Arab American University
Faculty of Graduate Studies

The Outcomes of ventilator weaning process for adult patient in intensive care department in Hebron government hospital

By
Feras Ahmad Itmaiza

Supervisor
Dr. Jamal Qaddumi

This thesis was submitted in partial fulfillment of the requirements for the Master`s degree in Intensive Care Nursing

September/2023

Thesis Approval

The Outcomes of ventilator weaning process for adult patient in intensive care department in Hebron government hospital

By

Feras Ahmad Itmaiza

This thesis was defended successfully on 18/09/2023 and approved by:

Committee members	Signature
1- Supervisor Dr. Jamal Qaddumi	
2- Internal Examiner Dr. Basmah Salameh	
3- External Examiner Dr. Kefah Zaben	

Dedication

To my family, especially my father and mother

To my dear wife and daughters

To all my friends

To everyone who helped me and stood by me until I reached this moment

To the wonderful and generous Dr. Jamal Qaddumi

To Dr. Basmah Salameh

To the teaching staff at the Faculty of Graduate Studies at the Arab American University

Acknowledgment

I thank God for granting me health and wellness and the ability to accomplish this work

I would like to thank the wonderful and creative Dr. Jamal Qaddumi for standing by my side in every moment

I would like to thank all the teaching staff at the Faculty of Graduate Studies at the Arab American University

I thank all the employees of ministry of health especially Hebron Governmental Hospital, especially the intensive care department nurses

I thank everyone who helped me and stood by me in completing this work

Declaration

I, the undersigned, declare that I submitted the thesis entitled:

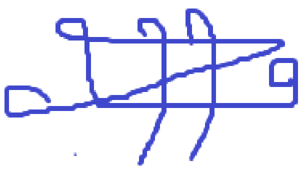
The Outcomes of ventilator weaning process for adult patient in intensive care department in Hebron government hospital

I declare that the work provided in this thesis, unless otherwise referenced, is the researches own work, and has not been submitted elsewhere for any other degree or qualification.

Student name: Feras Ahmad Itmaiza

Student ID:202112453

Signature:



Date :20/11/2023

Table of Contents

List of Tables

List of Figures

List of Abbreviation

ICU	Intensive care department
COPD	Chronic obstructive pulmonary disease
ARDS	Acute respiratory distress syndrome
APACHE II score	Acute Physiology and Chronic Health Evaluation II score
RASS score	The Richmond Agitation-Sedation Scale
SOFA score	Sequential Organ Failure Assessment score
PSV	Pressure support ventilation
SBTs	Spontaneous breathing trials
MAP	Mean arterial pressure
GCS	Glasgow Coma Scale
PaO2	Partial pressure of arterial oxygen
FiO2	Fraction of inspired oxygen
PH	Potential of hydrogen
PaCO2	Partial pressure of carbon dioxide
PEEP	Positive end-expiratory pressure
IMV	Invasive Mechanical Ventilation
VAP	Ventilator-associated pneumonia
PSV	Pressure support ventilation (PSV)
ABG	Arterial blood gas
RSBI	Rapid shallow breathing index

List of Appendices

The Outcomes of ventilator weaning process for adult patient in intensive care department in Hebron government hospital

By
Feras Ahmad Itmaiza

Supervisor
Dr. Jamal Qaddumi

Abstract

Background: the weaning outcome relates to patients who previously required a mechanical ventilator discontinuing or decreasing their dependency on it. In order to help the patient breathe on their own, the level of ventilator support provided by the ventilator is gradually reduced. Despite playing an essential role in saving lives, it has a number of problems ranging from minor to severe. Therefore, it's critical to lessen the hazards involved and patients' reliance on this technology in order to protect their wellbeing.

Aim: to identify the extent to which a patient connected to a ventilator responds to the weaning process followed in the intensive care department.

Methods: this retrospective study included 230 critically sick patients who were mechanically ventilated as a sample. The Hebron government hospital was the site of the study. The ICU housed all patients who were intubated and hospitalized between 1/1/ 2022 to 1/6/ 2023 (17 months). who had gone through the weaning process in accordance with accepted practice.

Results: a 230 critically sick ICU patients, 60.9% of whom were men and 39.1% of whom were women. Over two-thirds of the sample's participants were 60 years of age or older. Only 10.9% of patients on mechanical ventilation possessed Covid-19. As contrast to surgical case diagnosis, medical diagnosis was used in the majority of instances (85.2%). According to gasometry results, more than half of the sample had respiratory alkalosis, 75% had metabolic acidosis, and 42% had low PH. Age and length of intubation were significantly different, as were medical diagnosis and weaning outcome/risk of negative outcomes, SOFA Score and APACHE Score/Predicted Mortality Rate , and weaning outcome/risk of adverse events. Infection with Covid-19 and ICU mortality rate, as well as antibiotics for respiratory failure and risk of adverse events, were not shown to be significantly correlated. Along with the use of sedation, there was a statistically significant difference between the duration of intubation and the success of weaning, as well as between the two. However, there was no evidence of a correlation between the usage of vasopressors/GCS score and the length of the intubation, its causes, or the length of weaning. Therefore, the length of the intubation was related to the length of weaning. The entire length of ventilation, meanwhile, was connected to both the overall length of ICU stay and hospitalization. **Conclusion:** Based on the study's findings, we advise taking medical diagnosis into account when evaluating the success of weaning and risk of negative outcomes. To reduce the need for intubation, individuals who have suffered cardiac arrest require quick intervention and specialist treatment. Scores from SOFA and APACHE can be used separately to forecast ICU mortality. It's critical to keep intubations brief to lower the likelihood of unfavorable outcomes. Given its effect on the length of the intubation and the success of the weaning process, sedation should be administered with caution. It is not advised to regularly take antibiotics for respiratory infections unless clinically necessary. The duration of intubation does not appear to be impacted by vasopressor usage. Weaning protocols should be created and implemented specifically for each patient, taking into account their needs and medical issues. Clear criteria for assessment, monitoring, and decision-making during the weaning process should be included in these procedures. To find and fix any problems, healthcare personnel should give daily evaluations of ventilator settings, alarms, and equipment integrity first priority. The likelihood of difficulties can be reduced by taking care of these issues, which will result in more successful weaning outcomes.

Keywords: critical care nursing, patients, ventilator weaning, and mechanical ventilators.

Chapter One

Introduction and Theoretical Background

1.1 Introduction

Hospitalization and admission to the intensive care department (ICU), where severely ill patients need mechanical ventilation to survive, are frequently caused by respiratory failure. There are many disease cause of acute respiratory failure that lead to mechanical ventilation: pneumonia, intracranial hemorrhage, sepsis, postoperative conditions, COPD, cardiac disease, malignant disease, cervical spine disease, hypoxic encephalopathy, cerebral infarction, and miscellaneous, causes as classified by (Huang, 2022a). Hence, the ability to breathe is crucial for human health and well-being and is connected to emotions and endurance (Mart et al., 2021).

A ventilator is a temporary solution and not a long-term treatment option. It serves as a means to buy time to address other health issues. As the patient's health improves, their reliance on the ventilator decreases, initiating the weaning process (Wong et al., 2021).Thus, mechanical ventilation is the use of a machine to assist or replace spontaneous breathing by delivering a controlled and sustained airflow into the lungs (Chatburn et al., 2014). Ventilators have been a vital component of medical support in ICUs since their inception. Those suffering from basic respiratory failure or other conditions leading to secondary respiratory dysfunction, such as trauma, unconsciousness, intoxication, septic shock, heart failure, and neuromuscular diseases, require mechanical ventilation (Choi et al., 2021). While mechanical ventilation is seldom used as a primary treatment, it can help prolong life. The focus is on allowing the body to heal and recover, as well as ensuring the effectiveness of subsequent treatments. In mixed ICUs, approximately half of the patients require mechanical ventilation (Daugherty Biddison et al., 2019). Ventilators are sophisticated and technologically advanced medical devices with various systems for delivering air into the patient's respiratory system, each tailored to specific disease conditions, including oxygen ratio, volume, and air pressure (Christou et al., 2020).

Regardless of the mode or settings of the ventilator, it operates differently from natural breathing. The weaning process from mechanical ventilation involves strengthening the respiratory muscles since natural respiration relies on negative intra-thoracic pressure, which allows room air to enter the lungs. In contrast, mechanical ventilation involves positive pressure, where air is forced into the airways of the lungs (Yagi, 2018).

For ICU patients who are unable to breathe on their own, two main types of mechanical ventilation, invasive and non-invasive are frequently employed, depending on the patient's clinical status (Popat & Jones, 2012). Non-invasive ventilation is a positive pressure ventilation method administered through an external interface, such as a full-face mask or helmet. It has been demonstrated to help those with COPD who experience sudden hypercapnia (Yeung et al., 2018). The non-invasive mechanical ventilation may be required for postoperative or post-extubation respiratory failure, cardiogenic edema, and mild to moderate acute respiratory distress syndrome. Early extubation using non-invasive mechanical ventilation reduces the time spent on invasive mechanical ventilation (Haaksma et al., 2022).

Through non-invasive mechanical ventilation, the patient receives controlled breathing with settings for tidal volumes, respiratory frequency, and inspiratory to expiratory ratio determined by the device. Supported ventilation is a technique that gradually reduces ventilation as the patient's condition improves and is tailored to each patient (Fondazione Salvatore Maugeri, IRCCS, Respiratory Intensive Care Unit and Pulmonary Rehabilitation Unit, Pavia, Italy et al., 2018). Invasive mechanical ventilation involves establishing an artificial airway by inserting an endotracheal tube into the trachea through the mouth or nose, which is connected to the respiratory circuit and the mechanical ventilator (Scala & Pisani, 2018).

Invasive mechanical ventilation, on the other hand, is a medical procedure used to support or take the place of spontaneous breathing in seriously ill patients who are unable to do so on their own. It involves the insertion of an endotracheal tube or tracheostomy tube through the mouth or nose, or directly into the trachea. The tube is connected to a ventilator, which delivers pressurized air to the patient's lungs, mimicking the physiological process of breathing (Walter et al., 2018).

Acute respiratory failure, acute exacerbations of chronic obstructive pulmonary disease (COPD), pneumonia, acute lung injury, acute respiratory distress syndrome (ARDS), and trauma are only a few of the illnesses that can be treated with invasive mechanical ventilation. Additionally, it is applied during surgeries requiring general anesthesia (Nevins & Epstein, 2001).

There are various invasive mechanical ventilation modes, such as pressure support ventilation, synchronized intermittent obligatory ventilation, and assist-control ventilation. The manner of treatment is determined by the patient's clinical state, underlying disease, and treatment objectives. Invasive mechanical ventilation carries risks and complications, such as airway trauma, infections, barotrauma, and ventilator-associated lung injury. Close monitoring and frequent assessment of the patient's condition are essential to minimize these risks (Popat & Jones, 2012).

The length of mechanical ventilation varies from patient to patient in the intensive care unit and is determined by things including the patient's diagnosis, clinical profile, and demographics. These characteristics include the primary reason for ICU admission, APACHE II, Day 1 acute physiology score (APS), age, preceding patient location and hospital duration of stay, activity constraints due to respiratory disease, serum albumin levels, respiratory rate, and PaO2/FiO2 values. Furthermore, A study by (Seneff et al., 1996) reported that the average duration of ventilation for a sample of 42 ICU patients ranged from 2.6 to 7.9 days. Another study by (McConville & Kress, 2012) found that 7.3 days was the average number of days a control group of 64 patients used mechanical ventilation. On the other hand, in patients diagnosed with COVID-19 (n=88), In the ICU, the typical length of stay was 23 days, while the median time spent on mechanical ventilation was 29.5 days. A further risk factor for longer mechanical ventilation duration was also discovered to exceed age 65 years (Bastos et al., 2020).

The process of progressively reducing or stopping the use of a mechanical ventilator in a patient who was previously dependent on it for breathing support is known as weaning from mechanical ventilation (Blackwood et al., 2011). The goal of weaning is to allow the patient to breathe independently by gradually reducing the level of ventilatory support provided. Weaning can be divided into three types: simple weaning, difficult weaning, and prolonged weaning. Simple weaning is defined as successful weaning and extubation on the first try without any difficulty. Difficult weaning is failure of the initial weaning and requires up to three spontaneous breathing trials, or up to seven days to achieve successful weaning for prolonged weaning patient (Boles et al., 2007). Different weaning techniques, such as spontaneous breathing trials (SBTs), T-piece trials, and pressure support ventilation (PSV), can be used (Blackwood et al., 2013). The definition of weaning failure, on the other hand, is SBT failure or the requirement for re-intubation within 48 hours of extubation (Vallverdú et al., 1998). Respiratory, cardiovascular, neurological, cognitive, metabolic, dietary, malnutrition, and anemia variables are causes of weaning failure (Boles et al., 2007).

Clinical decision making regarding mechanical ventilation and weaning involves evaluating the patient's medical status, including their ability to breathe effectively on their own, level of fatigue and discomfort, and any underlying medical conditions that may affect their ability to wean. The healthcare team also considers the patient's response to previous weaning attempts and takes into account the goals and priorities of the patient and their family (Tingsvik et al., 2015). The patient's capacity to sustain appropriate gas exchange and ventilation with less help from the mechanical ventilator ultimately determines whether to start and continue the weaning phase. The healthcare team continuously monitors the patient's clinical status and adjusts the weaning plan accordingly (Tingsvik et al., 2015).

The patient's medical history, present health, degree of care received, and the technological, scientific, and human advancement of the ICU are only a few of the variables that affect how successfully the weaning process will go (Burns et al., 2018). However, a successful spontaneous breathing trial, a key diagnostic test used to identify whether patients can be effectively extubated, is frequently linked to successful weaning. In healthcare settings, patient centered care where individuals actively participate in their treatment and care has gained recognition (Kwong et al., 2019). Factors such as age, gender, medical diagnosis, and scores like SOFA and APACHE II also play a role in the outcome of the weaning process (Otaguro et al., 2021).

Hemodynamic stability, including factors like heart rate, body temperature, and mean arterial pressure (MAP), is crucial in the weaning process. Acid-base balance, as determined by pH, PaCO2, and SpO2, and oxygenation levels, assessed through parameters such as PaO2/FiO2, PEEP, SaO2, and Hb, also influence the weaning process. The psychological status of the patient, evaluated using the Glasgow Coma Scale (GCS), is another important consideration. Complications include infection, pneumonia, and barotrauma might develop if weaning from mechanical ventilation is delayed. Developing a knowledge-based weaning process can help determine the appropriate timing for initiating weaning and has the potential to be a valuable research-driven strategy for ventilator weaning (Guler & Kilic, 2018).

The purpose of this study is to better understand how patients interact with the critical care setting's mechanical ventilation weaning process. The study will focus on exploring various perspectives to gain a comprehensive understanding of the weaning process. The objective is to increase knowledge for patients, and healthcare staff to improve patient outcomes during the process of separating from mechanical ventilator, the study seeks to advance the knowledge of the weaning process, contributing to improved patient outcomes in ICUs.

1.2 Research Background

The Intensive Care Unit (ICU)

There has been a significant advancement in intensive care departments since the twentieth century, driven by the need to address respiratory failure in pediatric polio patients and postoperative surgical patients who received opioids. This led to the intervention of placing them on ventilators (Telias et al., 2022). Once the patient is on a ventilator, it is crucial to start the weaning process when the ventilator is no longer necessary (Gupta et al., 2020). Over time, intensive care departments have made significant progress in medical and nursing care to cater to the specific needs of patients with organ failure and various medical conditions (Morton & Fontaine, 2018).

The Swedish Society of Anesthesiology and critical Care highlights the significance of keeping critical care units up to date with contemporary technologies for exact diagnosis and enhancing nurse services (Block et al., 2019). Intensive care departments play a vital role in monitoring and supporting vital functions, providing diagnostic procedures, and delivering specialized nursing, medical, and surgical care. Complex procedures such as anesthesia, feeding, and resuscitation are performed in these departments (Morton & Fontaine, 2018). Intensive care units are equipped with advanced technology and staffed by highly qualified personnel (Chamberlain et al., 2018).

The ICU Team

The ICU team consists of skilled medical professionals who work collaboratively, including physicians or intensivists, ICU nurses, assistant nurses, and physiotherapists (Ma et al., 2018). These team members have complementary roles and work together to ensure patient safety and provide high-quality care (Donovan et al., 2018). To ensure patient safety, the intensive care personnel is highly specialized, collaborative, and communicative (Ma et al., 2018). Interprofessional teamwork is crucial for reducing errors, enhancing patient safety, and serving as the foundation of care in the ICU (Donovan et al., 2018).

Teamwork is fundamental in acute care departments, involving task allocation and cooperation, despite the challenges posed by the frequently changing staff and the need for effective patient information transmission (Acevedo-Nuevo et al., 2021). In addition to the physical and psychological restrictions imposed by the work environment, the frequently unstable work environment is a major impediment to cooperation in a field where the staff is changed every shift or every day and where the safe and complete transmission of patient information is required (Ervin et al., 2018).

The Swedish Association of Nurse Anesthetists and Critical Care Nurses outlines the responsibilities of intensive care unit nurses. In Scandinavia, nurses independently adjust pharmaceutical dosages (e.g., sedatives, analgesics, and inotropic medications), modify ventilator settings, and initiate the weaning process in accordance with predetermined medical objectives. Among other roles, the ICU nurse is responsible for nursing care, mobilization, family involvement, and intra hospital transportation (Morton & Fontaine, 2018). Critical care physicians, who are anesthesia and intensive care specialists, collaborate with the interdisciplinary team to discuss patients' health status and develop treatment plans (Ervin et al., 2018).

Mechanical Ventilation

Since their invention till the present, Ventilators have been crucial in providing medical support in intensive care units. They are used for patients with respiratory failure or other conditions causing respiratory dysfunction (Choi et al., 2021). Mechanical ventilation, while not a primary treatment, assists in prolonging life, allowing the body to heal and subsequent treatments to be effective. Approximately half of the patients in mixed ICUs require mechanical ventilation (Daugherty Biddison et al., 2019). Ventilators are sophisticated medical devices with different modes and criteria based on the specific disease condition, including oxygen ratio, volume, and air pressure (Christou et al., 2020).

1.3 Problem Statement

In critical care units (ICUs), the mechanical ventilation use is essential for saving lives, but it can also result in problems that can be minor to severe. Therefore, minimizing risks and reducing dependence on this device are important for patient well-being (El-Khatib & Bou-Khalil, 2008). Weaning from mechanical ventilation, known as Invasive Mechanical Ventilation (IMV), is a complicated process that is influenced by a number of variables, such as the patient's health and the impacts of intensive care. Recent advancements in ventilator modes, sedation methods, rehabilitation, and interdisciplinary collaboration have brought significant changes to IMV management (Merchán-Tahvanainen et al., 2017). However, the weaning process involves more than medical considerations. Understanding the experiences of healthcare providers (HCPs) and how the interdisciplinary team operates is crucial for improving patient outcomes (Abu Dalal et al., 2022).

The problem of the study lies in the lack of a special and modern protocol for separating patients from the ventilator in Hebron Governmental Hospital and relying entirely on the practical experience of the working medical staff. Further research is needed to investigate the variables that influence HCPs' weaning decisions and expand this knowledge in different contexts.

