

Characteristics and outcomes of mechanically ventilated elderly patients in the absence of an end-of-life care policy: a retrospective study from Bahrain

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BACKGROUND: Globally, the percentage of elderly patients has been increasing, leading to a higher demand for healthcare resources and intensive care. Bahrain has a majority Muslim population and Islam governs most policies, including end-of-life care. All patients at our institute receive full resuscitative measures regardless of the prognosis, leading to a high number of mechanically ventilated patients.

OBJECTIVES: Assess characteristics, outcomes, theoretical costs, and use of antibiotics in critically ill elderly patients requiring mechanical ventilation.

DESIGN: Retrospective.

SETTING: Intensive care unit and general ward of a tertiary medical care center.

PATIENTS AND METHODS: We studied all elderly patients (≥ 60 years old) admitted under general medicine in the period of January to June 2018 who needed intensive care and were intubated.

MAIN OUTCOME MEASURES: The duration of mechanical ventilation, theoretical costs, antibiotic usage.

SAMPLE SIZE: 140 patients.

RESULTS: Of 140 patients, 136 died (97%) and half of the deaths ($n=69$, 50.7%) occurred within the first 24 hours of intubation. Sixty-nine (79.3%) of the patients on short-term ventilation (≤ 96 hours) died within 24 hours of intubation, while the four survivors were on long-term ventilation (>96 hours) ($P<.001$). All the nonsurviving patients ($n=136$) were on antimicrobial therapy, mostly for hospital-acquired infections. The median (interquartile range) APACHE II score was relatively high at 28.0 (8.0) with significantly higher scores in the early mortality group compared to the late mortality group (30 [10] vs 26 [7], $P=.013$) and higher scores in the short-term vs long-term ventilation group (29 [10] vs 26 [7], $P=.029$). The median theoretical cost per patient in the early and late mortality groups was USD 10731 and USD 30660, respectively ($P<.001$).

CONCLUSIONS: Given that less than 3% of patients had a favorable outcome, 50% of the cases died within 24 hours after intubation, hospital costs and antimicrobial use were high, the current policy of “full resuscitative measures for all” should be revised. We suggest implementing an end-of-life care policy, since the goal of resuscitation is to reverse premature death, not prolong the dying process.

LIMITATIONS: Small sample size and absence of long-term follow-up.

Theoretical costs were used as no direct calculated costs were available in our hospital.

CONFLICT OF INTEREST: None.

One of the most notable changes in the demography of the world is the increasing number of elderly people. According to the national census of Bahrain in the year 2010, people aged 60 years and older comprised 3.5% of the population; by 2050, the elderly are expected to comprise 24.9% of the population of Bahrain.¹ This trend will lead to a higher demand in resources and manpower, especially intensive care services.² It is common practice in our hospital to provide full resuscitative measures to all patients regardless of outcomes and ethical considerations. This includes cardiopulmonary resuscitation, intravenous antibiotics, and invasive mechanical ventilation. As a result, if we maintain our trajectory with the current policy, intensive care services will need to undergo rapid expansion.

Historically, patients requiring mechanical ventilation (MV) are treated in the intensive care unit (ICU). This is not the case in our institute. Due to the increasing number of ventilated patients and a relatively small sized ICU, almost all intubated patients under the service of general medicine get treated in medical wards. The high number of ventilated cases is most likely due to Islamic policy on end-of-life care. Therefore, all patients, regardless of the prognosis and comorbidities, undergo all investigative and therapeutic measures throughout the course of their illness. Very unwell medical patients with a poor prognosis are usually admitted under general medicine at our institute and intensivists usually review such patients. There are no specific set criteria used but based on severity of illness, comorbidities, and baseline function, it is determined whether the patient would benefit from admission to ICU or not. Since the ICU is almost always at full capacity, patients with a poor prognosis get managed in medical wards with specialized care and the ICU is reserved for "salvageable patients" with a better predicted outlook.

