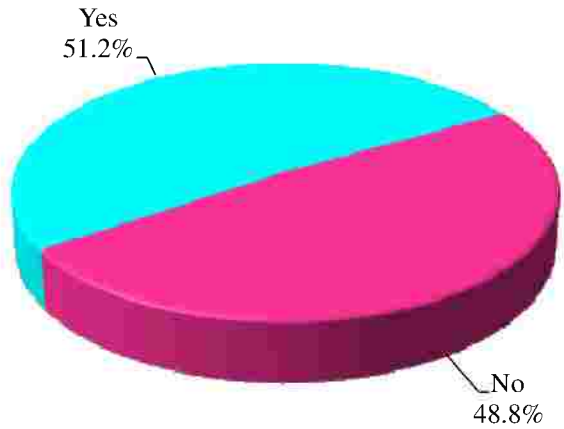

Figure (8): Distribution of studied patients according to need for mechanical ventilation

Table (8): Distribution of studied patients according to the need and duration of mechanical ventilation.

Need for mechanical ventilation (by duration in days)	Studied patients	
	No.	**%**
1-	28	45.2
5-	15	24.2
10-	7	11.3
15-	3	4.8
20-	9	14.5
Min - max.	1- 61	
Median (IQR).	5(2-13)	
Mean ± SD	9.56±11.43	
Subtotal	**62**	100%(**51.2%**)
No need for mechanical ventilation	**59**	**(48.8%)**
Total	**121**	**100.0%**

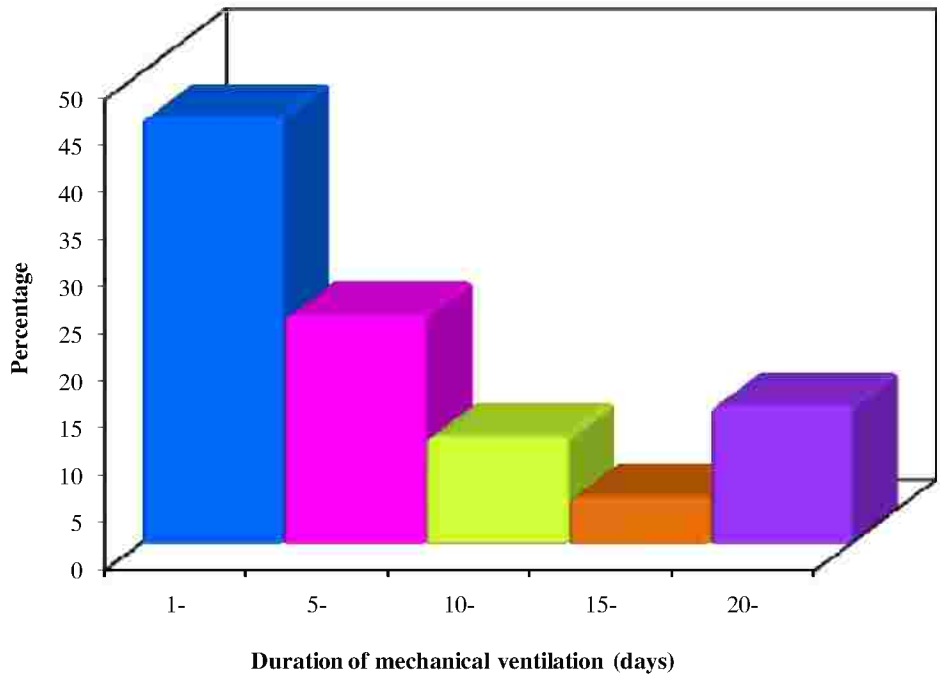

Figure (9): Distribution of studied patients needed mechanical ventilation according to its duration.

Relation between age and need for mechanical ventilation:

Table (9) reveals that the need for mechanical ventilation among the age group (55-85) years represent (50%) of studied patients who needed mechanical ventilation compared to the (22.1%) who did not need mechanical ventilation among the same age group, while the need for mechanical ventilation below 5 years of age represent (3.2%) of studied patients who needed mechanical ventilation compared to the (20.3%) who did not need mechanical ventilation among the same age group. This represents a significant association as the need for mechanical ventilation increases with increasing age where P=0.004.