1.4 Significance of Study

The significance of the study lies in achieving a clear vision of the process of separating patients from mechanical ventilator. In addition to learning about all the stages that the patient goes through in the process of separating the patient from the ventilator, which starts from the moment he is placed on the ventilator until it is removed from it. Another significance to identifying the duration of his stay on the ventilator, the weaning period, the duration of the patient's stay in the intensive care unit, and the duration of his stay in the hospital. In addition to identifying the possible side effects that may occur as a result of using a ventilator. It also lies in identifying the factors that help achieve positive results of the weaning process and knowing the factors related to increasing the probability of their occurrence.

The importance of the research lies in the Palestinian Ministry of Health's awareness of the reality of patients connected to mechanical ventilator in all its aspects, in order to move towards improving the health situation of these patients by adopting a modern protocol for separating patients connected to mechanical ventilator in government hospitals.

This study aims to address this knowledge gap by investigating and describing the weaning process from multiple perspectives. The significance of this study lies in the absence of an approved weaning protocol, and its outcomes have the potential to bring positive changes for patients and hospitals.

1.5 Research Questions

The study seeks to provide answers to the following questions based on the research problem and background:

Main Question:

1. Is there a relationship between the demographic data (age and gender) of intubated adult patients in the ICU of Hebron government hospital and the length of intubation and duration of weaning process and the weaning outcome?
2. Is there a relationship between the medical diagnosis of intubated adult patients in the ICU of Hebron government hospital and the duration of intubation and duration of weaning and the risk of adverse events?
3. Is there a relationship between the duration of intubation of adult patients in the ICU of Hebron government hospital and the risk of adverse events and the weaning outcome?
4. Is there a relationship between the causes of intubation of adult patients in the ICU of Hebron government hospital and duration of weaning?

Sub Question:

1. Is there a relationship between the SOFA and APACHE II Scores of intubated adult patients in the ICU of Hebron government hospital and the predicted mortality rate?
2. Is there a relationship between the use of antibiotics for respiratory infection in intubated adult patients in the ICU of Hebron government hospital and the risk of adverse events?
3. Is there a relationship between the use of sedation and the duration of intubation of adult patients in the ICU of Hebron government hospital and weaning?
4. Is there a relationship between the use of vasopressors in intubated adult patients in the ICU of Hebron government hospital and the duration of intubation?

5. Is there a relationship between the Glasgow Coma Scale (GCS) of intubated adult patients in the ICU of Hebron government hospital and the duration of intubation?

1.6 Aims and Objectives

In the planned study, the effectiveness of the ventilator weaning process for adult patients in the ICU of the Hebron government hospital would be evaluated. It seeks to establish the duration of invasive mechanical ventilation, the duration of weaning, and the duration of hospital and ICU stays while reducing the risk of problems. In particular, the study wants to accomplish the following goals:

1. To identify the relationship between the demographic data (age and gender) of intubated adult patients in the ICU of Hebron government hospital and the length of intubation and duration of weaning process and the weaning outcome.
2. To assess the relationship between the medical diagnosis of intubated adult patients in the ICU of Hebron government hospital and the duration of intubation and duration of weaning and the risk of adverse events.
3. To know the relationship between the duration of intubation of adult patients in the ICU of Hebron government hospital and the risk of adverse events and the weaning outcome.
4. To describe the relationship between the causes of intubation of adult patients in the ICU of Hebron government hospital and duration of weaning.
5. To determine the relationship between the SOFA and APACHE II Scores of intubated adult patients in the ICU of Hebron government hospital and the predicted mortality rate.

6. To assess the relationship between the use of antibiotics for respiratory infection in intubated adult patients in the ICU of Hebron government hospital and the risk of adverse events.
7. To know the relationship between the use of sedation and the duration of intubation of adult patients in the ICU of Hebron government hospital and weaning.
8. To identify the relationship between the use of vasopressors in intubated adult patients in the ICU of Hebron government hospital and the duration of intubation.
9. To determent the relationship between the Glasgow Coma Scale (GCS) of intubated adult patients in the ICU of Hebron government hospital and the duration of intubation.

1.7 Research Outcomes

Primary Outcomes

The following are the study's main outcomes:

1. **Mechanical Ventilation Duration:** To investigate the association between mechanical ventilation duration and weaning outcomes.
2. **Weaning Duration:** To investigate the relationship between weaning Duration and Weaning Outcomes.
3. **ICU Stay Length:** To look into the relationship between weaning outcomes and ICU stay length.
4. **Hospital Stay Length:** To evaluate the relationship between weaning outcomes and hospital stay length.

Secondary Outcomes

The study's secondary outcomes are:

1. **Identify the Adverse Effects:** By assessing the risk of adverse effects like sepsis, barotrauma, and ventilator-associated pneumonia (VAP), the first secondary outcome seeks to assess the safety and clinical efficacy of the adult IMV weaning process.
2. **Evaluation of the Safety and Clinical Effectiveness of the Weaning Process:** By examining patients' overall clinical conditions and keeping track of any negative weaning-related events, the second secondary outcome aims to evaluate the safety and clinical effectiveness of the adult IMV weaning process.

1.8 Hypotheses

1. There is no significant difference at 0.05 level between the demographic data (age and gender) of intubated adult patients in the ICU of Hebron government hospital and the length of intubation and duration of weaning process and the weaning outcome.
2. There is no significant difference at 0.05 level between the medical diagnosis of intubated adult patients in the ICU of Hebron government hospital and the duration of intubation and duration of weaning and the risk of adverse events.
3. There is no significant difference at 0.05 level between the duration of intubation of adult patients in the ICU of Hebron government hospital and the risk of adverse events and the weaning outcome.
4. There is no significant difference at 0.05 level between the causes of intubation of adult patients in the ICU of Hebron government hospital and duration of weaning.

5. There is no significant difference at 0.05 level between the SOFA and APACHE II Scores of intubated adult patients in the ICU of Hebron government hospital and the predicted mortality rate.
6. There is no significant difference at 0.05 level between the use of antibiotics for respiratory infection in intubated adult patients in the ICU of Hebron government hospital and the risk of adverse events.
7. There is no significant difference at 0.05 level between the use of sedation and the duration of intubation of adult patients in the ICU of Hebron government hospital and weaning.
8. There is no significant difference at 0.05 level between the use of vasopressors in intubated adult patients in the ICU of Hebron government hospital and the duration of intubation.
9. There is no significant difference at 0.05 level between the Glasgow Coma Scale (GCS) of intubated adult patients in the ICU of Hebron government hospital and the duration of intubation.

1.9 Conceptual and Operational Definition

Conceptual Definitions

Weaning Protocol: is defined as the gradual reduction of mechanical ventilator support as the patient's own respiratory system recovers from illness (Pathak & Shrestha, 2020) (Borges et al., 2017).

Successful Extubation: is describe as the absence of the need for noninvasive positive pressure breathing or high-flow nasal oxygen within 72 hours of extubation (Subirà et al., 2019).

Unsuccessful Extubation: is describe as the re-intubation or requirement for high-flow nasal oxygen or noninvasive positive pressure ventilation within 72 hours of extubation (Otaguro et al., 2021).

Operational Definitions

Total of ICU duration: refers to the period from admission to discharge or transfer to another unit in hours or days (Toptas et al., 2018).

Total hospitalization duration: the number of hours or days a patient spends in the hospital, including time spent in the intensive care unit (ICU), from the time of admission until discharge (Borghans et al., 2008).

Weaning duration: measured in hours or days from the beginning of the weaning process until extubation or the switch to non-invasive ventilation, weaning duration describes how long it takes to successfully wean a patient from mechanical ventilator (Vieira et al., 2007).

Total Duration of Ventilation: the period of time from the start of mechanical ventilation (MV) until it stops, expressed in hours or days, during which a patient receives mechanical ventilation support, including both invasive and non-invasive ventilation times (Payen et al., 2012).

The Glasgow Coma Scale (GCS): measures the patient's level of consciousness by adding the scores given to the patient's eye-opening response, verbal response, and motor response. Scores range from 3 to 15 for each component, with higher scores indicating a higher level of consciousness (Jain & Iverson, 2023).

Sequential Organ Failure Assessment (SOFA) score: this scoring system, which assigns scores to six organ systems based on physiological characteristics during a predetermined time period, measures the severity of organ malfunction in critically ill patients. Scores range from 0 to 4 for each organ system (Jones et al., 2009). **Acute Physiology and Chronic Health Evaluation II score (APACHE II):** is a grading system that considers physiological indicators, laboratory results, and pre-existing medical problems to determine the severity of illness and forecast the mortality risk of ICU patients (Wagner & Draper, 1984).

The Richmond Agitation-Sedation Scale (RASS): measures a patient's level of agitation or sedation while they are in the intensive care unit. The scale ranges from -5 to +4, with higher positive values suggesting increasing agitation and higher negative values indicating increased sedation (Sessler et al., 2002).

1.10 Contribution

The research makes an important improvement to the fields of mechanical ventilation and intensive care in many different ways.

First of all, it offers insightful data on the efficiency of weaning processes in terms of the length of invasive mechanical ventilation, the risk of complications, and the length of weaning and ICU hospitalizations.

Secondly, the study offers a comprehensive understanding of healthcare professionals' experiences and practices in the weaning process, including the factors influencing their decisions.

Thirdly, it informs the development of best practices in the management of invasive mechanical ventilation and weaning by identifying key contributing factors to success. The study's results are disseminated to healthcare professionals and institutions, equipping them with evidence-based knowledge necessary for informed decision-making regarding invasive mechanical ventilation and weaning management.

Moreover, the study has the potential to contribute to the development of relevant and effective weaning protocols for Palestinian hospitals. Overall, this study advances the field and enhances the quality of care for patients undergoing invasive mechanical ventilation.

Chapter Two

Literature Review

2.1 Introduction

Recent research on removing patients from mechanical ventilation is examined in this chapter. The MeSH terms clinical competence, critical care nursing, dyspnea, nurses, nurse's role, patients, professional competence, artificial respiration, respiration, role, ventilator weaning, and mechanical ventilators were used in the PubMed database. Additionally, key words and free-text sentences were used to search the databases of CINAHL, PubMed, and the Cochrane Library. The most frequent and important organ failure in critical care medicine is respiratory failure, which is treated with mechanical ventilation.

Related Work

2.2.1 Weaning from Mechanical ventilation

(Pu et al., 2015) found that Weaning from mechanical ventilation may be categorized as simple, difficult, or extended in 58%, 29%, and 13% of patients, respectively, according to a 343-participant observational cohort study. Comparing prolonged weaning to simple or challenging weaning, greater mortality rates were found. Lower Glasgow Coma Scale (GCS) scores and hypercapnia at the beginning of the weaning process were found in the study to be independent risk factors for protracted weaning. They came to the conclusion that increased $PaCO_2$ before and during the first SBT, baseline Glasgow Coma Scales (GCS), and heart rate during the first SBT were risk factors for extended weaning.

(Surani et al., 2020) conducted a retrospective case-control research to assess the effectiveness of a protocol-driven weaning strategy overseen by respiratory therapists who have passed the RDCP's certification exam. 51 patients made up the control group in the trial, whereas 111 patients made up the study group. The duration of weaning from mechanical ventilation was dramatically shortened once the protocol-driven weaning was put into place (16.76 +/- 18.91 before vs. 7.67 +/- 6.58 after, p 0.0001). The protocol-based approach resulted in lower death rates, according to the study. The protocol specified the following requirements for starting weaning: Accurate reversal of the initial rationale for endotracheal intubation and respiratory failure is necessary. With FiO2 being less than 50% and PEEP being less than 8 cm H2O, the PaO2/FiO2 ratio should be more than 150.Finally, there should be enough evidence that patients are capable of initiating an inspiratory effort.

(Hickey & Giwa, 2023) present an overview of the core elements, common ventilation modes, starting settings, and supportive care for patients needing intubation in their book on invasive mechanical ventilation. The text emphasizes that the primary indications for mechanical ventilation are compromised airway disease, airway protection in patients with altered consciousness or unstable airways, hypercapnic respiratory failure brought on by impaired respiratory drive, pump failure, or gas exchange impairment, and hypoxemic respiratory failure brought on by a variety of factors, including defects in alveolar filling, pulmonary vascular defects causing ventilation-perfusion (VQ) mismatch, diffusion. Due to problems with alveolar filling, pulmonary vascular defects that result in ventilation-perfusion (VQ) mismatch, diffusion defects, increased ventilator demand as a result of severe sepsis, shock, or severe metabolic acidosis, or other factors, hypoxemic respiratory failure can occur.

(Burns et al., 2021) conducted a prospective, international, observational study of 142 intensive care units (ICUs) in 19 countries divided into six regions (27 in Canada, 23 in India, 22 in the UK, 26 in Europe, 21 in Australia/New Zealand, and 23 in the United States) of critically ill adults receiving IMV for at least 24 hours. The study sought to investigate characteristics associated with the use of particular discontinuation techniques and unsuccessful initial spontaneous breathing trials (SBTs), as well as to highlight differences in international practice in stopping IMV. According to the study, an initial SBT was performed on almost 50% of patients, with a success rate of over 80%. But starting an SBT as opposed to a straightforward extubation was associated with increased ICU mortality, longer ventilation times, and longer ICU stays. In the ICU, failing the initial SBT was linked to higher fatality rates, longer ventilation times, longer stays, and a higher chance of still needing ventilation and being there on day 28.

In a literature review conducted by (Sánchez Sánchez et al., 2021), they aimed to propose evaluation techniques for effective MV weaning, integrating traditional scales with ventilatory monitoring to prevent reintubation. Using the keywords, a non-systematic search of MedLine, LILACS, ClinicalKey, and Google Scholar was performed. "Diaphragm," "Diaphragmatic Dysfunction," "Diaphragmatic Evaluation," "Extubation," "Intubation," "Electromyography," "Surface Electromyography," "Diaphragmatic Ultrasound,", "t-tube test," "Tobin and Yang index,", "Pressure Support,", "Transdiaphragmatic Pressure,", " Up to 70 articles published between 2010 and 2020 were examined.. The review concluded that the available techniques, such as diaphragmatic ultrasound, for assessing diaphragmatic function and predicting extubation have limited usefulness and critical limitations. The review also suggested exploring surface electromyography as a tool for determining extubation due to its lower cost compared to other techniques and its non-invasive nature, eliminating the need for invasive maneuvers.

A study conducted by (Burns et al., 2018) intended to understand the variety of weaning techniques, discover geographical variations in weaning habits, and ascertain the causes of these variations. Adult intensives members of regional critical care societies from six different geographic regions Canada, India, the United Kingdom, Europe, Australia/New Zealand, and the United States participated in the cross-sectional, self-administered study. The authors worked with these societies to choose participants at random, and 1,144 replies were received as a consequence. The results of the study showed that screening frequency, methods for spontaneous breathing trials, ventilator modes, written directives, noninvasive ventilation, and the tasks carried out by various staff members in various facets of weaning all varied significantly. These results emphasize the need for a multidisciplinary and collaborative approach to ventilator weaning by highlighting the existence and scope of practice variety in weaning around the world.

2.2.2 Risk Factors and Weaning Outcome

In a retrospective observational study conducted by (Huang, 2022a), From January 1, 2012, to December 31, 2017, a sample of 574 ICU patients who required prolonged mechanical breathing for more than 21 days were monitored. The study sought to investigate gender disparities in patient populations receiving prolonged mechanical ventilation in terms of age, respiratory failure reasons, discharge status, successful weaning, mortality rate, and long-term survival outcomes. According to the survey, the age range of 75 to 84 years was the most prevalent for both males (34.2%) and females (41.0%), while the age range below 45 years accounted for 3.1% of males and 2.8% of females. In terms of effective weaning, ventilator dependence, RCC mortality, general ward mortality, or in-hospital mortality, the study found no statistically significant differences ($p > 0.05$). The prevalence of cardiovascular comorbidity did, however, statistically differ across the sexes. The study also revealed a statistical difference between men and women in this age group, with men in this group showing worse survival results, as seen by a higher 6-month death rate and a greater percentage of malignant comorbidities.

In a prospective observational study conducted by (Na et al., 2022), It was found that extended weaning was associated with longer periods of mechanical ventilation (MV) prior to the first spontaneous breathing experiment (SBT). The study comprised consecutive adult patients who received MV for at least two calendar days in medical intensive care units from November 1, 2017, to September 30, 2020. The eligible patients were separated into two groups based on the WIND classification: those who suffered short or difficult weaning and those who endured protracted weaning. During the first attempt at separation, a multivariate logistic regression model was used to examine the risk factors for protracted weaning. On the day of the first SBT, the prolonged weaning group showed greater peak inspiratory pressures and lower $PaO2/FiO2$ ratios than the non-prolonged weaning group. These results imply that a prolonged weaning period can be predicted by having inadequate oxygenation before the first SBT.

A study conducted by (Raza et al., 2020) between January 1 and June 30, 2019, researchers in the MICU evaluated the process of weaning patients from mechanical ventilation. Patients in the study were divided into two groups: 250 patients were in the pre-intervention group, and 330 patients were in the post-intervention group. The importance of weaning, which normally takes up about 40% of the total time for mechanical ventilation, was stressed by the authors. Weaning is vital in reducing ventilator support. Weaning should last between 30 and 120 minutes, as longer weaning times are linked to a higher risk of problems related to the ventilator and lengthier stays in the intensive care unit (ICU). According to the study's findings, the average weaning time decreased from 4.31 hours prior to intervention to 2.5 hours following it. There was no discernible variation in the rate of re-intubation between the two time periods.

In a retrospective study conducted by (Otaguro et al., 2021) in Tokyo, Japan, In an intensive care unit (ICU), patients who received mechanical ventilation had their chances of successfully being extubated predicted using machine learning techniques. Data from a variety of sources, including demographics, vital signs, laboratory results, and ventilator information, were analyzed for the study, which focused on patients who underwent intubation for respiratory failure. Failure of extubation was defined as the requirement for reintubation within 72 hours. The results showed that the length of mechanical ventilation emerged as the most important element in all models, and the machine learning approach showed that it was capable of forecasting effective extubation.

In a retrospective observational cohort study conducted by (Hannun et al., 2022) a sample of 677 tracheostomized patients who required mechanical ventilation between January 2005 and December 2017 was examined. Finding predictors of death as well as weaning failure from mechanical breathing was the goal. The findings demonstrated that a variety of factors played a role in weaning failure. The odds ratios for these factors were as follows: being over 70 years old, having a history of cardiovascular disease, being admitted for a respiratory illness, and staying in the hospital for more than 105 days. A history of a cerebrovascular accident, being admitted to intensive care due to a cardiorespiratory arrest, being over 70 years old, being hospitalized for more than 64 days, and being admitted to intensive care were all risk factors for mortality.

In a prospective observational study conducted by (Saiphoklang & Auttajaroon, 2018) The researchers looked on the frequency and results of weaning off mechanical ventilation in medical wards at Thammasat University Hospital in Thailand. All patients (n = 164) who required endotracheal intubation and mechanical ventilation were included in the study, which was done between June and December 2013. The results showed that extended weaning, in particular, was associated with decreased ventilator-free days, higher rates of re-intubation and tracheostomy placement, and longer hospital admissions. The study emphasized the need for measures to address these variables and enhance outcomes for patients undergoing weaning by identifying bronchospasm, pneumonia, and malnutrition as major risk factors for weaning failure.