Many critically ill patients who get intubated end up requiring prolonged mechanical ventilation (PMV) due to persistent respiratory failure. This risk of PVM increases with old age and recurrent admissions, and the result is higher hospital expenses per visit.³ This percentage can reach as high as 13% of all patients on invasive mechanical ventilation.⁴ It is also well known that this percentage of cases consume a substantial amount of medical resources coupled with poor outcomes; in

particular, this is true for the oldest patients.⁵ The combination of an aging demographic along with improvements in the quality of critical care and the increasing availability of MV leads to a better survival rate in the early stages of acute respiratory failure.⁶ This leads to an increasing number of PMV cases, a phenomenon that is important to policy makers as these cases consume a disproportionate amount of resources and are associated with high costs related to illness.⁷

In this study, we looked at all patients admitted under the service of general medicine who were critically unwell and required intensive care. We observed treatment outcomes, costs, and antibiotic use. The aims of our study were to identify the characteristics and outcomes of elderly patients who were resuscitated and ventilated, to use theoretical costs to estimate the cost of treating such cases, and to observe the patterns of antimicrobial use. Our goal was to provide data to aid in the discussion of whether aggressive intervention for all patients is appropriate in these circumstances.

PATIENTS AND METHODS

This retrospective study was carried out in a 1200-bed tertiary hospital in Bahrain with a capacity of 22 ICU beds. We selected all patients aged 60 and above admitted under general medicine who required mechanical ventilation in the period of January 2018 to June 2018. Data was collected from the electronic health system including age, gender, chronic illnesses, total number of medications, reason for intubation, and cause of death. The predicted ten-year survival was obtained from the Charlson's comorbidity index.⁸ The Katz Index of Independence in Activities of Daily Living⁹ was calculated to identify the level of function two weeks prior to admission. The APACHE II¹⁰ scores were recorded to indicate the physiological condition of the patients on day one of intubation. We also looked at the names and duration of antibiotics used and estimated the total cost of the admission based on international figures. Early mortality was defined as mortality within the first 24 hours of intubation while late mortality was defined as death more than 24 hours after intubation. Furthermore, based on ICD-10-PCS criteria for mechanical ventilation, a cut-point of 96 hours was used to categorize the duration of ventilation. Specifically, short-term ventilation was defined as ventilation for ≤ 96 hours, while >96

hours defined long-term ventilation.

Categorical variables are presented as frequencies with percentages (%) and compared using χ^2 or the Fisher exact tests. Continuous variables are expressed as mean (standard deviation) or median (interquartile range [IQR]) and compared using the *t* test or a non-parametric test when appropriate. The statistical analysis was performed using IBM SPSS version 23 with a *P* value of $<.05$ to indicate statistical significance.

RESULTS

During the study period, 140 patients underwent intubation and mechanical ventilation under the service of general medicine (**Table 1**). The commonest reason for intubation was sepsis with an infective pathology being the top cause of death. In addition, the median (IQR)APACHE II score was relatively high at 28.0 (9.0). One hundred thirty-six (97.1%) died after intubation; only four patients survived; an insufficient number for statistical comparison with the nonsurvivors. There were no significant demographic differences between early mortality and late mortality groups except for the number of regular medications (**Table 2**). Nonetheless, the late mortality group patients were admitted for a longer period, required more antimicrobials and were on more antibiotics for hospital-acquired infections when compared to the early mortality patients ($P<.001$). The duration of intubation and length of stay were also significantly higher in the late mortality group. APACHE II scores were significantly higher in the early mortality group when compared to the late mortality group ($P=.013$). Cardiac arrest followed by sepsis was the most common cause of intubation in the early mortality group, while sepsis followed by pneumonia was more prevalent in the late mortality group ($P<.001$). There were no significant differences between groups in terms of cause of death. Using international figures, we also calculated theoretical costs which were significantly higher in the late mortality group as compared to the early mortality group (**Table 3**).

Short- and long-term ventilation comparison

Most patients in our study (62.1%, $n=87$) were intubated for less than 96 hours (short-term ventilation) (**Table 4**). Although there were no significant differences between short and long-term ventilation groups in demographics, ventilation duration and length of stay were significantly higher in the long-term ventilation group ($P<.001$). The 87 patients (64%) who underwent short-term ventilation (≤ 96 hours) died within 24 hours of intubation, while the four survivors were on long-term ventilation (>96 hours). Pneumonia was the common-

Table 1. Patient characteristics and outcomes ($n=140$).