Table (9): Relation between age and need for mechanical ventilation

Age	Need for mechanical ventilation					
	No (n= 59)		Yes (n= 62)		Total	
	No.	%	No.	%	No.	%
1 -	12	20.3	2	3.2	14	11.6
5 –	8	13.6	3	4.8	11	9.1
15 –	6	10.2	7	11.3	13	10.7
25 -	12	20.3	8	12.9	20	16.5
35-	4	6.8	4	6.5	8	6.6
45-	4	6.8	7	11.3	11	9.1
55-	9	15.3	13	21.0	22	18.2
65-	4	6.8	11	17.7	15	12.4
75 - 85	0	0.0	7	11.3	7	5.8
$\chi^2(^{MC}p)$	$22.40^{*}(0.004^{*})$					
Total	59	100 **(48.8%)**	62	100 **(51.2%)**	121	100 **(100%)**

χ2: Chi square test
MC: Monte Carlo test
*: Statistically significant at $p \leq 0.05$

Relation between presence of comorbid condition and need for mechanical ventilation:

Table (10) reveals that (62.9%) of admitted patients during the field work period with comorbid conditions needed mechanical ventilation, while only (37.1%) of admitted patients without comorbid conditions needed mechanical ventilation. While, less than three quarters (72.9%) of studied patients with no comorbid condition, did not need mechanical ventilation. The presence of comorbid conditions was significantly associated with the need for mechanical ventilation where Chi square test =15.614 and P<0.001.

Table (10): Relation between co morbid and need for mechanical ventilation

	Need for mechanical ventilation				**Total**	
	Yes (n= 62)		**No (n= 59)**			
	No.	**%**	**No.**	**%**	**No.**	**%**
Co morbid						
Yes	39	62.9	16	27.1	55	**45.5%**
No	23	37.1	43	72.9	66	**55.5%**
Total	62	**51.2%**	59	**48.8%**	121	**100%**
χ^2	15.614*					
p	<0.001*					

χ2: Chi square test
*: Statistically significant at $p \leq 0.05$

c. Use of antimicrobial treatment:

Figure (10) shows that (60.3%, n=73) of admitted patients received antimicrobial treatment.

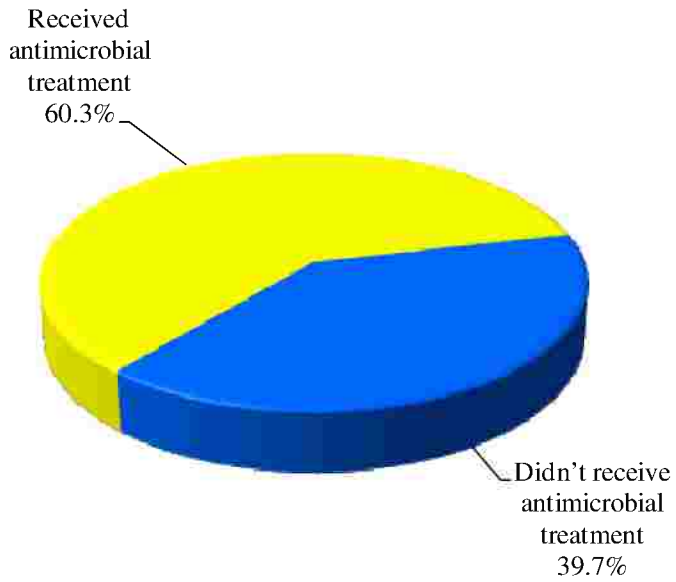

Fig.10: prescription of antimicrobial treatment among studied patients.

Section 4: outcome of studied patients:

Table (11) portrays that the majority of studied patients (59.6%) were referred to other wards in the hospital to complete their treatment after control of their critical illnesses. Death was the end of 35 patients presenting a death rate of 28.9%. Ten patients(8.3%) were discharged on family responsibility without improvement of their condition. Only 4 out of the 121 (3.3%) admitted patients during the field work period were discharged from the hospital after being completely improved.

Table (11): Distribution of studied patients according to their outcome.