In a study conducted by (Warnke et al., 2020), The goal was to look into factors that could predict survival among patients who had left a weaning clinic. A total of 597 patients with protracted weaning, with a mean age of 68 11, were participated in the study, which lasted from January 1, 2006, to December 27, 2016. Of them, 392 of them were men. Patients who were released were followed up on via routine phone calls or outpatient clinic appointments every three to six months. Data on survival was gathered up until February 9, 2019. ensuring that patients are followed up with for a minimum of two years. The findings showed that 407 (57.8%) of the patients successfully delayed their weaning from mechanical ventilator, while 106 (15.1%) patients were discharged with non-invasive ventilation. For the aforementioned categories, the post-discharge survival rates were 66.5% and 37.1%, respectively. Age, the duration of mechanical ventilation, specific clusters of comorbidities, and discharge with mechanical ventilation were all significant predictors impacting survival (p 0.001). As a result, these factors were found to be indicators of survival in the context of mechanical ventilation weaning outcomes.

In a retrospective observational cohort study conducted by (Fujii et al., 2012), The study looked at 71 elderly patients (65 years of age or older) who needed mechanical ventilation after being admitted to the hospital with community-acquired pneumonia between January 2003 and December 2007. The study's goal was to identify variables, with an emphasis on smoking history, vital signs, and background circumstances, that adversely affect the process of weaning elderly patients with community-acquired pneumonia from mechanical ventilation. Two groups of patients were created: group A, which included 33 patients who successfully weaned off of mechanical ventilation, and group B, which included 38 patients who were unable to wean off of the ventilator. The investigation discovered no statistically significant difference between the two groups in terms of the initial vital signs and background variables (A and B, $p > 0.005$). The weaning process from mechanical ventilation was negatively impacted by a history of smoking, according to the authors ($p = 0.012$ when comparing group A (who were weaned) and group B (who were not weaned). The study concluded that individuals receiving mechanical ventilation should stop smoking in order to maintain pulmonary function and lessen secretions from the respiratory tract.

2.2.3 Covid-19 and Weaning Outcome

In a retrospective observational study conducted by (Guzatti et al., 2022) at Santa Terezinha University Hospital, the researchers investigated COVID-19 patients' weaning from mechanical ventilation (MV). A total of 216 COVID-19 patients participated in the trial, of whom 60 passed away prior to weaning and 79 required tracheotomies. 77 patients were consequently included in the final analysis. The inclusion criteria included patients who were 18 years of age or older, had COVID-19 confirmed by reverse transcription polymerase chain reaction (RT-PCR) for SARS-CoV-2, and had been receiving invasive MV for more than 24 hours before weaning was required. Exclusion criteria included tracheotomies, unintentional or self-extubation, and patient deaths prior to weaning. The process of weaning was started based on factors like improvement of the underlying condition that was causing the respiratory failure, partial pressure of arterial oxygen (PaO2) over 60 mm Hg with a fraction of inspired oxygen (FiO2) below 0.4 and positive end-expiratory pressure (PEEP) of 5 cm of water or less, hemodynamic stability, the patient's ability to start an inspiratory effort, and the absence of a significant acid-base imbalance. Patients who could maintain adequate breathing while using pressure support ventilation (PSV) mode with a PEEP of 3-5 cmH2O and a pressure above PEEP of 7 cmH2O were extubated. The authors came to the conclusion that COVID-19 patients differ from non-COVID-19 patients in a number of ways, including age 66 years, length of symptoms 31 days, need for dialysis, and a PaO2/FiO2 ratio 200, which were all found to be independent predictors of extubation failure. Three of these factors significantly elevated the chance of extubation failure by a factor of 23.0. Throughout the course of their ICU stay, COVID-19 patients had a risk of failed extubation that was nearly three times higher than that of non-COVID-19 patients. The ICU team should use these four factors, according to the authors, when deciding whether to stop administering MV to COVID-19 patients.

In their study, (Peng et al., 2020) performed a case report on seven COVID-19 patients in critical condition. The study's goal was to document the clinical and laboratory results as well as the effective management of these patients who needed mechanical ventilation (MV) because of the severe coronavirus disease 2019 (COVID-19). Based on the severity of the patients' COVID-19 symptoms, their epidemiological background, and the findings of nucleic acid testing, they were admitted to the intensive care unit. Early prone positioning, early noninvasive-invasive sequential breathing, and a thorough pharmacotherapy regimen including antiviral, anti-inflammatory, immune-booster, and complication-prevention drugs were all part of the therapeutic strategy. The median length of stay in the intensive care unit was 12.9 days (interquartile range, 9.7-17.6 days; range, 7-19 days), according to the authors, while the median duration of MV was 9.9 days (interquartile range, 6.5-14.6 days; range, 5-17 days). Extubation and MV weaning were effective for all seven patients. The authors came to the conclusion that early noninvasive sequential ventilation and bundle medication can produce positive results in critically ill COVID-19 patients based on their data.

2.2.4 Antibiotics and Weaning Outcome

In a study conducted by (Emmi, 2005), It was debated how to manage pneumonia in critical care units (ICUs). Regardless of where the infection started, the article's main focus was on treating pneumonia in ICU patients. For severe community-acquired pneumonia, Streptococcus pneumoniae, Legionella, Hemophilus, and perhaps

Pseudomonas aeruginosa are the most typical bacteria to blame. Canadian and American recommendations for treatment call for a combination of beta-lactams plus a new generation macrolide or respiratory fluoroquinolone. An anti-Pseudomonas beta-lactam, anti-Pseudomonas fluoroquinolone, or aminoglycoside is recommended if Pseudomonas is detected. Early-onset HAP and VAP can be treated with antibiotics like ceftriaxone or fluoroquinolones, whereas late-onset HAP and VAP with risk factors for multi-resistant bacteria require combination therapy with an anti-pseudomonas cephalosporin or carbapenem and an anti-pseudomonas fluoroquinolone or aminoglycoside. The study further emphasizes ciprofloxacin's efficiency when combined with beta-lactams to treat infections with Pseudomonas or Klebsiella pneumoniae (ESbL+) or Acinetobacter sp. Overall, the study offers advice on how to treat pneumonia in ICU patients with the proper dosage of medicines.

A retrospective study was conducted by (Deniel et al., 2022) between 2012 and 2020, 391 patients with AECOPD who had no pneumonia and needed mechanical ventilation. The goal of the trial was to ascertain if early antibiotic therapy (eABT) increases the chances that patients with AECOPD without pneumonia will successfully wean off of mechanical support. When antibiotics are given within the first 24 hours of an ICU admission, the term "eABT" is used. According to the study, 66% of individuals obtained eABT. eABT was related with a lower likelihood of successfully escaping mechanical ventilation, even when the risk of death was taken into account, multivariate analysis revealed, with the exception of some subgroups. There was no appreciable difference in mortality at day 28, but patients who got eABT had fewer ventilator-free days, ICU-free days, and invasive mechanical ventilation-free days than those who did not. With the exception of patients who were on invasive mechanical ventilation on ICU

Day-1, patients whose ICU Day-1 worst PaCO2 was greater than 74, and patients who had been diagnosed with documented bacterial bronchitis at the time of ICU admission, the association between eABT and a lower likelihood of successfully liberating from mechanical ventilation was seen in all subgroups. The authors came to the conclusion that early antibiotic medication since ICU admission may not be advantageous in terms of good weaning outcomes for mechanically ventilated patients based on these findings.

(Sadegh et al., 2022) aimed to assess the impact of different antibiotic regimens on the weaning process of sepsis patients from mechanical ventilators. Seventy sepsis patients on mechanical ventilation were enrolled in this prospective cross-sectional trial, and they were randomized to either the meropenem and levofloxacin group or the meropenem, levofloxacin, and clindamycin group. With a mean age of 37.98 years, the study discovered that 68.6% of participants were men and 31.4% were women. The two-drug group (meropenem + levofloxacin) had a significantly shorter mean time of mechanical ventilation and ICU stay and hospitalization than the three-drug group (P 0.05). The ventilator connection time, however, did not change significantly ($P > 0.05$). These findings demonstrate that the combination of meropenem and levofloxacin, a two-drug regimen, is more efficient in promoting sepsis patients' recovery and is linked to better weaning outcomes in terms of the mean length of mechanical breathing and other outcomes.

2.2.5 Sedation and Weaning Outcome

A retrospective study was performed (Kallet et al., 2018) to examine the impact of implementing protocols for spontaneous breathing trials and daily sedation interruption (SBT/DSI) on the duration of mechanical ventilation and ICU stay. The study comprised 1,053 acute respiratory distress syndrome (ARDS) survivors in total. They were divided into two groups: the 397 patients in the pre-SBT/DSI group (June 2002–December 2007) and the 656 patients in the post-SBT/DSI group (January 2009–April 2016). Patients from the 2008 protocol implementation period were excluded from the analysis. Through the use of an extra database between 2008 and 2010, the effectiveness of SBT in helping ARDS patients transition to unassisted breathing was evaluated. The results of the study demonstrated that ARDS patients treated with SBT/DSI protocols had considerably shorter stays in the intensive care unit (ICU) and shorter times spent on mechanical ventilation than those treated without protocols. In the end, shorter durations of mechanical ventilation and ICU stays were independently correlated with the implementation of the SBT/DSI technique and higher baseline respiratory system compliance. After an average of two trials, the majority of the patients treated with the SBT/DSI combination were effectively weaned off of mechanical ventilation. Based on these findings, the authors hypothesized that daily sedation interruption combined with spontaneous breathing trials would result in a shorter length of mechanical ventilation and better outcomes for ICU stays.

In a clinical trial performed by (Blackwood et al., 2021), the goal was to determine how a sedation and ventilator liberation protocol intervention would affect how long newborns and kids would need to be kept on invasive mechanical ventilation. In the United Kingdom, the experiment was conducted at 17 hospital locations across 18 pediatric intensive care units. Patients were progressively randomized from standard care to the protocol intervention. 8,843 babies and children who were severely unwell were recruited from February 2018 to October 2019, and the follow-up period ended on November 11, 2019. Pediatric critical care units either provided standard treatment to

4,155 babies and children, as was the case in the intervention, or sedation and a ventilator liberation strategy to 4,688 infants and children. The intervention consisted of sedation level assessments, daily readiness screening for a spontaneous breathing trial, a spontaneous breathing trial to determine the likelihood of ventilator liberation, and daily rounds to review sedation and readiness screening and set patient-relevant goals. 8,843 babies and young children, 42% of whom were female, with a median age of 8 months (interquartile range, 1 to 46 months), were enrolled in the randomized controlled experiment. When compared to standard care, the median time to successful extubation was significantly reduced by the protocol intervention (64.8 vs. 66.2 hours, respectively; adjusted median difference, 6.1 h [interquartile range, 8.2 to 5.3 h]; adjusted hazard ratio, 1.11 [95% CI, 1.02 to 1.20], P =.02). Serious adverse events, such as hypoxia and nonvascular device dislodgement, were infrequently and were comparable between the groups receiving protocol intervention and standard care. In conclusion, as compared to standard care, the use of a sedative and ventilator liberation protocol intervention led to a statistically significant decrease in the time it took for a kid or infant to successfully extubate for the first time.

(Zhou et al., 2022) conducted a randomized clinical research to assess the efficiency and security of several sedative techniques in patients who were mechanically ventilated and severely ill. An academic, tertiary medical center's medical and surgical intensive care unit were the setting for the investigation. The participants were adult patients who were mechanically ventilated, severely sick, receiving midazolam, and whose mechanical ventilation was anticipated to last for 72 hours. They conducted a spontaneous breathing test (SBT) safety check, then a 30-minute SBT without satisfying the requirements for extubation, and sedation was required throughout the study. Each of the three groups—M-D (midazolam switched to dexmedetomidine), M-P (midazolam switched to propofol), and M (sedation with midazolam alone)—was randomly assigned to the patients. To obtain the required level of sedation (RASS - 2 to 0), the sedatives were modified. The findings revealed that 252 patients in all had signed up for the research. In comparison to patients in the M-P and M groups, those in the M-D group recovered more quickly, needed less time to be extubated, and spent more time at the desired level of sedation (all P 0.001). Additionally, they weaned more quickly (25.0 vs. 49.0 hours) and experienced less delirium (19.5% vs. 43.8%) than other groups. In comparison to the M group, the M-P group recovered more quickly (P 0.001), took less time to be extubated (P 0.001), and took less time to wean (P = 0.048), but the cost of sedative drug acquisition was higher (both P 0.001). The number of negative occurrences did not differ significantly between the groups (all P > 0.05). The sequential administration of midazolam and dexmedetomidine can therefore be a secure and efficient sedation method for critically sick patients who need long-term sedation during mechanical breathing, according to the authors' findings. For some patients, this strategy could have considerable clinical advantages.

2.2.6 RASS, GCS and Weaning Outcome

In a randomized clinical trial conducted by (Yousefi et al., 2015), the use of the Richmond Agitation-Sedation Scale (RASS) for drug delivery up till ventilator weaning was investigated in Isfahan, Iran, on 64 patients from three intensive care units (ICUs). 32 patients from each of the two groups the study group and the control group were assigned to their respective groups. During each shift, the patients in the control group had their drug intake and levels of consciousness monitored in accordance with doctor's orders. The RASS score was tracked in the study group every hour, and sedation was given in accordance. The findings demonstrated that, following the intervention, there was no discernible difference in the mean midazolam and morphine intake between the two groups. The control group used 379 g of fentanyl as opposed to the study group's usage of 75 g, which was significantly different (P = 0.03). In addition, the study group's average time hooked up to the ventilator was much less (P = 0.03). The authors came to the conclusion that nurses' use of RASS led to less frequent sedation needs, shorter ventilator connections, and shorter hospital stays.

In a randomized clinical trial conducted by (J.-B. Zhang et al., 2020), In patients with acute exacerbation of chronic obstructive pulmonary disease (AECOPD) and respiratory failure, the effectiveness of employing a modified Glasgow Coma Scale (GCS) score to guide sequential invasive-noninvasive mechanical ventilation weaning was evaluated. Based on the use of a modified GCS score of 13 or 10 points as the switching point for the sequential weaning method, respectively, the individuals were randomly divided into two groups, A and B. A total of 240 patients (141 men and 99 women) with a mean age of 55.39.1 years (range, 31-86) participated in the study. Age, sex, BMI, concurrent diseases, mean blood pressure, heart rate, respiratory rate, oxygenation index, and arterial blood analysis upon admission did not significantly differ between the two groups at the outset. Group A's invasive mechanical ventilation (IMV) time was considerably less than that of group B. Re-intubation, pneumonia brought on by a ventilator, in-hospital mortality, or hospital stay duration did not vary substantially amongst the groups. The authors came to the conclusion that using a modified GCS score of 13 as the threshold for sequential invasive-noninvasive ventilation may result in shorter IMV durations in patients with AECOPD and respiratory failure.

2.2.7 APACHE II, SOFA Score and Weaning Outcome

In a retrospective study conducted by (Kao et al., 2013), In addition to existing severity ranking methods, the goal was to find early indicators of outcome in patients with severe acute respiratory failure. 111 adult patients who were sequentially admitted to the designated ICU between January 1, 2010, and July 31, 2010, and who met the criteria for severe acute respiratory failure were included in the study, which was conducted at a medical ICU in a tertiary teaching hospital in southern Taiwan. Acute respiratory insufficiency resulting in severe acute respiratory failure necessitated at least 24 hours of ventilator assistance. Comorbidities, SOFA score, APACHE II score, PaO2, FiO2, PaO2/FiO2, PEEP, mean airway pressure (mPaw), oxygenation index (OI), variations in OI over the course of the first three days of mechanical breathing, and other variables were noted. The findings revealed that 38% of patients died during the research period, and 48% were unable to wean themselves off of their ventilators. Day 3 OI ($P=0.004$) and SOFA scores ($P=0.02$) were found to be independent predictors of hospital mortality in a multivariate analysis. Weaning failure ($P=0.002$) was shown to be predicted by a prior cerebrovascular accident ($P=0.002$). Higher day 3 OI was linked to a shorter survival time, according to a Kaplan-Meier analysis (log-Rank test, P0.001). The authors concluded that the SOFA and OI scores were independent predictors of weaning outcome in patients with severe acute respiratory failure.

In a comprehensive review conducted by (Dehghani et al., 2016), The purpose of this study was to provide an overview of common prediction tools, such as the

APACHE II score for weaning patients from mechanical ventilator. The review included works that were published between 1996 and 2014 and were located using databases like PubMed, Magiran, Google Scholar, Elsevier, and SID. The review's conclusions showed that the APACHE II score has been acknowledged as a highly accurate technique for predicting early weaning and mortality and is frequently used as an indicator of success or failure in weaning patients from the ventilator. In terms of treatment and weaning, patients with lower APACHE II values typically perform better than those with higher scores. Regarding the precise APACHE II score threshold for determining whether weaning will be successful or not, contrasting results have been published. Although the score, along with other factors like respiratory rate and rapid shallow breathing index, may offer some predictive value for weaning success, it is difficult to accurately predict mechanical ventilation duration and early extubation based solely on common clinical criteria due to the lack of generalizability and the dynamic nature of patients in the ICU.

In a retrospective study performed by (Lee et al., 2020), examining patients who needed home mechanical ventilation (HMV) with a tracheostomy and had trouble weaning off invasive mechanical ventilation (IMV) during their medical ICU admission was the goal. From September 2013 to August 2016, the study was carried out at Severance Hospital, Yonsei University, Seoul, Korea. In the medical ICU, 72 patients who were challenging to wean were switched from IMV to HMV for the trial. The results showed a 46% weaning success rate, with in-hospital mortality being considerably lower in the successfully weaned group compared to the poorly weaned group. Weaning rates varied little depending on the primary diagnosis, although successful weaning was correlated with a higher body mass index (BMI), a lower

APACHE II score upon ICU admission, and the absence of neuromuscular disease. The 3-month and 6-month survival rates were 82.5% and 72.2%, respectively, after a median follow-up of 4.6 months. In comparison to the poorly weaned group, the successfully weaned group showed greater survival rates 3 and 6 months following ICU discharge. The authors' findings were summarized by stating that 46% of patients who were hard to wean and switched from IMV in the medical ICU were successfully weaned with HMV. Higher BMI, a lower APACHE II score at ICU admission, and the lack of neuromuscular illness were all related with successful weaning. In comparison to the unsuccessfully weaned group, the group that was effectively weaned had considerably lower in-hospital mortality and greater survival rates three- and six-months following ICU discharge.

2.2.8 Use of Vasopressors and Weaning Outcome

(Zarrabian et al., 2022) conducted a retrospective cohort study involving 6,140 invasive mechanically ventilated patients to investigate the association between vasopressor use during extubation and various outcomes. The study examined the medical files of adult patients who were brought to Calgary intensive care units (ICUs), received vasopressors while invasive mechanical ventilation was being administered, and underwent an attempt at extubation. Reintubation within 96 hours, in-hospital mortality, and length of stay in the ICU or hospital were among the outcomes that were looked at. According to the results, 721 (11.7%) of the patients who were undergoing mechanical ventilation were extubated while still using vasopressors, while 5,419 (88.3%) were extubated after stopping vasopressor use. In general, the risk of reintubation was not significantly increased by extubation while using vasopressors. On the other hand, it was linked to greater fatality rates and longer hospital stays. In comparison to extubation after stopping vasopressors, extubation while taking high-dose vasopressors (>0.1 g/kg/min) was associated with a greater risk of reintubation. Contrarily, patients who were extubated while taking low-dose vasopressors (0.1 g/kg/min) had lower mortality rates shorter ICU stays, while those who had stopped taking vasopressors had no significant difference in reintubation or hospital length of stay. In conclusion, the authors emphasized the significance of carefully weighing the pros and cons of using vasopressors during the weaning process and customizing management to individual patient needs, as extubation while on vasopressors was linked to higher mortality rates and longer hospital stays rather than an increased risk of reintubation.