Mean age (years)	81.0 (10.1)
Sex (male)	68 (48.6)
Nationality (Bahraini)	135 (96.4)
Median number of chronic illnesses	3 (2-4)
Diabetes mellitus	78 (55.7)
Hypertension	94 (67.1)
Cerebro-vascular accident	37 (26.4)
Hyperlipidaemia	36 (25.7)
Ischemic heart disease	36 (25.7)
Chronic renal disease	25 (17.9)
Median number of regular medications	5 (3-8)
Median APACHE II Score (IQR, range)	28 (8, 11-42)
Median Charlson's Comorbidity Index (points)	5 (4-6)
Median predicted 10-year survival (%)	21 (2-53)
Median Katz Index score	3 (1-6)
Hospital course and outcomes	
Median length of stay (days)	14 (5-32)
Median intubation duration (days)	2 (1-10)
Outcome	
Alive	4 (2.9)
Early mortality	69 (49.3)
Late mortality	67 (47.9)
Intubation reason	
Sepsis	55 (39.3)
Pneumonia	39 (27.9)
Cardiac arrest	33 (23.6)
Pulmonary edema	9 (6.4)
Others ^a	4 (2.9)
Cause of death ($n=136$)	
Infective	124 (91.2)
Malignancy	4 (2.9)
Cardiac	3 (2.2)
Others ^b	5 (3.7)
Antimicrobial	
Median number of antibiotics	3 (2-4)
Median duration of antibiotic therapy (days)	9 (4-15)
Theoretical cost of hospital stay	
Median cost of admission (USD)	21 462 (7665-49 056)

Data are number (%) and mean (standard deviation) for age or median (interquartile range)

^aChronic obstructive pulmonary disease, metabolic intoxication, and neuromuscular disorders.

^bNon-infective respiratory, renal, and gastrointestinal related cause

est reason for intubation in the long-term ventilation group (43.4%) as opposed to sepsis in the short-term ventilation group (41.4%). Patients who were ventilated for a short period had a higher APACHE II score ($P=.029$) and were more likely intubated due to cardiac arrest or sepsis compared to those who were ventilated for a long period as the majority were ventilated due to pneumonia ($P<.002$). There was no statistically significant difference between groups in terms of function, estimated 10-year survival, and cause of death.

Antimicrobial use among patients

All of the nonsurviving patients ($n=136$) were on antimicrobial therapy. The most prescribed antibiotic was meropenem, followed by vancomycin and piperacillin-tazobactam (61.4%, 50% and 44.3% respectively) (Table 5). The median number (interquartile range) of antibiotics per patient was 3 (2-4) antibiotics and as many as

24% of the patients received 5 or more antibiotics. In addition, 84.3% ($n=118$) of our cohort were taking antibiotics for hospital-acquired infections. The median duration of antibiotic therapy was 9 days. Long-term ventilation was associated with a greater median number of administered antibiotics compared with short-term ventilation (2 vs 5 antibiotics respectively) (Figure 1).

DISCUSSION

Since our institute has no end-of-life care policy and guidelines on resuscitation status, accommodating mechanically ventilated elderly patients in the ICU can prove challenging. Usually, ICU beds get reserved for patients with fewer comorbidities and better predicted outcomes. The same approach is used in Israel, where elderly patients may be treated outside the ICU even if they have a poor prognosis.¹¹ Alternatively, in Taiwan, an integrated prospective payment program was set up

Table 2. Comparison between patients with early and late mortality ($n=136$).

	Early mortality ($n=69$, 50.7%)	Late mortality ($n=67$, 49.3%)	P value
Age (years)	81.9 (10.0)	79.6 (9.4)	.177
Sex (male)	34 (50.7)	33 (49.3)	.998
Nationality (Bahraini)	66 (50.4)	65 (49.6)	.673
Median number of chronic illnesses	3 (2-3)	3 (2-5)	.081
Median number of regular medications	4 (2-7)	7 (4-10)	.004
Diabetes mellitus	36 (48)	39 (52)	.479
Hypertension	42 (46.7)	48 (53.3)	.184
Cerebrovascular accident	16 (44.4)	20 (55.6)	.379
Hyperlipidaemia	17 (47.2)	19 (52.8)	.623
Median APACHE II Score	30 (10)	26 (7)	.013
Median Charlson's Comorbidity Index (points)	5 (4-6)	5 (4-7)	.563
Median predicted 10-year survival (%)	21 (2-53)	21 (0-53)	.769
Median Katz Index score	3 (2-6)	2 (1-6)	.436
Hospital course and outcomes			
Median length of stay (days)	7 (3-16)	20 (11-20)	<.001
Median intubation duration (days)	1 (1)	10 (3-24)	<.001
Intubation reason			
Sepsis	24 (44.4)	30 (55.6)	<.001
Pneumonia	12 (32.4)	25 (67.6)	
Cardiac arrest	29 (87.9)	4 (12.1)	
Pulmonary edema	3 (33.3)	6 (66.7)	
Others ^a	1 (33.3)	2 (66.7)	

Table 2 (cont.). Comparison between patients with early and late mortality (n=136).