Outcome of studies patients	Studied patients (n=121)	
	No.	%
• Discharge from hospital after improvement of the case.	4	3.3
• Referral to another department.	72	59.6
• Discharge from hospital on family responsibility	10	8.3
• Death.	35	28.9
Total	**121**	**100.0**

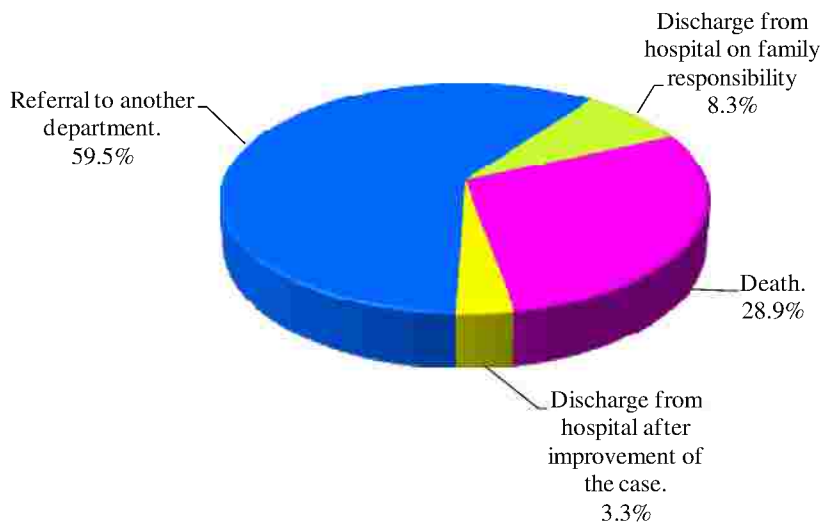

Figure (11): distribution of studied patients according to their outcome.

Relation between age and outcome:

Table (12) portrays that the highest mortality rate (59.1%) among the studied patients was encountered among those aged 55 to less than 65 years, followed by (45.4%) among those aged 5 to less than 15 years, while the mortality rate among those aged 75-85 years was (42.9%), and no mortalities were encountered among those aged 15 to less than 25 years. Increasing age was significantly associated with the mortality outcome of studied patients where chi square test= 40.874 and p= 0.001.

Table (12): Relation between age and outcome

Age	Outcome									
	Death		Discharge from hospital after improvement of case		Discharge from hospital on family responsibility		Refer to another department		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
1 -	1	7.1	0	0.0	1	7.1	12	85.6	14	100(**11.6**)
5 –	5	45.4	0	0.0	3	27.3	3	27.3	11	100(**9.1**)
15 –	0	0.0	2	15.4	1	7.7	10	76.9	13	100(**10.7**)
25 -	2	10.0	2	10.0	0	0.0	16	80.0	20	100(**16.5**)
35-	3	37.5	0	0.0	0	0.0	5	62.5	8	100(**6.6**)
45-	4	36.4	0	0.0	2	18.2	5	45.4	11	100(**9.1**)
55-	13	59.1	0	0.0	1	4.5	8	36.4	22	100(**18.2**)
65-	4	26.7	0	0.0	2	13.3	9	60.0	15	100(**12.4**)
75 - 85	3	42.9	0	0.0	0	0.0	4	57.1	7	100(**5.8**)
χ^2(^{MC}p)	40.874*(0.001*)									
Total	35	28.9	4	3.3	10	8.3	72	59.5	121	**100%**

χ^2: Chi square test
MC: Monte Carlo test
*: Statistically significant at $p \leq 0.05$

Relation between length of stay and outcome:

Table (13) shows that the highest mortality rate (54.5%) was encountered among patients with a length of stay 10 to less than 15 days, followed by (50%) among patients with a length of stay 15 to less than 20 days, and was the least (15.2%) among patients with a length of stay 2 to less than 5 days. This represents insignificant relation between length of stay and mortality outcome of studied patients where chi square test = 20.970 and p=0.065.