2.2.9 Hemodynamics Changes and Weaning Outcome

(Vignon, 2018) a thorough review with an emphasis on the hemodynamic alterations brought on by stopping mechanical ventilation. The goal of the study was to highlight the use of hemodynamic monitoring, in particular critical care echocardiography (CCE), in guiding tailored therapeutic management for patients at high risk of unsuccessful weaning due to cardiovascular failure during the transition to spontaneous breathing. It also aimed to summarize the underlying mechanisms of weaning failure related to cardiovascular issues and outline the diagnostic process. According to the author, even people who have never had a history of heart illness can develop weaning failure because of cardiac problems such marginal systolic function or left ventricular diastolic dysfunction, especially when there is a sizable positive fluid balance. While many approaches, such as the use of cardiac biomarkers or measurements of hemoconcentration and lung water, have been suggested for diagnosing weaning-induced pulmonary edema (WiPO), CCE stands out as the only non-invasive technique capable of providing real-time identification of WiPO and its underlying mechanism. As a result, CCE is a perfect method for identifying patients who are at a high risk of weaning failure, monitoring them throughout and after spontaneous breathing trials (SBT), and directing the best management practices.

(Salam et al., 2003) carried out a study to look into how arterial blood gas (ABG) measurements affect extubation choices. One of three critical care attending physicians examined each patient at their bedside as part of the study. In order to prepare for extubation, ABGs were obtained throughout the spontaneous breathing trial (SBT), and assessments were made by the attending physician and any available nurses, respiratory therapists, or residents. Physical measurements were performed both before and after the SBT. The results showed that 83 patients out of 100 SBTs were analyzed, and mean blood pressure, heart rate, and respiration rate all increased significantly. Blood oxygen saturation and the PaO2/FIO2 ratio both indicated a considerable decline. In 86 patients, extubation was tried; 76 remained extubated after 72 hours. Seven of the fourteen SBTs that were performed without extubation were clinically and anaerobically unsuccessful. The decision to extubate based on ABG readings was changed in just one case out of the 72 SBTs assessed by bedside nurses. Four such incidents were noted by respiratory therapists, and patients who were not extubated displayed twice as many average changes in heart rate and blood pressure as those who were. Ten patients (11.6%) were extubated by the attending physician, however they needed to be reintubated within 72 hours. The study concluded that there was no discernible difference in extubation choices depending on ABG values.

In a prospective randomized study conducted by (Cirit Ekiz et al., 2022), In patients with hypercapnic respiratory failure receiving non-invasive mechanical ventilation (NIMV), the efficacy of full-face and oronasal masks was assessed, as well as patient compliance with the masks. Sixty patients with hypercapnic respiratory failure were divided into two groups at random. Respiratory rates and arterial blood gas levels were assessed before and after therapy at various intervals. A full-face mask was worn by one group (n = 30), whereas an oronasal mask was worn by the other group (n = 30). As a consequence of chronic hypercapnia and mask-face mismatch, respectively, two patients from the oronasal mask group and eight patients from the full-face mask group were eliminated, according to the results. At the first and 24th hours of treatment, the full-face mask group showed improved pH, and at the 72nd hour of therapy, PCO2 decreased. The groups did not differ significantly in terms of patient compliance or respiratory rate. While complaints of a burning feeling and pressure in the eyes were more common in the full-face mask group, pressure ulcers were more frequent in the oronasal mask group. According to the study's findings, using a full-face mask caused a higher reduction in PCO2 and an improvement in pH. In addition, compared to the oronasal mask, it decreased the risk of pressure ulcers.

In a systematic review and meta-analysis conducted by (Mandelzweig et al., 2018), The goal was to compare the results of weaning mechanical ventilation in adults and kids. The search included observational studies and trials of non-invasive mechanical ventilation (NIV) in adults and post-neonatal children with acute respiratory failure (ARF) or during the peri-extubation phase in the MEDLINE, CENTRAL, and EMBASE databases up until January 2016. The study comprised 54 studies, mostly from South Asia, with 10 studies including children (n = 1099) and 44 studies involving adults (n = 2904). Pneumonia and chronic obstructive pulmonary disease (COPD) were the most frequently identified conditions. According to the findings, both children and adults who underwent NIV had a moderate risk of death, NIV failure, and intubation. Compared to those with hypercapnic ARF, individuals with hypoxemic ARF had a greater probability of passing away. NIV showed a decrease in mortality in individuals with COPD and those undergoing ventilation weaning. Pneumothorax risk was minimal in both children and adults.

2.2.10 SBT and Weaning Outcome

(Yi et al., 2021) compared and ranked four typical Spontaneous Breathing Trial (SBT) modalities in critically sick patients receiving mechanical ventilation by conducting a systematic review and meta-analysis. The modes were continuous positive airway pressure (CPAP), pressure support ventilation (PSV), automated tube compensation (ATC), and T-piece (MV). In this study, weaning success, reintubation, SBT success, length of acute care, and ICU mortality were evaluated. Up until May 17, 2020, the researchers looked for pertinent papers in PubMed, EMBASE, and the Cochrane Central Register of Controlled Trials (CENTRAL). The analysis covered a total of 24 publications with a 4,241 person sample size. In comparison to T-piece and PSV, the results showed that ATC had a much greater success rate for extubation. ATC performed better than other SBT strategies in terms of SBT effectiveness. In comparison to T-piece, CPAP had a greater rate of reintubation. The length of stays in the ICU and long-term weaning units did not significantly differ between SBT modes. Through network meta-analysis, comparable outcomes were attained. In terms of improving weaning success and SBT success, ATC came out on top. The researchers came to the conclusion that ATC appeared to be the best indicator of successfully weaning from the ventilator in critically ill patients, and they suggested conducting more randomized controlled studies to confirm their findings.

In a study conducted by (Kishore & Jhamb, 2021) the researchers wanted to evaluate the efficiency of a pressure support spontaneous breathing experiment (PS SBT) to traditional weaning techniques in children who had been on mechanical ventilator for at least 24 hours. Patients who met the criteria underwent daily screening before being randomly assigned. The control group had standard weaning with synchronized intermittent mandatory breathing mode, a T-piece trial, and extubation while the intervention group underwent a 2-hour PS SBT followed by these steps. There were 80 participants in the trial, 40 in each group. According to the findings, 77.5% of the intervention group's patients successfully completed the PS SBT on their first try. The time spent on mechanical ventilation was not significantly different between the two groups. In the control group, mechanical ventilation lasted an average of 4.77 (2.89, 9.46) minutes, while it lasted 4.94 (2.23, 6.35) minutes in the intervention group. The rate of extubation failure did not significantly differ across the groups. No matter which group the patient was in, it was discovered that mortality was considerably higher in patients who required reintubation compared to those who did not. The authors came to the conclusion that the PS SBT-based protocol was a secure method for determining readiness for extubation and did not raise the risk of extubation failure, despite the fact that it did not shorten the period of mechanical breathing.

(Saeed & Lasrado, 2023) outlined a book that sought to close the preparation gap for starting a spontaneous breathing trial in mechanically ventilated patients. The guidelines for passing a trial of spontaneous breathing and assessing weaning readiness were also covered in the book. The authors state that a spontaneous breathing trial can last anywhere between 30 minutes and two hours. The T-tube (T-piece) experiment, pressure-support ventilation, continuous positive airway pressure, automatic tube compensation, and automated weaning are some of the techniques that can be utilized to carry out the trial. The review emphasized a number of weaning parameters that have been investigated in clinical studies, including minute ventilation, maximum negative inspiratory pressure, static compliance, occlusion pressure, reduction of venous oxygenation saturation, rapid shallow breathing index (RSBI), and maximal inspiratory pressure (MIP). The RSBI of less than 105, the MIP of less than -30 cm of water, and the minute ventilation of less than 10 liters per minute are the three metrics that are most frequently used as indications of weaning readiness.

2.2.11 Efficacy of Different Weaning Protocols

A study conducted by (Ghanbari et al., 2020) at Poursina Hospital in Rasht, Iran, In ICU patients, the researchers contrasted a nurse-led weaning procedure with a physician-led protocol. A convenience sample of 65 ICU patients who required mechanical breathing for more than 72 hours was chosen for the study, which used a quasi-experimental methodology with a one-group design. The study's conclusions showed that a safe and efficient method for determining a patient's preparedness for weaning from artificial ventilator is to use the Burn's Weaning Scale (BWS) in three working phases, as assessed by nurses. Compared to other techniques frequently employed in ICUs, this strategy was found to more efficiently shorten the duration of mechanical ventilation. In order to promote optimal care and to reduce complications, the authors underlined the critical role of ICU nurses. They also emphasized the significance of delivering excellent nursing care.

In another study conducted by (Oliveira et al., 2019), the purpose of the study was to evaluate how a ventilatory weaning strategy affected the effectiveness of weaning and patient outcomes. By contrasting information gathered from a prospective study with information from a retrospective investigation, the study used a quantitative, quasi-experimental design. The information was gathered using a weaning log sheet at an ICU in northern Portugal between September and December 2015, following the introduction of the weaning protocol. Then, this data was contrasted with the baseline data from the year before the protocol adoption. The findings showed that the ventilatory weaning protocol-following experimental group had a higher mean score for overall weaning quality. Additionally, there was a 36.6% reduction in weaning length and a 27.3% reduction in the time needed to start the procedure. The study's findings led to the conclusion that the use of the ventilatory weaning protocol considerably increased the overall quality of weaning, made it possible to identify patients who were ready for weaning earlier, and decreased the amount of time spent on mechanical ventilation.

(Nitta et al., 2019) conducted a prospective observational cohort study at Shinshu University Hospital's Advanced Emergency and Critical Care Center. Patients who required tracheal intubation and mechanical breathing for at least 48 hours between April 2007 and March 2013 were the primary subject of the study. The Shinshu University School of Medicine's Ethics Review Board gave the study their approval. The results showed that the use of resources and the amount of time spent in the intensive care unit (ICU) decreased as a result of the application of ventilator weaning methods. However, neither mortality nor rates of reintubation were significantly affected.

In a systematic review with meta-analysis conducted by (Hirzallah et al., 2019), the authors looked at adult patients on mechanical ventilation who were weaned under a nurse's supervision. Studies that discussed the effects of nurse-led weaning regimens on weaning outcomes were included in the review. The search was done from the earliest date available through January 2016 in databases such CINAHL, PubMed, Scopus, and the Cochrane Central Register of Controlled Trials. 532 patients were included in the analysis after 369 papers in total were retrieved and reviewed. The results showed that nurse-led weaning protocols may be used efficiently and safely, resulting in considerable decreases in the amount of time spent on mechanical ventilation, the amount of time spent in the intensive care unit, and the amount of time spent in the hospital. The ICU healthcare personnel also considered the protocols to be simple to use, safe, and well-accepted.

2.2.12 Providing Palliative Care through Comfort

In a study conducted by (Suparman Rustam et al., 2018), it has been discovered that people who are ventilator-connected need constant comfort. According to the survey, 54% of patients report feeling uncomfortable, which can be linked to things like loneliness, anxiety, and auditory discomfort. These discomforts may result in undesirable consequences like sadness, agitation, or delirium. The study, which examined 42 studies written between 2002 and 2016, underlined the value of bringing comfort to patients through a variety of means, including medication, nursing care, and complementary or alternative therapies provided by medical staff.

2.2.13 Daily Assessment for Weaning Eligibility

(Elew et al., 2022) April 2022 saw the completion of a review article on the subject of weaning from mechanical ventilation at Sohag University in Egypt. Databases like PubMed, Google Scholar, and ScienceDirect were searched for English-language papers from 1992 to 2021. The review's conclusions recommended that all patients receiving ventilator support should go through a daily assessment to see if they are ready to be weaned. Meeting certain prerequisites and participating in a spontaneous breathing test (SBT) may be required for this evaluation. Alternative strategies, such as pressure support ventilation (PSV) or gradually increasing times of spontaneous breathing, can be taken into consideration if the initial weaning attempts are unsuccessful.

Chapter Three

Methods

3.1 Introduction

This chapter provides an overview of the study's methodology, including a description of the population, study setting, research sample, tools, ethical issues, data collection, and data analysis. This section provides a comprehensive overview of the research method used to conduct the study and the rationale behind the selection of the research design, population, instruments, data sources, and techniques. The procedures for collecting and presenting the data, as well as the methods and techniques used for analysis, are also clearly described.

3.2 Research Design

This study uses a retrospective design to look at the results of adult intubation patients' weaning from ventilators in the intensive care unit (ICU) of the Hebron government hospital in Hebron city.

3.3 Study Setting

This study was conducted in the intensive care unit of the Hebron government hospital in Hebron City, which has a total of 15 ICU beds. Hebron Governmental Hospital, or Princess Alia Governmental Hospital, is located in the center of Hebron and was established in 1957. It is one of the largest hospitals in the region and provides a wide range of medical services to the community. The hospital has a capacity of over 240 beds and is equipped with modern medical equipment, including MRI and CT scanners, digital radiography, and ultrasound machines. It contains specialist branches for surgery, pediatrics, obstetrics and gynecology, internal medicine, and more. The hospital is staffed by over 700 team members, including 36 critical care nurses, medical staff, including doctors, nurses, and support personnel, who are all well qualified, who work together to provide quality healthcare to patients (Government Service Quality Department, 2018).

3.4 Research Population and Sample

Population

All patients intubated and admitted from 1/1/2022 to 1/6/2023 (17 months) consisted in the ICU of Hebron government Hospital who had undergone the weaning process as per standard practice. To minimize the impact of seasonal variations, all participants were selected from patients admitted to the ICUs that meet the inclusion/exclusion criteria at the same time. Whereas, the decision to separate the patient or keep him on the ventilator was taken only by a specialist doctor, the weaning process was performed for the patient by the staff of specialists in the internal medicine department and the anesthesiology department. But without a written protocol that is available in the intensive care departments. All safety principles used were also applied and the highest possible level in terms of quality of medical service is given.

All patients were provided with high quality of treatment and received best medical practice by the health care medical and nursing team and enjoyed maximum safety conditions and public safety procedures.

The Sample Size

The sample size is 230 patients, was determined based on a fixed time period of 17 months starting from 1/1/2022 and ending on 1/6/2023. In addition to taking into account 4 studies related to the subject of the study. According to 4 previous study and use of average of mortality rate was 10.175 % and calculated by sample size program:

The first study is a retrospective published in 2021 and the mortality rate is 9 %, the name is “machine learning for prediction of successful extubation of mechanical ventilated patients in an intensive care unit”.

The second study is a prospective published in 2012 and the mortality rate is 10 %, the name is a “weaning protocol administered by critical care nurses for the weaning of patients from mechanical ventilation”.

The third study is a prospective published in 2019 and the mortality rate is 6.9 %, the name is “ a comprehensive protocol for ventilator weaning and extubation”.

The fourth study is a prospective published in 2017 and the mortality rate is 14.8 %, the name is “mechanical ventilation weaning protocol improves medical adherence and results”.

The sample size had been increased by 10% to allow for probable dropouts, bringing the total number of patients to 230.

3.5 Selection Criteria

Inclusion Criteria

1- Adults who were on mechanical ventilation (MV).

2- Admitted from 1/1/2022 to 1/6/2023 in the ICU of Hebron government Hospital.

3- Have undergone weaning process as the standard practice.

Exclusion Criteria

1- Were below 15 years of age (according to hospital policy any patient age below 15 years follow up by pediatric team and age above 15 years follow up by medical team).

2- Received tracheostomy.

3- Were transferred to other hospital under MV.

4- Patients with chronic disease such as congenital heart disease, neuromuscular disease, tracheostomy, or paralysis.

In order to ensure that the sample was representative of the target population and to lessen the likelihood that unexpected variables would have an impact on the results, inclusion and exclusion criteria were used in this study. The study attempted to obtain a group that is homogeneous and may produce relevant results by restricting the sample to adult patients on MV and removing those with impairments.

3.6 Instrumentation

According to prior relationships in other studies, a structured instrument was employed in this study to gather data on demographic and related characteristics.

The first study: is a retrospective, published in 2021 under name of "machine learning for prediction of successful extubation of mechanical ventilated patients in an intensive care unit" (Otaguro et al., 2021).

The Second study: is a prospective, published in 2019 under name of "a comprehensive protocol for ventilator weaning and extubation" (Nitta, Okamoto et al. 2019).

The Tool Encompasses Three Parts:

1. Demographic variables: Information about the age, gender, and other demographic characteristics of the participants was collected using a structured questionnaire.
2. Clinical variables: Information about the participant's medical history, current health status, and other clinical variables relevant to the study was collected through medical charts and interviews with the healthcare provider.
3. The weaning outcome: The results of the weaning process, including the time required to complete it, its success or failure, and any adverse outcomes or problems, were documented using conventional surveys and medical records.

3.7 Validity

English was the language of the data collecting tool, and content validity was used. After then, it was examined by specialists two intensivists (Head of the Intensive Care Department, Dr. Ziad Ramadan, and Dr. Mahmoud Qdemat, Head of the Anesthesia Department at Hebron Governmental Hospital), and researcher, and a statistician to make sure the tool was appropriate for the research topic, no any recommendation add by all experts.

3.8 Pilot Study (Readability)

Twenty patients participated in a pilot research that was not included in the sample size. The pilot study assessed the tools' applicability, the data's accessibility, and the anticipated duration of the data collection process. According to the result of the pilot study, the reliability scale (Cronbach's Alpha) was subsequently calculated.

3.9 Study Variables

The dependent variable and the independent variables were the main focus of the study, which looked at the relationship between them.

Dependent variable

Weaning outcomes, which was evaluated as the study's main result.

Independent Variables

1. Demographic variables, including age, gender, and medical history.
2. Clinical variables, including comorbidities, diagnosis, and how long mechanical ventilation remains.

3.10 Supporting Scale (Severity Score)

The following scales were also used to support the measurements throughout the study:

Score for assessing sequential organ failure (SOFA Score)

The SOFA score is used to assess the severity of organ dysfunction in critically unwell patients. It rates the functioning of the respiratory, cardiovascular, hepatic, coagulation, renal, and neurological organ systems. Points are awarded based on how severe the impairment is. A higher value indicates more significant organ dysfunction, with a maximum score of 24. As a reliable predictor of death in critically sick patients, the SOFA score is often used in clinical studies and quality improvement initiatives (Kao et al., 2013).

Glasgow Coma Scale (GCS)

This scale use to assess the patient's level of consciousness. It rates 3 factors, eye opening, verbal response, and motor reaction, and provides a score between three and fifteen. With a score of 3 showing no response to any stimuli and a score of 15 indicating normal consciousness, a lower score denotes a more severe neurological disability. Patients who have experienced a stroke, severe brain damage, or other neurological problems are frequently evaluated and monitored using the GCS (J.-B. Zhang et al., 2020).