	Early mortality (n=69, 50.7%)	Late mortality (n=67, 49.3%)	P value
Cause of death			
Infective	60 (48.4)	64 (51.6)	.489
Malignancy	3 (75)	1 (25)	
Cardiac	2 (66.7)	1 (33.3)	
Others ^b	4 (80)	1 (20)	
Antimicrobials			
Median number of antibiotic	2 (1-3)	4 (3-5)	<.001
Median duration of antibiotic therapy (days)	5 (2-10)	12 (7-20)	<.001
Theoretical cost of hospital stay			
Median cost of the admission (USD)	10731 (4599-24 528)	30660 (16863-70 518)	<.001

Data are number (%) and mean (standard deviation) for age or median (interquartile range)

^aChronic obstructive pulmonary disease, metabolic intoxication, and neuromuscular disorders.

^bNon-infective respiratory, renal, and gastrointestinal related causes.

Table 3. Cost of intensive care unit bed per day on mechanical ventilation in selected regions around the world.

Country/Region	Total cost in local currency	Conversion rate	Total cost in USD
Europe ^{a,18}			1628
USA ¹⁹			1522
China ²⁰	Eur 1,383	×1.18	1212
Adopted theoretical cost in our study			1522

^aCountries that participated: Germany, Italy, Netherlands, United Kingdom.

Table 4. Comparison between short-term and long-term ventilation (n=140).

	Short-term ventilation (n=87, 62.1%)	Long-term ventilation (n=53, 37.9%)	P value
Baseline characteristics			
Age (years)	81.4 (10.1)	80.3 (10.2)	.546
Sex (male)	43 (49.4)	25 (47.2)	.466
Nationality (Bahraini)	84 (96.6)	51 (96.2)	.682
Median number of chronic illnesses	5 (4-6)	5 (4-6)	.305
Median number of regular medications	4 (3-8)	6 (4-10)	.470
Diabetes mellitus	48 (55.2)	30 (56.6)	.869
Hypertension	55 (63.2)	39 (73.6)	.205
Cerebrovascular accident	20.0 (23)	17 (32.1)	.237

Table 4 (cont.). Short-term and long-term ventilation.

	Short-term ventilation (n=87, 62.1%)	Long-term ventilation (n=53, 37.9%)	P value
Hyperlipidaemia	22 (25.3)	14 (26.4)	.882
Median APACHE II Score	29 (10)	26 (7)	.029
Median Charlson's Comorbidity Index (points)	5.37 (5-5.74)	5.38 (4.90-5.86)	.975
Median predicted 10-year survival	21 (2-53)	21 (2-53)	.781
Median Katz Index score	3 (1-6)	2 (1-6)	.592
Hospital course and outcomes			
Median length of stay (days)	7 (3-17)	32 (15-50)	<.001
Median intubation duration (days)	1 (1)	12 (9-32)	<.001
Outcome			
Alive	0 (0)	4 (7.5)	<.001
Early mortality	69 (79.3)	0 (0)	<.001
Late mortality	18 (20.7)	49 (92.5)	<.001
Intubation reason			
Sepsis	36 (41.4)	19 (35.8)	.002
Pneumonia	16 (18.4)	23 (43.4)	
Cardiac arrest	29 (33.3)	4 (7.5)	
Pulmonary edema	5 (5.7)	4 (7.5)	
Others ^a	1 (1.1)	3 (5.7)	
Cause of death			
Infective	78 (89.7)	46 (86.8)	.829
Malignancy	3 (3.4)	1 (1.9)	
Cardiac	2 (2.3)	1 (1.9)	
Others ^b	4 (4.6)	1 (1.9)	
Antimicrobial characteristics			
Median number of antibiotic	2 (1-3)	5 (3-6)	<.001
Median duration of antibiotic therapy (days)	5 (2-10)	15 (10-21)	<.001
Cost of hospital stay			
Median cost of the admission (USD)	10731 (4599-26061)	49056 (22995-76650)	<.001

Data are number (%) and mean (standard deviation) for age or median (interquartile range)

^a Chronic obstructive pulmonary disease, metabolic intoxication, and neuromuscular disorders.