Table (13): Relation between length of stay and outcome

Length of stay	Outcome								Total	
	Death (n = 35)		Discharge from hospital after improvement of case (n = 4)		Discharge from hospital on family responsibility (n = 10)		Refer to another department (n = 72)			
	No.	%	No.	%	No.	%	No.	%	No.	%
1 -	9	22.0	1	2.4	1	2.4	30	73.2	41	100(**33.9**)
2-	5	15.2	1	3.0	6	18.2	21	63.6	33	100(**27.2**)
5-	10	45.5	1	4.5	2	9.1	9	40.9	22	100(**18.2**)
10-	6	54.5	1	9.1	0	0.0	4	36.4	11	100(**9.1**)
15-	1	50.0	0	0.0	0	0.0	1	50.0	2	100(**1.7**)
≥ 20	4	33.3	0	0.0	1	8.3	7	58.4	12	100(**9.9**)
χ^2(^{MC}p)	20.970(0.065)									
Total	35	28.9	4	3.3	10	8.3	72	59.5	121	**100.0**

χ2: Chi square test
MC: Monte Carlo test

Section 5: health services indicators:-

a) Average daily census =

$$\frac{\text{Total number of inpatient service days in the Third ICU during the field work period}}{\text{Total number of days in the same unit and period}}$$

Total number of inpatient service days during January= **411** service days, with an average daily census= **13.26** patients served per day.

Total number of inpatient service days during February= **244** service days, with an average daily census= **8.7** patients served per day.

Total number of inpatient service days during March= **181** service days, with an average daily census =**5.8** patients served per day.

b) Inpatient bed occupancy rate (BOR)=

$$\frac{\text{Total number of inpatient service days in the Third ICU during the field work period}}{\text{Total number of inpatient bed count days for the same unit and period}} \times 100$$

Bed count days are calculated by multiplying the number of days in the given period by the number of beds available during the time frame of interest.

Bed occupancy rate during January= $\frac{411}{15\times 31}\times 100 = \mathbf{88.4\%}$

Bed occupancy rate during February= $\frac{244}{7\times 28}\times 100 = \mathbf{124.5\%}$

Bed occupancy rate during March= $\frac{181}{7\times 31}\times 100 = \mathbf{83.4\%}$

c) Bed turnover rate (BTR) =

$$\frac{\text{Total number of discharges (including deaths) in the Third ICU for the field work period}}{\text{average bed count for the same unit and period}}$$

Bed turnover rate during January= $\frac{42}{15} = \mathbf{2.8}$ patients/month.

Bed turnover rate during February= $\frac{42}{7} = \mathbf{6}$ patients/month.

Bed turnover during March= $\frac{34}{7}$ = **4.9** patients/month.

d) Length of stay& average length of stay:-

Length of stay (LOS) is calculated for each patient after he or she is discharged from the ICU. It refers to the number of calendar days from the day of patient admission to the day of discharge.

It equals **[863]** days.

Average length of stay (ALOS) =

$$\frac{\text{Total length of stay in the Third ICU for the field work period}}{\text{Total number of discharges (including deaths) for the same unit and period}}$$

$$= \frac{863}{121} = \mathbf{7.1} \text{ days}$$

e) Gross death rate& net death rate:-
Gross death rate=

$$\frac{\text{Total number of inpatient deaths in the Third ICU during the field work period}}{\text{Total number of discharges (including deaths) for the same unit and period}} \times 100$$

$$= \frac{35}{121} \times 100 = \mathbf{28.9\%}$$

Net death rate=

$$\frac{\text{Total number of inpatient deaths after 48hours of admission in the Third ICU during the field work period}}{\text{Total number of discharges - deaths} \leq \text{48hours for the same unit and period}} \times 100$$

$$\frac{35-13}{121-13} = \frac{22}{108} \times 100 = \mathbf{20.4\%}$$

f) ICU readmission rate=

$$\frac{\text{Number of readmitted patients during the first 24hours of of discharge from the Third ICU during the field work period}}{\text{Total number of admitted patients for the same unit and period}} \times 100$$

$$= \frac{2}{121} \times 100 = \mathbf{1.7\%}$$

The causes of readmission in the two readmitted patients were viral encephalitis and electrolyte disturbance which were related to the primary causes of admission.