Acute Physiology and Chronic Health Evaluation (APACHE II Score)

When a patient is critically ill, the severity of their illness is evaluated using the APACHE II score. It assesses 12 physiological indicators, including body temperature, blood pressure, and respiration rate, and scores each one according to how aberrant it is. As extra criteria, it also takes into account old age and chronic health status. The maximum score is 71, and a higher number indicates a greater severity of sickness and a greater danger of death. Intensive care units routinely use the APACHE II score to determine the severity of a patient's condition and determine their prognosis (Akavipat, 2019).

Richmond Agitation Sedation Scale (RASS)

This Score is a structured assessment that is used to provide easy-to-use criteria for evaluating arousal and agitation, direct sedation therapy to more effectively meet patients' titration needs, and enhance communication between healthcare professionals regarding sedation and agitation. The range of the RASS, a 10-point scale, is -5 to +4. Sedation levels range from -1 to -5, where -1 indicates "awakens to voice" and -5 indicates "unarousable." Rising annoyance is represented by levels +1 to +4. At its lowest point, agitation shifts from trepidation and dread to aggressiveness and violence. The definition of RASS level 0 is "alert and calm." As a result, RASS is frequently used in critical care units (ICUs) to assess patients' levels of pain, delirium, anxiety, and other underlying causes of agitation (Yousefi et al., 2015).

3.11 Ethical Considerations

The AAUP University Committee on Ethics and Institutional Review Board (IRB) assessed and gave its approval to this work under the reference number 2023/A/71/N. The management of the partnering hospital also consent the study's use of its infrastructure. Healthcare professionals who took part in the study received information about its goals and methods as well as assurances that the tools questions and the data collection process were not harmful to their patient health. The ministry of health gave its consent for the study's data collection, which was done exclusively from patient files.

3.12 Data Collection Procedures

Following approval from the AAUP University Committee of Ethics and the administration of the collaborating hospital, data collection was done. The researcher discussed the goals, scope, and methods of the study with the head nurse and the ICU director. The researcher had provided comprehensive information and obtained consent via a consent form in order to guarantee anonymity and maintain patients' rights. For simplicity of communication during data collection, the researcher's email and phone number were supplied in the cover letter. Utilizing patient records and administrative data from mechanically ventilated patients who met the inclusion criteria between 01/01/2022 to 01/06/2023, a span of 17 months, the researcher completed the study data. The researcher was provided with all the file numbers of patients who were admitted to the intensive care department during the time period from 1/1/2022 to 6/1/2023 by the Information Technology Department in the Palestinian Ministry of Health, and the process of accessing patient files was facilitated through the Avicenna program. Then, all patient files (1700 files) were reviewed. Then, 230 patients who could meet the inclusion criteria were selected. All the required information was collected before starting the process of separating the patient from the ventilator.

3.13 Data Analysis

The data was evaluated using SPSS Version 25. Descriptive statistics, such as frequencies, and percentages, averages, and standard deviations, were used to create the data. To determine the significance of the results, two statistical tests the Mann-Whitney test, the Two Independent Samples T test, and the Chi-Square test were used. The Mann-Whitney test and the Two Independent Samples T test were used to compare means between patient groups for quantitative variables, while the Chi-Square test was used to compare percentages between patient groups for qualitative data. The P-Value 0.05 cut off was used to define statistical significance. The relationship between the independent and dependent variables in the study was also predicted using regression analysis.

Finally, tables and charts were used to simply and effectively show all the information. The potential consequences of the findings and their significance were explained in great depth in the interpretation of the findings. The study's findings were discussed in relation to the body of previous research and the research hypothesis. The study's strengths and limitations were emphasized, and ideas for additional research were recommended.

Chapter Four

Results

4.1 Introduction

The results of a study conducted in the intensive care unit (ICU) of the Hebron government hospital in Hebron city, to evaluate the effectiveness of the ventilator weaning process for adult patients are presented in this section. Along with limiting the risk of problems, the study also wants to determine the duration of invasive mechanical ventilation, the duration of weaning, and the duration of hospital and ICU stays. The patients who needed mechanical ventilation were included in the analysis. We talk about their demographics, medical history, and clinical profile. The presentation of figures and bivariate analysis both help to clearly answer the research questions.

4.2 Demographic Information

This study conducted at Hebron government Hospital included a sample of n=230 (60.9% males, 39.1% female) ICU seriously unwell patients who were placed to mechanical ventilation in the period between 1/1/2022 to 1/6/2023 (17 months). The mean age was 60.70 years as it varied between 15 and 61 or more In which the elderly (61 years old and above) accounted for almost two thirds of the sample. Furthermore, the mean BMI of MV adult patients was 18. However, most patients (57.0%) had an emergency source of admission when placed on the MV. Hence, only one third of the patients were smokers. For more details regarding the demographic information and their central tendency, see table 1 and 2 respectively.

Table 1: The Demographic Information of the Mechanically Ventilated Patients

Variable	Category	Frequency	%
Age	15-20	14	6
	21-40	25	10.9
	41–60	59	25.7
	>61	132	57.4
Gender	Male (M)	140	60.9
	Female (F)	90	39.1
BMI	<18.5 – underweight	2	0.9
	[18.5; 24.9] – Normal	109	47.4
	[25; 29.9] – Overweight	110	47.8
	[30; 34.9] – Obese	9	3.9
Relationship status	Divorced	2	0.9
	Married	126	54.8
	Single	29	12.6
	Widow	73	31.7
Professional	Active	53	23.0
	Inactive	177	77.0
Having children	Yes	200	87.0
	No	30	13.0
Source of admission	Departments	84	36.5
	Emergency service	131	57.0
	Operating room	5	2.2
	Other intensive care	10	4.3
Smoking	Yes	73	31.7
	No	157	68.3

Table 2: The central tendency of demographic information of the mechanically ventilated patients including [Age and BMI]

	N	Range	Minimum	Maximum	Mean	SD	Variance
Age	230	85	15	100	60.71	19.517	38.897
BMI	230	15	18	33	24.60	2.889	8.345

4.3 Medical History

Most patients ranging between 90% to 95% of the study sample didn't have a history of trauma, GI Bleeding and abdominal surgery. Meanwhile, Only 10.9% of the Mechanically ventilated patients have been infected with Covid-19 previously despite the fact that nearly half of them got vaccinated with Pfizer as a mostly 32.5% prescribed vaccine type. For more details, see table 3.

Table 3: Medical History of Mechanically Ventilated Patients

Variable	Category	Frequency	%
Trauma	Yes	10	4.3
	No	220	95.7
GI bleeding	Yes	12	5.2
	No	218	94.8
COVID 19	Positive	25	10.9
	Not Tested	93	40.4
	Negative	112	48.7
Vaccine	Yes	104	45.2
	No	126	54.8

Variable	Category	Frequency	%
Type of Vaccine	Astrazeneca	29	12.6
	Moderna	11	4.8
	No Vaccine	126	54.8
	Pfizer	35	15.2
	Sinopharm	15	6.5
	Sputnik	14	6.1
Doses	0	126	54.8
	1	23	10.0
	2	70	30.4
	3	11	4.8
Abdominal surgery	Yes	19	8.3
	No	211	91.7

4.4 Clinical Presentations

Upon diagnosis on admission, most of the cases, accounting for 85.2%, were medically diagnosed over a surgical case diagnosis. Tachycardia and desaturation were detected in almost one third of the MV patients. Although the average body temperature of the MV patients included in the analysis was almost 37, nearly a quarter of the study sample had developed a fever T >37.5. Based on the gasometry parameters findings, more than a half of the sample had a respiratory alkalosis $PaCO_2 < 35$ while the mean $PaCo_2$ of the sample was within the normal range. Meanwhile, Metabolic acidosis, $Hco_3<22$, was found in three-quarters of the sample and PH was lower than 7.35 in almost half of the patients.

Furthermore, 85% of the selected patients varied in the diagnosis between the respiratory failure, and the severe respiratory failure, the critical respiratory failure, in which the critical respiratory failure patients contributed to the greatest percentage up to

70%. Hence, only 18.2% of the sample size needed a pressure support. For more details regarding the frequency and the central tendency of the clinical presentations' values, see table 4 and 5 respectively.

Table 4: Clinical Presentations of the Mechanically Ventilated Patients

Variable	Category	Frequency	%
Diagnosis on Admission	Medical Case	196	85.2
	Surgical Case	34	14.8
PH	7.35 - 7.45 Normal	82	35.7
	<7.35 Acidosis	107	46.5
	>7.45 Alkalosis	41	17.8
PaCO2	35-45 normal	60	26.1
	<35 - respiratory alkalosis	125	54.3
	>45 respiratory Acidosis	45	19.6
Hco3	22-26 Normal	37	16.1
	<22 metabolic Acidosis	171	74.3
	>26 Metabolic Alkalosis	22	9.6
Pao2	<200 Critical respiratory Failure	155	67.4
	>=400 Normal	20	8.7
	200-250 Severe respiratory Failure	16	7.0
	250-300 Respiratory Failure	25	10.9
	300-400 Hypoxemia	14	6.1
PEEP	5-10	225	97.8
	<5.>10	5	2.2

Variable	Category	Frequency	%
Pressure Support	10-20	187	81.3
	<10	43	18.7
Fio2	<50	124	53.9
	>50	106	46.1
Tidal Volume	400-600	200	87.0
	<400	30	13.0
MAP	>65	153	66.5
	<65	77	33.5
Saturation	>92 Normal	165	71.7
	<92 Desaturation	65	28.3
Respiratory rate	<10 Bradypnea	6	2.6
	10-20 Normal	210	91.3
	>20 Tachypnea	14	6.1
Heart rate	<50 Bradycardia	10	4.3
	50-100 Normal	157	68.3
	>100 Tachycardia	63	27.4
Temperature	<35.5 Hypothermia	3	1.3
	35.5-37.5 Normal	180	78.3
	>37.5 Fever	47	20.4

Table 5: The Central Tendency of Clinical Presentations of the Mechanically Ventilated Patients

	N	Range	Minimum	Maximum	Mean	SD	Variance
Fio2	230	79	21	100	59.97	25.113	630.63
Tidal volume	230	330	250	580	464.53	41.908	1756.303
Hco3	230	38	3	41	19.07	5.996	35.951
Pao2/fio2	230	887	27	914	186.22	136.426	18612.060
PaCO2	230	108	15	123	37.85	16.788	281.850
MAP	230	118	30	148	73.39	20.592	424.047
SAT	230	55	45	100	92.41	8.466	71.676
RR	230	109	10	119	16.36	7.377	54.414
HR	230	127	43	170	88.55	24.390	594.868
T	230	7	35	42	36.99	1.422	2.022

4.5 Causes of Intubation

The most frequent cause of intubation among critically ill ICU patients was the post cardiac-arrest which was reported in one third of the cases followed by a decreased level of consciousness (LOS) that contributed to one quarter of the patients requiring mechanical ventilation. On the other hand, Decreased LOS combined with Destruction and Destruction alone varied in range between (11% - 15%) among all of the intubation causes. However, ARDs and Trauma were found to be the least frequent causes for intubation. For more details, see table 6.

Table 6: Causes of Intubation

Causes of intubation	Frequency	%
ARDS	3	1.3
Brain hemorrhages	11	4.8
CO2 retention	5	2.2
Decreased LOC	53	23
Decreased LOC and Desaturation	24	10.4
Desaturation	35	15.2
Trauma	3	1.3
Post operation	13	5.7
Post-cardiac arrest	67	29.1
Sepsis	9	3.9
Others	7	3.0

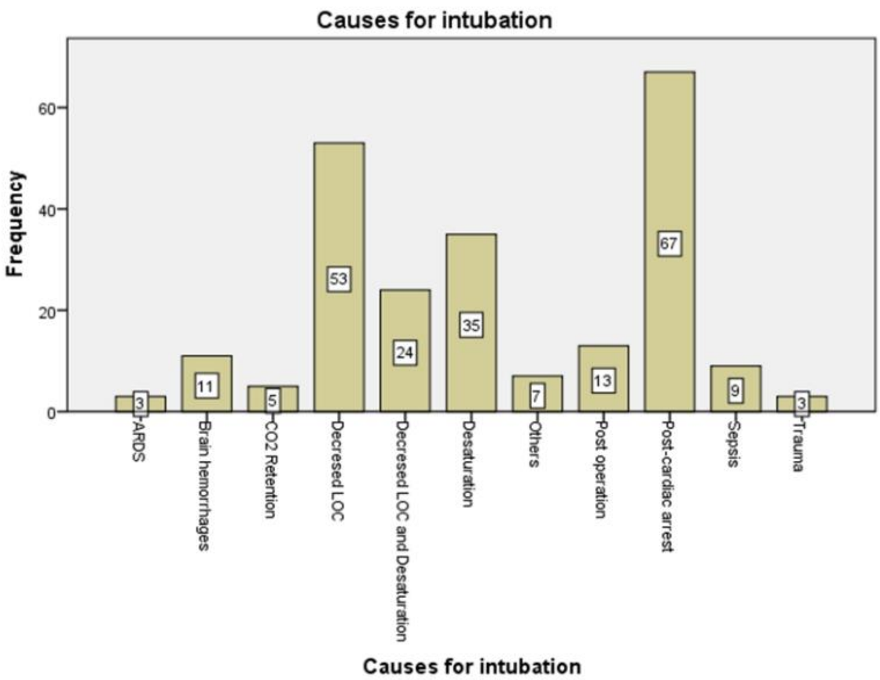


Figure 1: Causes of Intubations

We observe on this table that patients admitted to intensive care had eleven different causes of intubations: the first cause of intubation with a frequency of 3 and a percentage of 1.3% were ARDS. The second cause of intubation with a frequency of 11 and a percentage of 4.8% was Brain hemorrhages. The third cause of intubation with a frequency of 5 and a percentage of 2.2% was CO2 Retention. The fourth cause of intubation with frequency of 53 and a percentage of 23% was Decreased LOC. The fifth cause of intubation with frequency 24 and 10.4% percent was Decreased LOC and Desaturation. The sixth cause of intubation with a frequency of 35 and a percentage of 15.2% was desaturation. The seventh cause of intubation with a frequency of 7 and a percentage of 3% was Others. The eighth cause of intubation with a frequency of 13 and a percentage of 5.7% were Post operation. The ninth cause of intubation with a frequency of 67 and a percentage of 29.1% were post-cardiac arrest. The tenth cause of intubation with a frequency of 9 and a percentage of 3.9% was Sepsis. The eleventh cause of intubation with a frequency of 3 and a percentage of 1.3% was Trauma.

4.6 Glasgow Coma Score

Based on the GCS count, two thirds of the cases that had a severe impairment of consciousness, while the rest suffered from moderate impairment levels of consciousness.

Table 7: Glasgow Coma Score

Variable	Category	Frequency	%
GCS	13-15 Mild	1	0.4
	9-12 Moderate	57	24.8
	3-8 Severe	172	74.8

4.7 RASS Scale

Using the RASS scale, up to 25% of patients who needed mechanical ventilation rated themselves as drowsy. Additionally, Alert and Calm, Restlessness, moderate and light scale varied from 17% to 22% in RASS Scale scores in which light sedation had the highest score among the fourth categories. Meanwhile, agitation and deep sedation scored the least (1.3%).

For more details, see table 8.

Table 8: RASS Scale

Variable	Category	Frequency	%
RASS Scale	-1 Drowsy	54	23.5
	-2 Light Sedation	49	21.3
	-3 Moderate Sedation	39	17.0
	-4 Deep Sedation	3	1.3
	+1 Restless	41	17.8
	+2 Agitated	2	0.9
	+3 Very Agitated	1	0.4
	0 Alert and Calm	41	17.8

4.8 Frequency and Central Tendency of RSBI

All of the patients had success weaning off of mechanical ventilation, according to the rapid shallow breathing index (RSBI), which determines weaning success. The mean RSBI was 32.59 among adult MV patients, nevertheless.

Table 9: Frequency of Rapid Shallow Breathing Index

Variable	Category	Frequency	%
RSBI	<105 Successful weaning	230	100.0

Table 10: Central Tendency of Rapid Shallow Breathing Index

	N	Range	Minimum	Maximum	Mean	SD	Variance
RSBI	230	48	16	64	32.59	7.325	53.658

4.9 ICU Mortality Rate and Reasons of Discharge

ICU mortality rate documented in the patients' records was 79.6% and thus was highlighted as the most frequent reason for discharge. The other reasons for discharge varied in percentage of 20.4% between Going Home, transferred to another hospital or transferred to ward (in-patient floor) in which the latter represented the second reason of discharge up to 14%.

Table 11: ICU Mortality Rate and Reasons of Discharge

Variable	Category	Frequency	%
ICU Mortality Rate	Yes	183	79.6
	No	47	20.4
Reasons of Discharge	Death	183	79.6
	Go home	7	3.0
	Transfer to other hospital	5	2.2
	Transfer to other ICU	3	1.3
	Transfer to ward (In-patient floor)	32	13.9

4.10 Differential Analysis

Hospitalization period (days), ventilation period (days), period spent in the intensive care unit (days), and weaning length (hours)

This study included 230 adult patients who were critically ill and receiving mechanical ventilation. As a result, the average hospital stay for very ill adult patients treated with MV was 8.39 days, and the average length of stay in the ICU was close to a week. On the other hand, it was found that the average duration of mechanical ventilation was just 2 hours, whereas the average duration of ventilation was 5 days.

For more details on the central tendency measurements, see table (12).

Table 12: Hospitalization Period (Days), Ventilation Period (Days), Period Spent in the Intensive Care Unit (Days), and Weaning Length (Hours)

	N	Range	Minimum	Maximum	Mean	SD	Variance
Total duration of hospitalization, days	230	55	1	56	8.39	8.68	75.26
Total duration of ventilation (days)	230	88	1	89	5.00	8.78	77.13
Duration of weaning, (hours)	230	8	0	8	2.01	2.51	6.31
Total duration of intensive care unit, (days)	230	92	1	93	6.92	9.47	89.68

The Relationship Between Demographic Information [Age, Sex and Covid-19] and the Dependent Variables [Duration of Intubation and Weaning Outcome];

A statistically significant difference between age and intubation time was found (P = 0.001). However, because the P value above 0.05, it was not connected to the weaning result. Additionally, there was no statistically significant relationship between gender and either the duration of the intubation or the success of the weaning process (P>0.05).

The Relationship Between Demographic Information [Age, Sex and Covid-19] and the Dependent Variables [Duration of Intubation and Weaning Outcome]; Using Chi-Square Test.