^b Non-infective respiratory, renal, and gastrointestinal related causes

to encourage integrated care of patients on mechanical ventilation and reduce the demand for high-cost ICU beds.¹²

The frequency of early mortality in our study are high. Late mortalities with prolonged ventilation being financially draining. In the literature, the definition of PMV can be confusing as it ranges from as low as 1 day to as high as 29 days.^{13,14} This makes it challenging when it comes to policy making regarding PMV. There are other limitations in the literature such as the availability of data on short-term ventilation, lack of accurate PMV cost effectiveness, and whether the informational

needs and expectations of patients and relatives have been met. All these represent a significant barrier to understanding how multiple clinical factors can affect outcomes in such cases.¹⁴

In our study we used the ICD-10-PCS classification and divided our patients based on the 96-hour mark. Most of our patients (62.1%) were ventilated short term due to the high early mortality rate. A study conducted on ventilated patients in the UK reported that the incidence of PMV (>21 days) was 4.6 per 100 ventilated admissions.⁷ In our study, looking at just elderly patients, 38 per 100 required ventilation >4 days and

14 per 100 required ventilation >21 days. This higher incidence is most probably related to our age inclusion criteria and absence of conservative treatment policy. It is also important to note that patients ventilated for

more than 4 days and more than 21 days had a 7.5% and 0% survival rate, respectively. Over half of all ICU days are accounted for by elderly patients.¹⁵ They also comprise the highest lifetime costs per quality-adjusted life year, which are disproportionately affected by PMV. The current data in the literature show that PMV demonstrates low cost-effectiveness among elderly patients and those with low predicted one-year survival.¹⁵ This emphasizes the importance of developing prognostic models to aid communication of the health outcomes that are likely to occur and help maximize the value of intubating acutely unwell elderly patients in our service. In the literature, one third of patients who are ventilated will need PMV; however, they utilize two-thirds of hospital resources designated to MV.¹⁶

Table 5. Antibiotic use.

Antibiotic(s)	Number of patients using each antibiotic
Meropenem	86
Vancomycin	70
Piperacillin/tazobactam	62
Colistin	44
Ceftriaxone	43
Linezolid	23
Metronidazole	16
Anidulafungin	11
Tigecycline, Fluconazole	9
Ciprofloxacin	8
Amoxicillin/clavulanate, gentamicin	6
Ceftazidime, cefepime, levofloxacin	5
Amikacin, topical antibiotic	3
Clindamycin	2
Cefuroxime, imipenem, aciclovir, cefotaxime, azithromycin, ampicillin	1

Identifying the costs of admission to ICU and ventilator days is complicated, especially when considering all the venues of care and services provided. To get a more accurate idea of “cost savings”, those types of costs need to be explored thoroughly.¹⁷ The only available cost per day provided by the finance department in the Ministry of Health is for general wards for the year 2017, which is a total of 323.9 Bahraini Dinars (BD). This is equivalent to 859 USD. There were no studies or calculations done on ventilated patients in Bahrain, therefore, we reviewed the literature on costs of ventilated patients per day (**Table 3**) and adopted the pricing of the United States, which is 1522 USD per day.¹⁸⁻²⁰ Adopting this cost, we calculated a median total cost per patient of 10731 USD in the early mortality group and 49056 USD in the late mortality group, with a difference that was highly significant statistically ($P<.001$).

Our inpatient mortality was very high at 97.2%. A recent multicenter study on patients intubated in an emergency department demonstrated a 67% chance of survival in elderly intubated patients.²¹ Our high mortality rate can be explained by numerous factors. Firstly, most of our patients were intubated for “comfort measures” in the absence of end-of-life care policies as evidenced by the fact that most died within 24 hours of intubation (50.7%). In a different institute, these patients would not have been candidates for intubation in the first place. Secondly, the high mortality rate among our patients could be due to the fact that our patients were managed in a general ward and not ICU. Liberman et al compared the outcome of elderly patients ventilated in and out of ICU.¹¹ In-hospital mortality for patients admitted to non-ICU wards was higher than ICU, 68.2% and 53.0%, respectively ($P<.001$). The deaths were most likely related to patient characteristics and not quality of care. It would have been interesting to compare our cohort with elderly patients admitted in our main ICU. Thirdly, this