Variables	Value	Df	P value
Age ; Duration of Intubation	113.309a	69	0.001
Age ; Weaning Outcome	12.157a	6	0.059
Sex ; Duration of Intubation	25.454a	23	0.327
Sex ; Weaning Outcome	1.356a	2	0.508
Covid -19 ; Duration of Intubation	56.144a	46	0.145

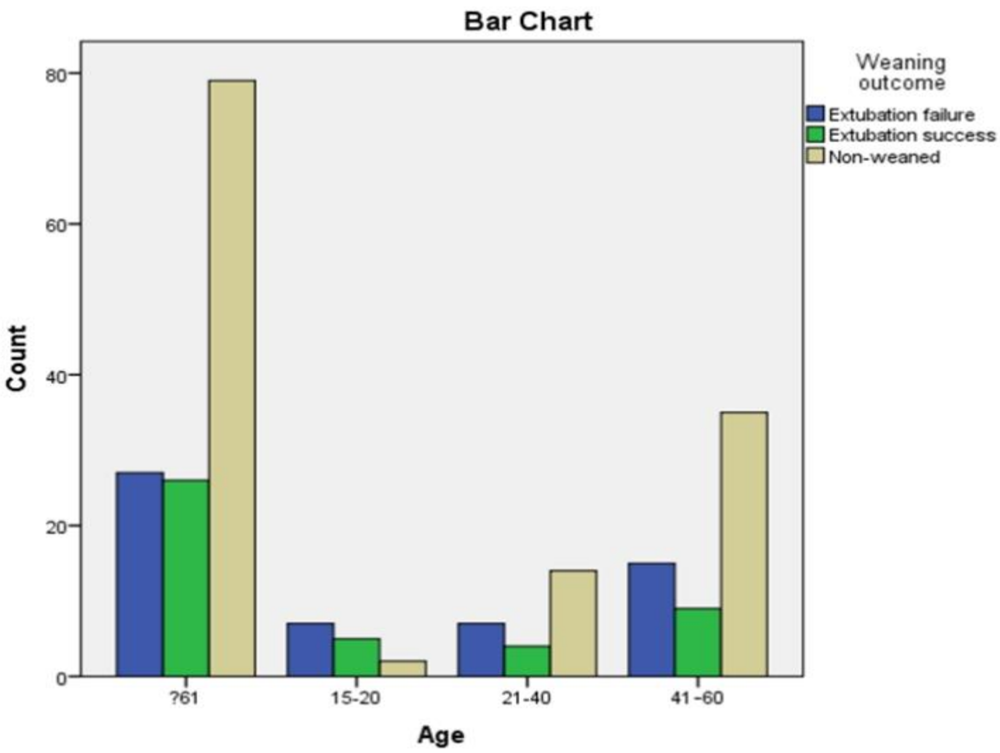


Figure 2: The Relationship Between Age and Weaning Outcome

On this table, we find that there is no association between AGE and WEANING outcome since it is not statistically significant at the 5% threshold because the p value is 0.059.

The association between the independent variable [Medical Diagnosis] and the dependent Variables [Duration of Intubation, Weaning Outcome and Risk of Adverse Effects];

Medical diagnosis and risk of adverse events as well as weaning outcomes varied statistically significantly. P=0.042. In contrast, there was no correlation between the length of the intubation (p>0.05) and the medical diagnosis.

The association between the independent variable [Medical Diagnosis] and the dependent Variables [Duration of Intubation, Weaning Outcome and Risk of Adverse Effects]; using Chi-square test.

Variables	Value	Df	P value
Diagnosis on Admission ; Duration of intubation	26.435a	23	0.281
Diagnosis on admission ; Weaning Outcome	6.348a	2	0.042
Diagnosis on Admission ; Risk of Adverse Effects	29,070a	17	0.034

Regression Analysis

Is there a relationship between medical diagnosis and weaning duration in hours?

At the significance level of 5%, we reject the hypothesis H0 which states that the factor is zero. The model is significant at the 5% threshold.

	Model fit criteria	Plausibility ratio tests		
Effect	**Likelihood log -2 of the scale model**	**Khi-square**	ddl	GIS.
Constant	8.140a	0.000	0	.
Diagnosis on admission	11.769	3.629	2	.163

The difference between the final model and a smaller model in the -2 likelihood logs is represented by the chi-square statistic. By leaving out an effect from the complete model, the scale model is created. According to the null hypothesis, this effect's inputs are all equal to 0.

Weaning duration	**B**	**SE**	**Wald**	**Ddi**	**GSI.**	**Exp (B)**	**%95 confidence interval for Exp(B)**	
							Lower bound	**Top bound**
Constant	1.022	.389	6.907	1	.009			
Diagnosis on admission=Medical case]	.996	.448	4.952	1	.026	2.708	1.126	6.511
[Diagnosis on admission=Surgical case]	0^b	.	.	0	.		.	.

OR = Exp(B) = 2.708 this means that the chance of obtaining a weaning time of less than 5 hours compared to a weaning time greater than 5 hours for a medical case is 2.7 times greater.

The Association Between the Independent Variable [SOFA Score] And the Dependent Variables [APACHE II Score and Anticipated ICU Mortality Rate].

There was actually a statistically significant difference between the SOFA Score, APACHE SCORE, and Predicted Mortality Rate (P=0.000).

Chi-Square Tests Are Used to Analyze the Association Between the Independent Variable [SOFA Score] And the Dependent Variables [APACHE II Score and Anticipated ICU Mortality Rate].

Variables	Value	Df	P value
SOFA Score ; APACHE II score	1150.763a	792	0.000
SOFA Score ; Predicted Mortality rate	90.001a	18	0.000

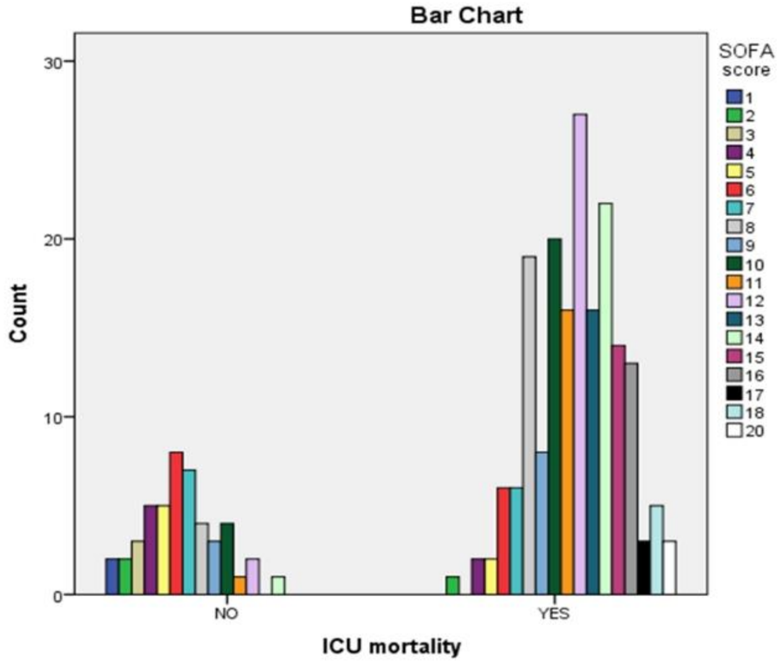


Figure 3: The Relationship Between SOFA Score & ICU Mortality Rate

We can see in the above table that there is a correlation between the SOFA score and the ICU mortality rate because the SOFA score is statistically significant at the 5% level and the p value is.000.

The Association Between Independent Variables [APACHE II, Covid-19] And the Dependent Variables The [ICU Mortality in Intensive Care]

Critical care mortality and APACHE II showed a statistically significant difference (P = 0.000).

The Association Between Independent Variables [APACHE II, Covid-19] And the Dependent Variables The [ICU Mortality in Intensive Care] Using Chi-Square Tests.

Variables	Value	Df	P value
APACHE II : ICU Mortality in intensive care	117.918a	44	0.000
Covid-19 : ICU Mortality in intensive care	2.972a	2	0.226

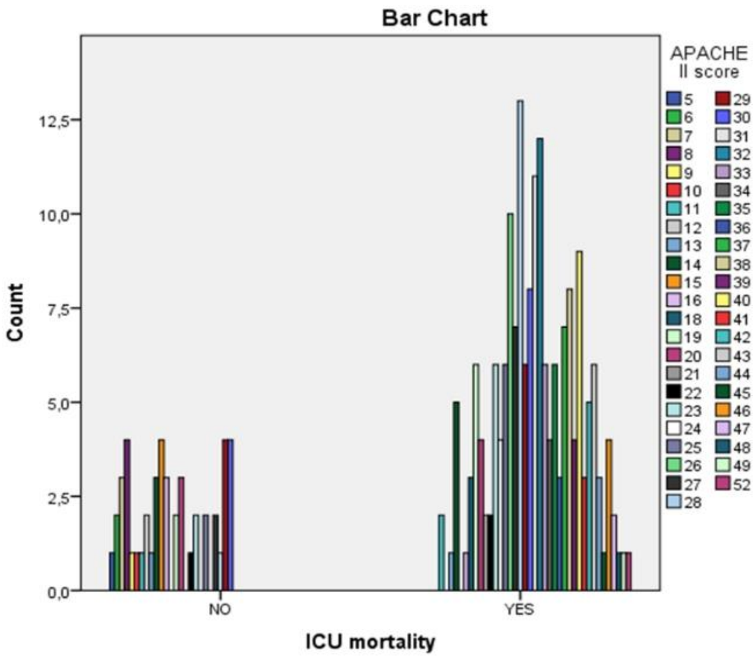


Figure 4: The Correlation Between APACHE II And ICU Mortality

This table shows the correlation between APACHE II and ICU mortality. because the p value is.000, it is statistically significant at the 5% range.

The Relationship Between the Independent Variables [The Use of Antibiotics for Respiratory Infection, Duration of Intubation & Covid-19] And the Dependent Variable [Risk of Adverse Events],

The duration of intubation and the potential of an adverse outcome had a statistically different relationship, P=0.000. The possibility of adverse effects, on the other hand, did not significantly correlate with the use of antibiotics for respiratory failure (p>0.05).

The Relationship Between the Independent Variables [The Use of Antibiotics for Respiratory Infection, Duration of Intubation & Covid-19] and the Dependent Variable [Risk Of Adverse Events], Using Chi-Square Tests.

Variables	Value	Df	P value
The use of Antibiotics for respiratory infection ; Risk of Adverse Events	7.885a	15	0.928
The Duration of Intubation ; Risk of Adverse Events	1241.863a	391	0.000
Covid-19 ; Risk of Adverse Events	20.616a	30	0.00

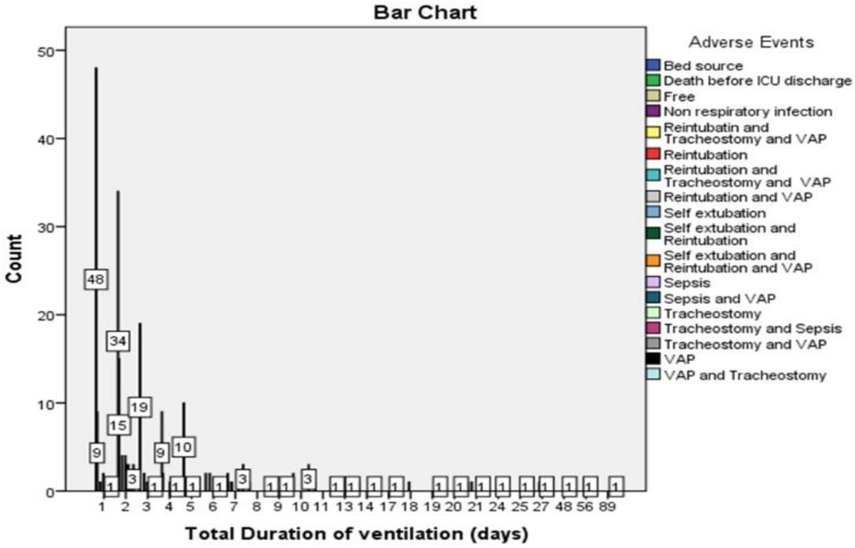


Figure 5: The Relationship Between Duration of Ventilation and Risk of Adverse Events

Since it is statistically significant at the 5% level and the p value is.000, we can observe in this table that there is a correlation between the length of ventilation and the risk of adverse outcomes.

The Relationship Between the Independent Variable [Vaccine (Yes or No)] and The Independent Variables [ICU Mortality Rate and Risk of Adverse Events].

The vaccination did not statistically significantly differ from the risk of adverse events or the ICU mortality rate. P>0.05.

The Relationship Between the Independent Variable [Vaccine (Yes or No)] And the Independent Variables [ICU Mortality Rate and Risk of Adverse Events], Using Chi-Square Test.

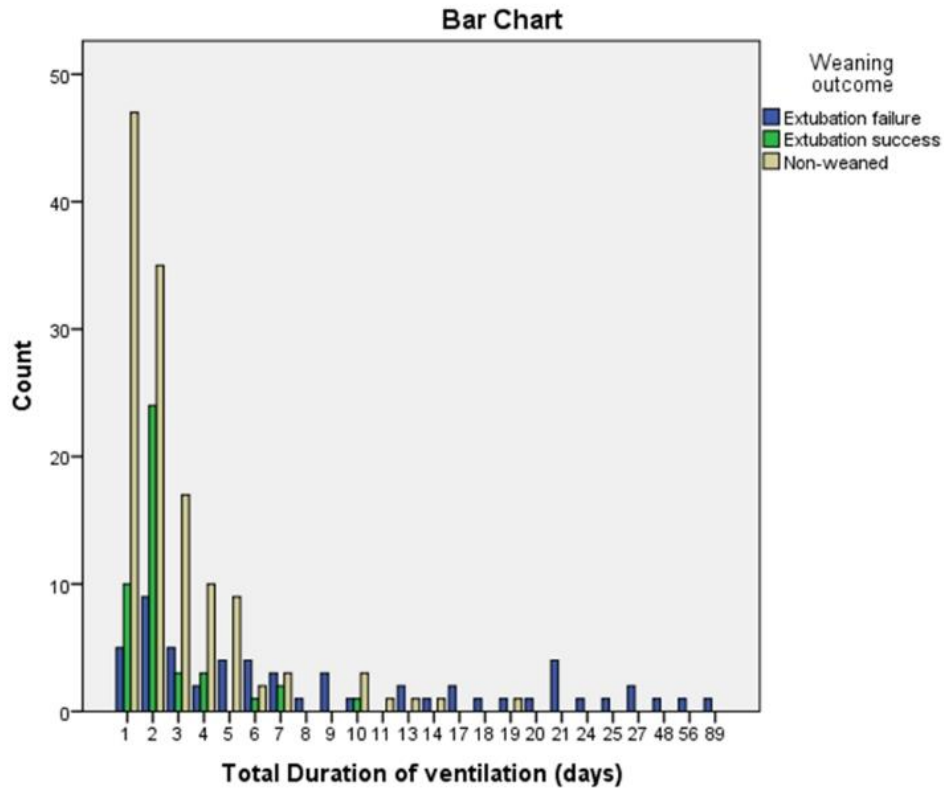
Variables	Value	Df	P value
Vaccine ; ICU Mortality Rate	1.516a	1	0.218
Vaccine ; Risk of Adverse Events	12.353a	15	0.652

The Relationship Between Independent Variable [Duration of Intubation] and the Dependent Variable [Weaning Outcome];

There was a difference of statistical significance (P = 0.000) between the length of intubation and the weaning outcome.

The Relationship Between Independent Variable [Duration of Intubation] and the Dependent Variable [Weaning Outcome]; Using Chi-Square Test.

Variables	Value	Df	P value
Duration of Intubation ; Weaning Outcome	99.881a	46	0.000



.

Figure 6: The Association Between Total Duration Of Intubation & Weaning Outcome

In this table, we see an association between duration of intubation and weaning outcome since it is statistically significant at the 5% threshold because the p value is .000.

The Relationship Between the Independent Variables [Use of Sedation, Use of Vasopressors And GCS] And the Dependent Variables [Duration of Intubation and Weaning Outcome]

Sedation use and the length of intubation and weaning outcome differed statistically significantly ($p < 0.05$). Contrarily, there was no correlation between the duration of intubation and either vasopressor use or GCS score ($p > 0.05$).

The Relationship Between the Independent Variables [Use of Sedation, Use of Vasopressors And GCS] And the Dependent Variables [Duration of Intubation and Weaning Outcome]. Using the Chi-Square Tests.

Variables	Value	Df	P value
Use of Sedation ; Duration of Intubation	41.856a	23	0.009
Use of Sedation ; Weaning Outcome	8.302a	2	0.016
Use of Vasopressors ; Duration of Intubation	31.572a	23	0.109
GCS ; Duration of Intubation	33.351a	46	0.918

The Association of The Independent Variables [Demographic Information Including Age and Sex] And the Dependent Variable [Weaning Outcome].

The demographic variables (age and sex, for example) and weaning outcome did not differ statistically significantly ($p>0.05$).

The Association of The Independent Variables [Demographic Information Including Age and Sex] And the Dependent Variable [Weaning Outcome], Using the Chi-Square Tests.

Variables	Value	Df	P value
Age ; Weaning Outcome	12.157a	6	0.059
Sex ; Weaning Outcome	1.356a	2	0.508

The Relationship Between the Independent Variable [Causes of Intubation] And the Dependent Variable [Duration of Weaning (Hrs)],

Between the reasons for intubation and the length of weaning, there was a difference of statistical significance ($p>0.05$).

The Relationship Between the Independent Variable [Causes of Intubation] And the Dependent Variable [Duration of Weaning (Hrs)], Using Chi-Square Tests.

Variables	Value	Df	P value
Causes of Intubation ; Duration of Weaning (hrs)	112.232a	60	0.000

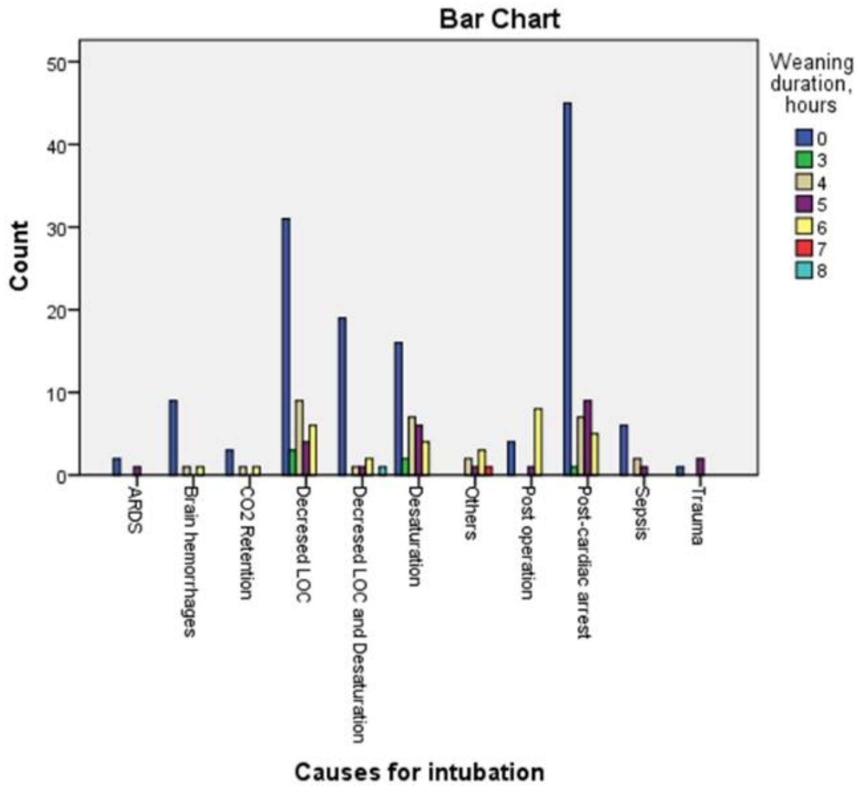


Figure 7: The Relationship Between Causes of Intubation and Duration of Weaning (Hrs)

This table shows a correlation between the reasons for intubation and the amount of time it took to wean the patient (hours), which is statistically significant at the 5% level due to the p value of.000.

The Association Between Duration of Intubation (Days) And the Duration of Weaning (Hrs),

The time between the intubation and weaning procedures a difference of statistical significance way (P=0.000).

The Association Between Duration of Intubation (Days) And the Duration of Weaning (Hrs), Symmetric Measurement Was Used.