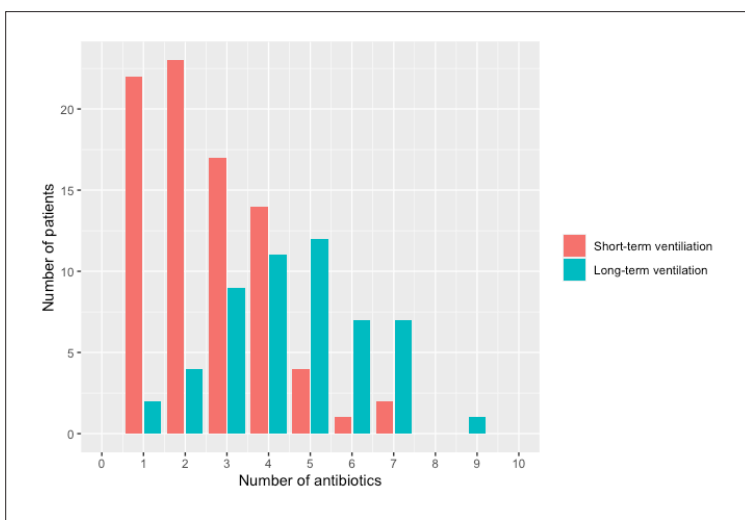


Figure 1. Number of antibiotics used by patients on short- and long-term mechanical ventilation.

very high mortality could be attributed to the relatively high APACHE II scores of our patients, (median 28, IQR 9). These high scores go in hand with why they were refused for ICU admission in the first place. Similar studies in the literature also looked at APACHE II scores and outcomes of critical elderly patients managed outside of ICU. Compared to our cohort, their lower in-hospital mortality rate is paired with lower APACHE II scores. Lieberman et al reported a mortality rate of 68.3% with a mean APACHE II score of 22.0 (27.8-16.2).¹¹ Pintado et al looked at patients aged 75 years and above and reported a mortality rate of 55.6% with mean APACHE II scores of 17 (11-24).²²

Although we did not follow these patients or assess their function upon discharge, the literature suggests that elderly patients who survive MV are more likely to suffer from disabilities compared to survivors without PMV; this disability is usually larger than would be predicted from the premorbid functional status.²³

Problems that develop during the acute stage of illness and during MV are difficult to eradicate and are associated with unavoidable complications. As a result, organization of dedicated services for prolonged care has been encouraged. This includes multidisciplinary rehabilitation services which are mostly beneficial to frail geriatric populations requiring prolonged hospitalization.²⁴ In addition to poor functional outcomes, severity of illness and increased length of hospital stay are also associated with an increased prevalence of hospital-acquired infections. Healthcare-associated infections affect an estimated prevalence of 3.5% to 9.0% of patients hospitalized in Europe with consequences such as decreased quality of services, delayed patient recovery, and even death.²⁵ This leads to prolonged hospitalization, and in turn, additional costs incurred primarily by hospitals, but also by patients and their families, and the cost born by society as a whole. In our study, the number and duration of antibiotics more than doubled when compared with the short-term and long-term ventilation groups.

When it comes to end-of-life care, patients not only want to live longer but also want to maintain their health during that period. Therefore, the chosen treatment plan can be challenging for the clinician as it has to be tailored to that specific patient with special emphasis on the patient's and relatives' goals while balancing benefits in the context of the prognosis.²⁶ One of the major problems in the ICU is a high incidence of ventilator-associated pneumonia on the 118 patients (45.4%) and possibly multidrug-resistant organisms.²⁷ In our study, approximately 84% of the patients (n=118) received antibiotics for multidrug-resistant organisms,

which was coupled with a high mortality rate. The average duration of antibiotics in short-term ventilation is 7 days and the duration increases to 16 days with prolonged ventilation. Antibiotics do not always improve symptoms when provided as part of end-of-life care. Antibiotic therapy does not guarantee prolonged survival or more time with loved ones. In addition, the use of antibiotics in end-of-life care can become a burden as it negatively affects the patient by prolonging the suffering, excluding the use of comfort measures, associated adverse events, and complications related to method of administration, which is a noticeable common characteristic in our cohort. It also burdens the hospital with increased costs and time in addition to manpower exhaustion and antibiotic resistance.

In a progressively aging population, there is an increase in the number of elderly patients with multiple comorbidities and eventually poorer outcomes. Also expected are an increase in common illnesses such as dementia.²⁸ As a result, aggressive therapeutic measures including life support and critical care in treating dementia patients has always been an area of intense debate due to the high rate of morbidity and mortality and the enormous impact on resources within the hospital.²⁹ In addition, poorer outcomes and higher mortality rates in ventilated patients are related to advanced age and low functional status.¹¹ These findings are important for patients, families, clinicians, and policymakers alike. It is of crucial importance to note that a high cost of bed occupancy and heavy antibiotic use is coupled with a very poor outcome. This leaves us to wonder whether these extreme interventions are at all necessary. A study conducted recently by Weng et al in the same institute looked at health care providers' attitudes and beliefs on providing palliative care to patients in Bahrain.³⁰ Most health care providers highlight the need for end-of-life care and palliative care policies with barriers to the development of those policies being culture, health care law and policy, conservative interpretations of Islam, and a lack of professional expertise. When it comes to prioritizing who would benefit from ICU admission and who would not, The APACHE II score could be superior to the Katz functional Index and Charlson's Comorbidity Index. In our cohort, the APACHE II score was significantly higher in both early mortality and short-term ventilation groups making it possibly a better predictor for a worse outcome.

Given difficulties with financial resources in healthcare and the uncertainties regarding the benefits of full resuscitation and invasive therapeutic measures in some cases, simply adding more ICU beds does not seem like a promising policy. In our opinion, a better

approach should be undertaken. Most important is setting up an end-of-life care policy, where patients are selected for aggressive care based on a set multifactorial criteria related to co-morbidities and outcomes. This will help identify who will most likely benefit from full resuscitative measures to reduce unnecessary, and to an extent, harmful intensive care measures like performing cardiopulmonary resuscitation and intubation. Once patients have been assessed and a decision has been made in terms of end-of-life care, a model of "critical palliative care" can be initiated where the focus is directed towards comfort as opposed to invasive and aggressive management. This method can optimize quality of life in such cases by minimizing suffering when "curative" treatments are futile. In theory, such a model of care can serve as a substitute to ICU admission for all non-salvageable patients. In Saudi Arabia, which has close cultural, religious, and political ties with Bahrain, do not resuscitate (DNR) orders are widely used. Therefore, similar policies can be applied in our hospital so potential DNR patients can be highlighted to avoid "pointless" CPR efforts that cause more harm than benefit.

Our study has several limitations. Only in-hospital mortality was measured and not post discharge outcomes. Also, the study subjects were selected from patients admitted under the hospital general medicine service, which may not represent all other services. Therefore, it may not be suitable to generalize our study results to other cohorts, hospitals or countries. However, our study is the first one of its kind that focuses on the issue of applying full resuscitative measures to

elderly, very sick patients where they most likely would not benefit from such invasive management in our institute. A major limitation is our "theoretical" cost calculation where we adopted the figures from the United States since we have no estimates within our institute. Also, it is well known that the first few days of ventilation are more costly than the days that follow.

In conclusion, allowing death to occur naturally in the terminally ill can save the patient and relatives a lot of grief and can reduce the burden on the healthcare system as a whole. The adoption of an end-of-life care policy may reduce healthcare costs both directly and indirectly, as it establishes grounds for utilization of treatment options that are specific to the patient's condition. When deciding on an end-of-life plan it is important to consider the patient's function, prognosis, and degree of systemic involvement. Other factors are also as important, including the concerns of delaying the usage of comfort treatment, prolonging the process of dying, creating a bigger reservoir for resistant pathogens, and increasing costs. The incidence of MV in elderly patients is likely to increase in the coming years given the rise in the elderly population. Given the disproportionately high costs and associated poor outcomes, clinicians at our institute need to reconsider their approach in treating such cases. Currently, the use of MV and full resuscitative measures in the decision-making process is marked by unrealistic expectations and poor communication. It is, therefore, very important that clinicians not only convey a clear picture of long-term outcomes to patients and relatives, but also describe the likely demands and negative aspects of such treatment.

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