Variable	Value	Df	P Value
Duration of Intubation(days) ; Duration of weaning (hrs)	0.302	0,038	0.000c

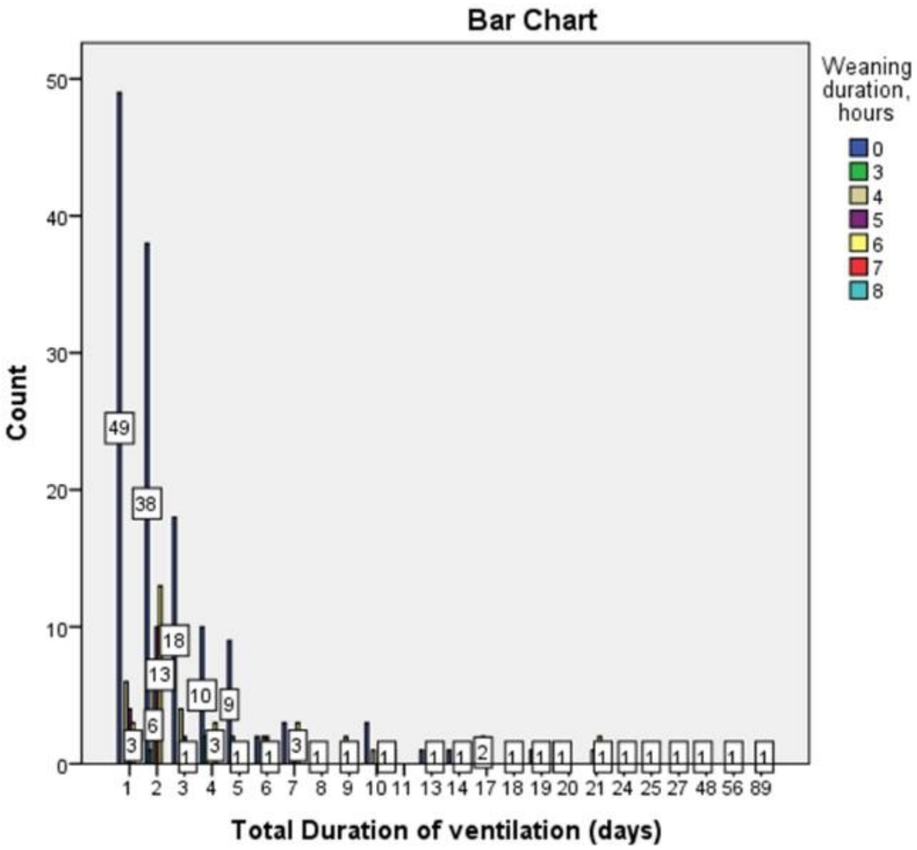


Figure 8: The Relationship Between Duration of Intubation and Duration Of Weaning

In this table, we find the relationship between the duration of intubation and duration of weaning since it is statistically significant at the 5% threshold because the p value is .000[c]

The Relationship Between the Independent Variables [Comorbidity, Total Duration Of ICU] And the Dependent Variable [ICU Mortality Rate],

ICU mortality rate, comorbidity, and overall ICU length did not differ statistically significantly (P>0.05).

The Relationship Between the Independent Variables [Comorbidity, Total Duration Of ICU] And the Dependent Variable [ICU Mortality Rate], Using Chi-Square Tests.

Variable	Value	Df	P Value
Comorbidity ; ICU Mortality Rate	38.745a	36	0.347
Total Duration of ICU ; ICU Mortality Rate	35.531a	29	0.188

Another Analysis

As of P<0.05, there was a difference statistically significant between the possibility of adverse outcomes and the findings of culture. Contrarily, with values of culture P> 0.05, there was no correlation between the ICU mortality rate and overall ICU length.

The Relationship Between the Independent Variables [Risk of Adverse Events, Mortality in Icu And Total Icu Duration] And the Dependent Variable [Results of Culture] Using Chi-Square Tests.

Variables	Value	Df	P value
Risk of Adverse Events ; Results of Culture	53.737a	30	0.005
Mortality in The Intensive Care Unit ; Results of Culture	4.546a	2	0.103
Total ICU Duration ; Results of Culture	52.846a	58	0.667

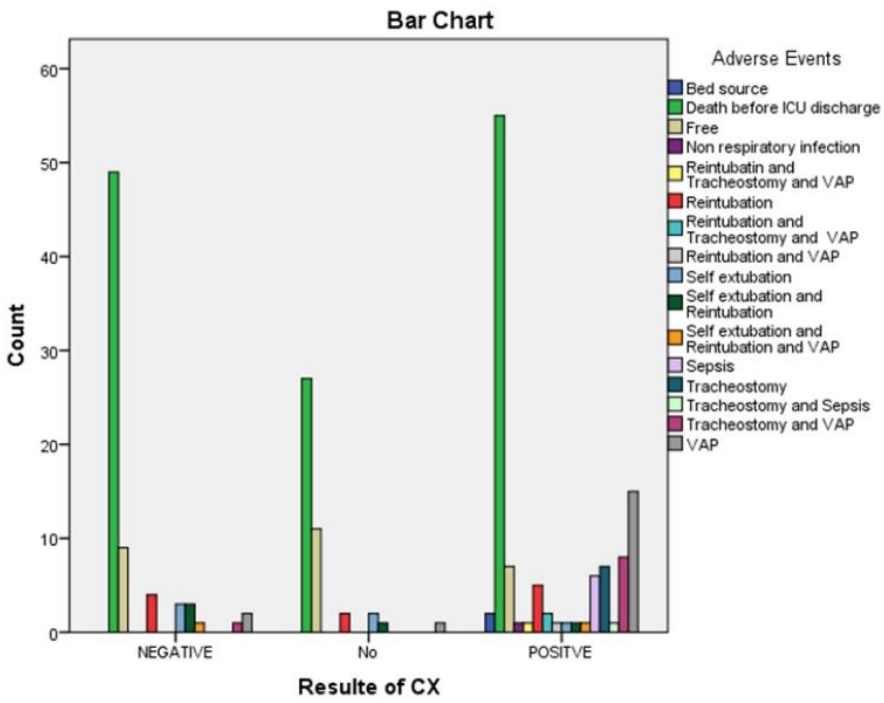


Figure 9: The Relationship Between Culture Results And Adverse Events

In this table, we see an association between culture result and its relationship with adverse events since it is statistically significant at the 5% threshold because the p value is .005. Then the comment we can make of the graph is:

-The magnitude of the adverse effect "Death before ICU discharge" is the largest regardless of the culture result

-There are more adverse effects in positive ones, and a greater amplitude including VAP, Tracheostomy and VAP, Tracheostomy.

Another Analysis

The duration of ventilation differed significantly from the lengths of the intensive care unit and the hospital stay (P=0.000).

Chi-Square Tests Are Used to Analyze the Connection Between the Independent Variable (Total Duration of Ventilation) And the Dependent Variables (Total Duration Of ICU And Total Length Of Hospital Stay).

Variables	Value	Df	P value
Duration of ventilation ; Duration of ICU	3060.984a	667	0.000
Duration of ventilation ; Duration of hospitalization	2180.651a	736	0.000

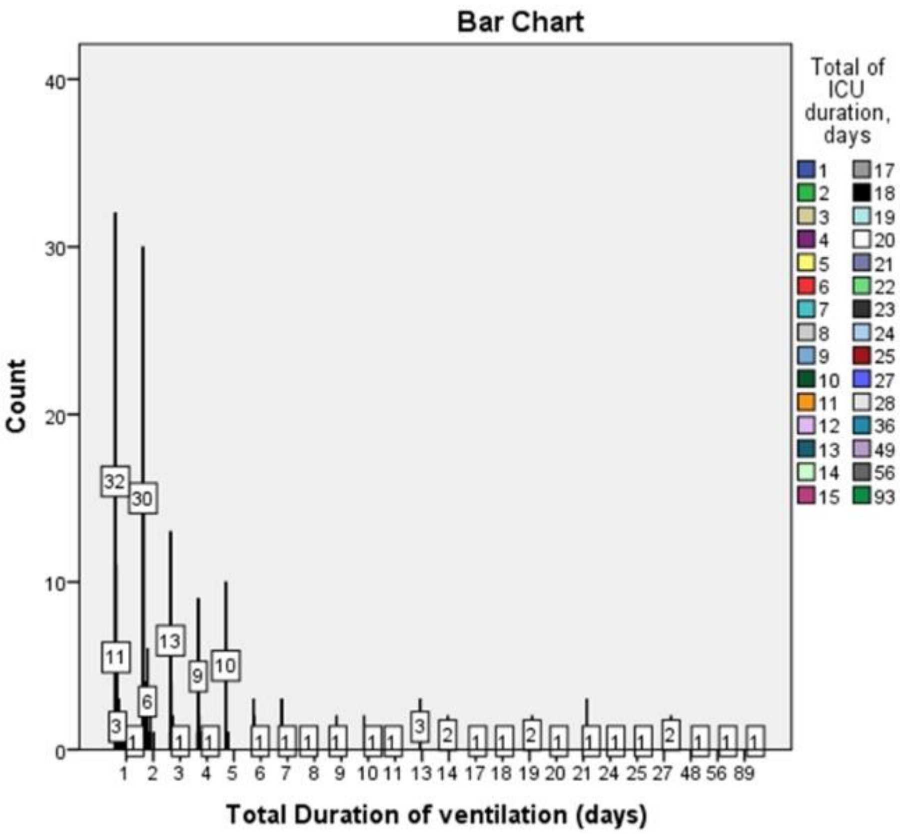


Figure 10: The Correlation Between Ventilation Duration and The Length Of ICU Stays

Since it is statistically significant at the 5% level because the P value is.000, we can find the relationship between the overall duration of ventilation and the total duration of the ICU in this table. According to the graph, it can be seen that the Total of ICU Duration is very significant during the first days of ventilation and reduces as the number of days of ventilation expand.

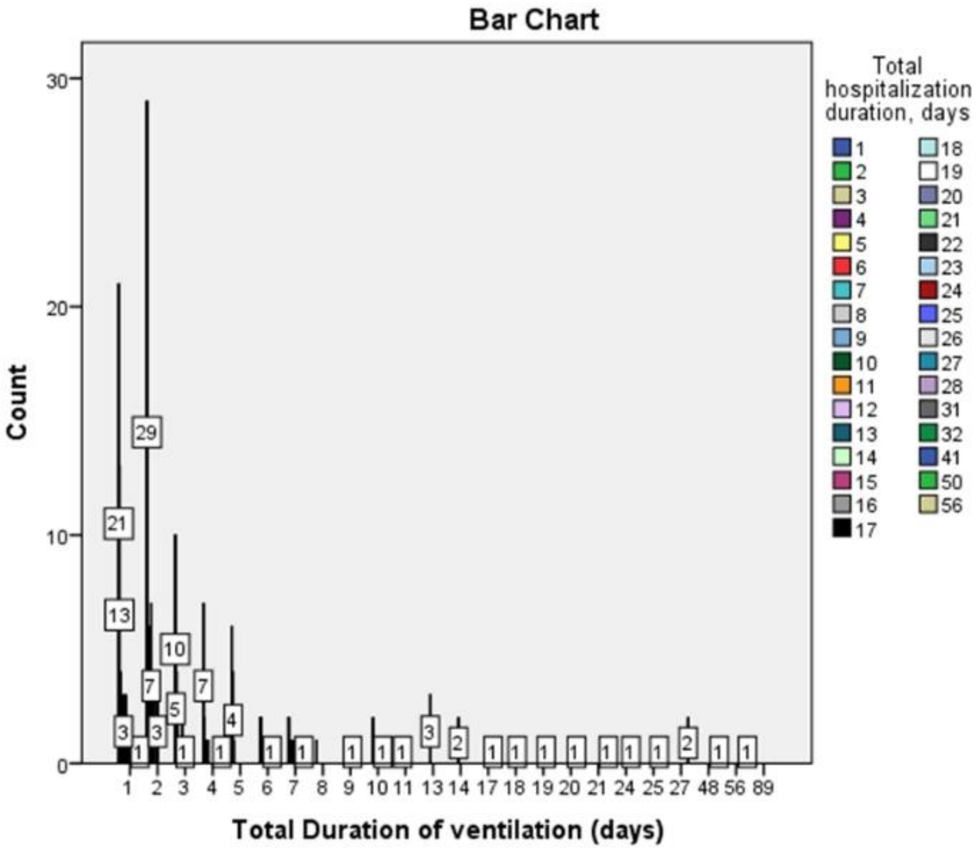


Figure 11: The Correlation Between Hospitalization Duration And Ventilation Period

Since it is statistically significant at the 5% level because the P value is.000, we can find the relationship between the total time of ventilation and the overall period of hospitalization in this table. According to this graph, the total length of hospitalization is significantly correlated with a ventilation duration of less than 4 days and decreases as ventilation duration increases.

Chapter Five

Discussion

5.1Introduction

In order to reduce the risk of problems for adult patients in the ICU of the Hebron government hospital, the length of mechanical ventilation, the duration of weaning, and the period of hospital stays were all factors in this retrospective cohort analysis.

5.2 Summary of The Findings

Patients who required mechanical ventilation made up a significant number of those older than 61. The patients that were a part of this study were, on average, 60.71 years old. Additionally, the adult MV patients' mean BMI fell within the normal range. In our sample, males were predominant accounting for more than %60 with a minority of other sociodemographic characteristics in both genders such as smoking. In regards to the medical history, only a small percentage of patients %10 was reported to have infection with COVID-19. However, over half of the sample was not vaccinated. Additionally, more than %90 of the Mechanically ventilated patients didn’t have a previous history of trauma, GI bleeding and/ or abdominal surgery.

Most of the patients, %85.2 of the sample, who were included in our study had a medical diagnosis on admission over a surgical diagnosis. On the other hand, one third of the cases were reported with tachycardia and tachypnea. The average body temperature of the mechanically ventilated patients included in our sample was almost 37. However, less than a quarter of the study sample %20.4 suffered from fever t>37.5. There Are different causes of intubation such as cardiac causes, decreased LOS and desaturation, ARDS, brain hemorrhages and/or etc. In our retrospective study, According to our findings, the most common reason for intubation was post cardiac arrest, accounting for 29.2% of cases. This was followed by decreased level of consciousness and desaturation.

Whereas, ARDS, Brain hemorrhages, CO2 retention, trauma, sepsis captured the least frequent causes of intubation. The mean PaCo2, Hco3 of the sample were within the normal range. However, Gasometric parameters findings were significantly unbalanced as PH, PaCO2, Hco3 and Pao2 readings were abnormally deviated. Acidosis was found in almost half of the MV patients PH<7.35 and further Hco3 value was < 22 in almost two thirds of the included patients 74% which corresponds with metabolic acidosis. However, PaCo2 value measured less than 35 that suggests respiratory alkalosis was found in more than half of the study sample. This significant change in the PaCo2 value could be explained as a primary respiratory compensation to the acidosis due to the change in PH and metabolic acidosis (Feher, 2012).

Furthermore, Critical respiratory failure represented up to %70 of the cases requiring mechanical ventilation. Glasgow Coma score identified that two thirds of the cases were suffering from severe impairment levels of consciousness with a percentage of 74.8. Meanwhile RASS scale suggested that up to %25 of patients requiring MV were classified as Drowsy.

The ICU mortality rate was almost %80. Hence, Death was documented as the most frequent cause of discharge. Our findings indicated that critically ill adult patients typically required ventilation for average 5 days, while average time for weaning off ventilation 2 hours. In contrast, the average length of stay in hospital exceeded 8 days, while the mean duration of ICU stay was determined to be 7 days.

The study discovered that individuals who were 61 years or older had a longer period of intubation, but there was no correlation between age and the success of weaning off the ventilator.

However, sex and infection with Covid-19 had no association with either duration of intubation and weaning outcome. Medical diagnosis was associated with both weaning outcome and risk of adverse events while there was no association in regards to the duration of intubation. SOFA Score was associated with both predicted mortality rate. APACHE II and Covid-19 were associated with mortality rate in ICU. the Duration of Intubation and Covid-19 were associated with risk of adverse events while use of antibiotics for respiratory infection had no association with risk of adverse events. Vaccine was associated with both ICU mortality rate and risk of adverse events.

The findings of the study indicate that a prolonged period of intubation is linked to a higher likelihood of extubation failure and difficulties in the weaning process. Conversely, the administration of sedation is associated with both the duration of intubation and the outcome of weaning.

Meanwhile, use of vasopressor and GCS had no association with duration of intubation. The presence of intubation, particularly in cases post cardiac arrest, has been found to be correlated with an extended period of weaning.

Duration of intubation was associated with longer duration of weaning. ICU mortality rate had no association with total duration of ICU and comorbidity. Risk of adverse events was associated with cx results. In contrast, there was no association between both ICU mortality rate and ICU duration with cx results. The length of time a patient required intubation was found to be correlated with the duration of stay in both the ICU and the overall hospitalization period.

The findings of our study indicate that individuals who are classified as very old, specifically those aged over 60 years, tend to experience a prolonged period of intubation. A large frequency of this age category had a weaning outcome of non-weaned. However, we found the age and sex were not risk factors for weaning outcomes. Furthermore, patients' gender was found to have no effect on the duration of the intubation. The study results partially agreed with (Huang, 2022) which found no association between both age and sex with weaning outcome However, the authors of this study further highlighted that very old age in females gender >/ 80 had better survival outcomes than males from the same age category in terms of higher mortality rate for 6 month and the malignancy comorbidities. Our results debated the findings of (Hannun et al., 2022) and (Trudzinski et al., 2022) that revealed that higher Age, female gender were the main risk factors for weaning failure.

The findings showed that post cardiac arrest was the most frequent cause of intubation while other causes such as trauma, sepsis, ARDs and brain hemorrhage accounted for the least frequent causes of intubation. Additionally, we found an association between causes of intubation and duration of weaning in hours. (Villalba et al., 2020) investigated the causes of reintubation within 28 days free intubation; The findings of the study revealed that sepsis was identified as the primary factor contributing to the most prevalent cause of ventilation reconnection.

Neurological comorbidities and delayed weaning were independent risk factors to reinstitution within 28 days of weaning. Furthermore, (Trudzinski et al., 2022) The identification of intubation as a prominent causative factor for both increase duration of Mechanical Ventilation and weaning failure has been emphasized.

The sequential organ failure assessment score (SOFA) and APACHE II scores were used in the study to measure the mortality rate among patients receiving mechanical ventilation in the ICU. According to the findings, there is a link between rising SOFA and APACHE scores and greater ICU death rates. In light of this, these ratings were recognized as independent predictors of ICU mortality in patients who were using mechanical ventilation (Kao et al., 2013). Multivariate analysis verified these results. The authors further suggested that in patients with severe acute respiratory failure, the SOFS and Ol scores could function independently as prognostic indications for the effectiveness of weaning.

In a review conducted by (Dehghani et al., 2016), they found that the APACHE score was considered as the most accurate predictor of the ICU mortality and Weaning success. However, the search on the threshold of the prediction on weaning success or failure had yielded debatable scores. In addition, (Lee et al., 2020) suggested that weaning success depends on lower APACHE and high BMI.

We discovered that the average length of ventilation in our cohort was 5 days, but the average length of weaning was 2 hours. Furthermore, our results showed that average length of hospital and ICU stay was around seven days. These findings debated with the findings of (Lellouche et al., 2006) The study revealed that the standard weaning group had an average ventilation duration of 12 days, with an average weaning duration of 5 hours. Furthermore, the authors observed that the average hospital stay was 35 days, while the average ICU stay was 15 days. This substantial variation in durations may be attributed to the progress made in standard healthcare practices over a span of 17 years.

The results of study revealed a significant relationship between the length of intubation and the likelihood of adverse events in mechanically ventilated patients in the ICU. However, we found no evidence to suggest that the administration of antibiotics for respiratory infections had any effect on the risk of developing adverse events. Thus, these results debated the result of a study performed by (Sadegh et al., 2022) The study demonstrated that the administration of two antibiotic regimens, as opposed to three, in the treatment of mechanically ventilated septic patients, resulted in a significant decreased in the duration of intubation and length of stay in the ICU. Additionally, it was found that this approach led to improved outcomes in terms of weaning from mechanical ventilation.

However, (Deniel et al., 2022) found that the introduction of early antibiotics therapy, at the 24 hrs. The presence of pneumonia was found to be a significant factor in the successful weaning of patients without pneumonia, as it was associated with a decreased likelihood of weaning success. Additionally, the duration of intubation was also examined in relation to these patients, the study results were consistent with the findings of (Rivera & Tibballs, 1992) The study revealed a significant correlation between the duration of intubation and mechanical ventilation and the likelihood of experiencing adverse events. These adverse events include accidental extubation, lung atelectasis, air leak, infection, tissue damage, endobronchial intubation, postintubation stridor, bronchopulmonary dysplasia, and endobronchial tube blockage.

The study found that Glasgow Coma score and use of vasopressors had no association with the duration of intubation. According to the study findings, (Pu et al., 2015) suggested that lower GCS score and elevated $PaCO_2$ were independent risk factors for long duration of weaning. Furthermore, (J.-B. Zhang et al., 2020) It is suggested that employing a modified GCS score of 13 as the threshold for transitioning from invasive mechanical ventilation (IMV) to sequential invasive-noninvasive ventilation (NIV) may potentially lead to a decrease in the duration of IMV. Furthermore, this approach may offer additional benefits,(Zarrabian et al., 2022) The study's findings indicate that extubation while on vasopressors does not pose an elevated risk of reintubation, commonly referred to as weaning failure.

However, it is important to note that this practice is linked to increased mortality rates and longer hospital stays. Specifically, extubation while on high-dose vasopressors is associated with a heightened risk of reintubation, whereas extubation while on low-dose vasopressors is connected to lower mortality rates and a shorter duration of stay in the ICU. Conversely, the use of sedation is found to impact the length of intubation and the outcome of weaning.

Hence, (J.-B. Zhang et al., 2020) The study findings demonstrated that patients who were transitioned from midazolam to dexmedetomidine for sedation exhibited quicker recovery, faster extubation, and longer periods of maintaining the desired sedation level compared to patients in the midazolam to propofol and midazolam-only sedation groups. Additionally, these patients experienced a shorter weaning duration and a lower occurrence of delirium. These results suggest that the implementation of sedation has a positive impact on the success of the weaning process, an RCT conducted by (Yousefi et al., 2015) proved that introducing sedative drugs according to the application of RASS led nurse protocol have minimized its consumption, ventilator connection, and LOS in the hospital while preserving weaning outcome.

Our study findings highlighted patients with Covid-19 infection had no association with duration of intubation, ICU mortality in ICU and risk of adverse events. Furthermore, Covid-19 vaccine had no association with ICU mortality and risk of adverse events. Hence, (Guzatti et al., 2022) reported that patients positive covid-19 are at three times risk of weaning failure compared to non- patients Covid-19. On other side, (Musheyev et al., 2021) stated that mechanically ventilated patients with Covid-19 who experience a decline in functional status upon hospital discharge are found to have longer durations of invasive mechanical ventilation (IMV), advanced age, male gender, and a higher burden of comorbidities. Additionally, (Rahimzadeh et al., 2020) suggested that the mortality rate among individuals who are severely ill with COVID-19 is significantly elevated, particularly among those experiencing dyspnea and necessitating mechanical ventilation, as they face an increased likelihood of mortality.

This study revealed that ICU mortality rate was not associated with both comorbidities and duration of ICU stay. Our results debated with the literature findings(X.-C. Zhang et al., 2012).

The study revealed that the presence of multiple types of shock occurring simultaneously, known as comorbidity, was identified as the primary determinant for an extended duration of stay in the ICU among the subjects under investigation. Meanwhile, (Trudzinski et al., 2022) The findings of the study indicated that the presence of comorbidities is a significant risk factor for extended periods of mechanical ventilation and consequently longer stays in the ICU. On the other hand, our results varied from (Abelha et al., 2006) findings that The study revealed that patients with more severe illness upon admission to the ICU are more likely to experience a longer duration of stay in the ICU. Furthermore, this prolonged ICU stay is found to be correlated with a higher rate of mortality within the hospital setting. Furthermore, (Trivedi et al., 2019) The findings of this study have consistently demonstrated that patients who experience prolonged stays in the ICU exceeding 48 hours are at a significantly higher risk of mortality both during their hospitalization and in the long term.

In the present investigation, it was observed that the length of time a patient required ventilation and intubation was correlated with the duration of weaning (measured in hours), as well as the length of stay in the intensive care unit and the overall duration of hospitalization. Hence, (Peres et al., 2020) The study found that a significant risk factor for a prolonged stay in the critical care unit was the amount of time a patient required mechanical ventilation. Additionally, the results of a thorough review and meta-analysis that (Blackwood et al., 2011) conducted to support this conclusion revealed that the use of standardized ventilation weaning protocols has been found to significantly reduce the time required for ventilation, weaning, and hospital stays. The length of stay in the ICU and hospital, as well as the duration of ventilation, are all related, according to these data.

The goal of this retrospective study was to evaluate the effectiveness of ventilator weaning in adult patients admitted to the intensive care unit (ICU) of the Hebron government hospital in Hebron city. The purpose of the study was to quantify the time spent receiving invasive mechanical ventilation, the time spent weaning, and the total length of stay in the ICU and hospital. Additionally, the study aimed to minimize the occurrence of complications associated with the weaning process. However, it has a few limitations. Male gender was predominant on the females in a percentage of %60. Half of the sample included very old patients >60 years old. In addition, up to %50 of the mechanically ventilated patients was not tested for Covid-19 which resulted in only a small percentage of positive Covid-19 cases being included in the analysis.

5.3 Limitations and Strengths

The research project consists of a single retrospective study., which limits its ability to establish causation compared to a randomized controlled trial. Furthermore, an important limitation is that the results of the study regarding COVID-19 questions may differ due to only 10% of the population being tested, while 40% of the sample was not tested. SOFA and APACHE scores not use in ICU. This discrepancy raises concerns about the generalizability of the findings to the broader population, particularly in the context of COVID-19. Nevertheless, The study's sample size of 230 severely sick patients receiving mechanical ventilation was appropriate for the hospital's population and consistent with other research. A statistician specialists assessed the data gathering instrument, reducing bias and boosting the dependability of the results. In general, the study's strengths include adequate sample size, but its limitations include a retrospective design, a lack of COVID-19 information, and the fact that it is a single observational study.

Overall, the study advances our understanding of how well weaning process strategies reduce hospital and ICU stays, shorten the need for invasive mechanical ventilation, and increase patient safety. The study's findings provide a thorough understanding of the actions and reactions of medical experts during the weaning process as well as the factors influencing their decisions. This study will assist in the creation of best practices for the management of invasive mechanical ventilation and weaning by highlighting the critical variables that result in success. Institutions and healthcare professionals will be informed of the findings so they may make decisions about invasive mechanical ventilation and weaning.

5.4 Conclusion

According to the study, longer intubation times were linked to older ages. Medical diagnosis, meanwhile, was linked to both the success of weaning and the possibility of unfavorable outcomes. Intubations were most frequently performed after cardiac arrest. Additionally, ICU mortality was independently predicted by SOFA and APACHE scores. The study also showed that the duration of intubation was substantially correlated with risk of adverse events, although the use of antibiotics for respiratory infections was found to be unrelated to risk of bad events. Additionally, whereas the use of vasopressors showed no relationship with the length of intubation, use of sedation was associated with the duration of intubation and the success of weaning. There was no correlation between Covid-19 infection and vaccination risk and ICU mortality or adverse event risk. Contrary to what was found in the literature, ICU mortality was not correlated with both comorbidities and length of stay.

5.5 Recommendation

1- We recommend that medical diagnosis be considered when evaluating weaning outcome and risk of adverse events.

2- Patients who have suffered a cardiac arrest require special care, and early intervention may help prevent the need for intubation.

3- SOFA and APACHE scores can be used to predict ICU mortality independently.

4- To lower the likelihood of adverse events, intubation should be performed for the shortest period of time possible.

5- Sedation should be used with caution because it is linked to intubation duration and weaning outcome.

6- Unless clinically indicated, antibiotics should not be used routinely for respiratory infections.

7- The use of vasopressors does not appear to be related to intubation duration.

8- Due to the lack of a correlation between Covid-19 MV patients and risk of unfavorable events, our data suggested that patients with Covid-19 should get routine therapy.

9- To sum up, it is critical to create and put into practice adjusted weaning procedures that are suited to the needs and conditions of each patient.

10- Clear criteria for assessment, monitoring, and decision-making during the weaning process should be included in these procedures. Close monitoring by the medical staff, which includes routine assessment of the patient's response to weaning attempts, can assist in identifying possible problems and enable prompt treatments (use modern weaning protocol).

11- Regular and thorough evaluation of the mechanical ventilator device is essential to ensure optimal functioning and patient safety.

12- Healthcare providers should prioritize daily assessments of ventilator settings, alarms, and equipment integrity to detect any malfunctions or deviations from the intended parameters.

13-Timely identification and resolution of issues related to the mechanical ventilator can minimize the risk of complications and ensure effective weaning outcomes.

14- I recommend my fellow researchers in the medical and nursing fields, especially in Palestine, to conduct more research related to the main topic of the study because of its great importance and great benefit to these patients and health institutions. In order to advance the Palestinian health situation.

References

Abelha, F. J., Castro, M. A., Landeiro, N. M., Neves, A. M., & Santos, C. C. (2006). Mortalidade e o tempo de internação em uma unidade de terapia intensiva cirúrgica. Revista Brasileira de Anestesiologia, 56(1), 34–45. https://doi.org/10.1590/S0034-70942006000100005

Abu Dalal, H. J., Ramoo, V., Chong, M. C., Danaee, M., & Aljeesh, Y. I. (2022). The impact of organisational communication satisfaction on health care professionals' work engagement. Journal of Nursing Management, 30(1), 214–225. https://doi.org/10.1111/jonm.13476

Acevedo-Nuevo, M., González-Gil, M. T., & Martin-Arribas, M. C. (2021). Physical Restraint Use in Intensive Care Units: Exploring the Decision-Making Process and New Proposals. A Multimethod Study. International Journal of Environmental Research and Public Health, 18(22), 11826. https://doi.org/10.3390/ijerph182211826

Akavipat, P. (2019). Acute Physiology and Chronic Health Evaluation (APACHE) II Score – the Clinical Predictor in Neurosurgical Intensive Care Unit. Acta Clinica Croatica. https://doi.org/10.20471/acc.2019.58.01.07

Alía, I., & Esteban, A. (2000). Weaning from mechanical ventilation. Critical Care (London, England), 4(2), 72–80. https://doi.org/10.1186/cc660

Arts, D. G. T., De Keizer, N. F., Vroom, M. B., & De Jonge, E. (2005). Reliability and accuracy of Sequential Organ Failure Assessment (SOFA) scoring: Critical Care Medicine, 33(9), 1988–1993. https://doi.org/10.1097/01.CCM.0000178178.02574.AB

Bastos, G. A. N., Azambuja, A. Z. de, Polanczyk, C. A., Gräf, D. D., Zorzo, I. W., Maccari, J. G., Haygert, L. S., Nasi, L. A., Gazzana, M. B., Bessel, M., Pitrez, P.

M., Oliveira, R. P. de, & Scotta, M. C. (2020). Clinical characteristics and predictors of mechanical ventilation in patients with COVID-19 hospitalized in Southern Brazil. Revista Brasileira De Terapia Intensiva, 32(4), 487–492. https://doi.org/10.5935/0103-507X.20200082

Blackwood, B., Alderdice, F., Burns, K., Cardwell, C., Lavery, G., & O'Halloran, P. (2011). Use of weaning protocols for reducing duration of mechanical ventilation in critically ill adult patients: Cochrane systematic review and meta-analysis. BMJ, 342(jan13 2), c7237–c7237. https://doi.org/10.1136/bmj.c7237

Blackwood, B., Tume, L. N., Morris, K. P., Clarke, M., McDowell, C., Hemming, K., Peters, M. J., McIlmurray, L., Jordan, J., Agus, A., Murray, M., Parslow, R., Walsh, T. S., Macrae, D., Easter, C., Feltbower, R. G., McAuley, D. F., & SANDWICH Collaborators. (2021). Effect of a Sedation and Ventilator Liberation Protocol vs Usual Care on Duration of Invasive Mechanical Ventilation in Pediatric Intensive Care Units: A Randomized Clinical Trial. JAMA, 326(5), 401–410. https://doi.org/10.1001/jama.2021.10296

Block, L., Petzold, M., Syrous, A. N., Lindqvist, B., Odenstedt Hergès, H., & Naredi, S. (2019). Age, SAPS 3 and female sex are associated with decisions to withdraw or withhold intensive care. Acta Anaesthesiologica Scandinavica, 63(9), 1210–1215. https://doi.org/10.1111/aas.13411

Boles, J.-M., Bion, J., Connors, A., Herridge, M., Marsh, B., Melot, C., Pearl, R., Silverman, H., Stanchina, M., Vieillard-Baron, A., & Welte, T. (2007). Weaning from mechanical ventilation. The European Respiratory Journal, 29(5), 1033–1056. https://doi.org/10.1183/09031936.00010206

Borges, L. G. A., Savi, A., Teixeira, C., de Oliveira, R. P., De Camillis, M. L. F., Wickert, R., Brodt, S. F. M., Tonietto, T. F., Cremonese, R., da Silva, L. S., Gehm, F., Oliveira, E. S., Barth, J. H. D., Macari, J. G., de Barros, C. D., & Vieira, S. R. R. (2017). Mechanical ventilation weaning protocol improves medical adherence and results. Journal of Critical Care, 41, 296–302. https://doi.org/10.1016/j.jcrc.2017.07.014

Borghans, I., Heijink, R., Kool, T., Lagoe, R. J., & Westert, G. P. (2008). Benchmarking and reducing length of stay in Dutch hospitals. BMC Health Services Research, 8(1), 220. https://doi.org/10.1186/1472-6963-8-220

Burns, K. E. A., Raptis, S., Nisenbaum, R., Rizvi, L., Jones, A., Bakshi, J., Tan, W., Meret, A., Cook, D. J., Lellouche, F., Epstein, S. K., Gattas, D., Kapadia, F. N., Villar, J., Brochard, L., Lessard, M. R., & Meade, M. O. (2018). International Practice Variation in Weaning Critically Ill Adults from Invasive Mechanical Ventilation. Annals of the American Thoracic Society, 15(4), 494–502. https://doi.org/10.1513/AnnalsATS.201705-410OC

Burns, K. E. A., Rizvi, L., Cook, D. J., Lebovic, G., Dodek, P., Villar, J., Slutsky, A. S., Jones, A., Kapadia, F. N., Gattas, D. J., Epstein, S. K., Pelosi, P., Kefala, K., Meade, M. O., & Canadian Critical Care Trials Group. (2021). Ventilator Weaning and Discontinuation Practices for Critically Ill Patients. JAMA, 325(12), 1173–1184. https://doi.org/10.1001/jama.2021.2384

Chamberlain, D., Pollock, W., & Fulbrook, P. (2018). ACCCN Workforce Standards for Intensive Care Nursing: Systematic and evidence review, development, and appraisal. Australian Critical Care, 31(5), 292–302. https://doi.org/10.1016/j.aucc.2017.08.007

Chatburn, R. L., El-Khatib, M., & Mireles-Cabodevila, E. (2014). A Taxonomy for Mechanical Ventilation: 10 Fundamental Maxims. Respiratory Care, 59(11), 1747–1763. https://doi.org/10.4187/respcare.03057

Choi, J., Carlos, G., Nassar, A. K., Knowlton, L. M., & Spain, D. A. (2021). The impact of trauma systems on patient outcomes. Current Problems in Surgery, 58(1), 100849. https://doi.org/10.1016/j.cpsurg.2020.100849

Christou, A., Ntagios, M., Hart, A., & Dahiya, R. (2020). GlasVent—The Rapidly Deployable Emergency Ventilator. Global Challenges, 4(12), 2000046. https://doi.org/10.1002/gch2.202000046

Cirit Ekiz, B., Köksal, N., Tuna, T., & Güllü, Y. T. (2022). Comparison of full-face and oronasal mask effectiveness in hypercapnic respiratory failure patients with non-invasive mechanical ventilation. Tuberkuloz Ve Toraks, 70(2), 157–165. https://doi.org/10.5578/tt.20229806

Daugherty Biddison, E. L., Faden, R., Gwon, H. S., Mareiniss, D. P., Regenberg, A. C., Schoch-Spana, M., Schwartz, J., & Toner, E. S. (2019). Too Many Patients…A Framework to Guide Statewide Allocation of Scarce Mechanical Ventilation During Disasters. Chest, 155(4), 848–854. https://doi.org/10.1016/j.chest.2018.09.025

Dehghani, A., Abdeyazdan, G., & Davaridolatabadi, E. (2016). An Overview of the Predictor Standard Tools for Patient Weaning from Mechanical Ventilation. Electronic Physician, 8(2), 1955–1963. https://doi.org/10.19082/1955

Deniel, G., Cour, M., Argaud, L., Richard, J. C., & Bitker, L. (2022). Early antibiotic therapy is associated with a lower probability of successful liberation from mechanical ventilation in patients with severe acute exacerbation of chronic obstructive pulmonary disease. Annals of Intensive Care, 12(1), 86. https://doi.org/10.1186/s13613-022-01060-2

Donovan, A. L., Aldrich, J. M., Gross, A. K., Barchas, D. M., Thornton, K. C., Schell-Chaple, H. M., Gropper, M. A., & Lipshutz, A. K. M. (2018). Interprofessional Care and Teamwork in the ICU. Critical Care Medicine, 46(6), 980–990. https://doi.org/10.1097/CCM.0000000000003067

Elew, A. N. E. O., Abd Alrahman, A. A. H., El Khayat, H. M. H., & Badawy, F. A. (2022). Weaning from Mechanical Ventilation: Review Article. The Egyptian Journal of Hospital Medicine, 87(1), 1000–1005. https://doi.org/10.21608/ejhm.2022.220731

El-Khatib, M. F., & Bou-Khalil, P. (2008). Clinical review: Liberation from mechanical ventilation. Critical Care, 12(4), 221. https://doi.org/10.1186/cc6959

Emmi, V. (2005). [Guidelines for treatment of pneumonia in intensive care units]. Le Infezioni in Medicina, Suppl, 7–17.

Ervin, J. N., Kahn, J. M., Cohen, T. R., & Weingart, L. R. (2018). Teamwork in the intensive care unit. American Psychologist, 73(4), 468–477. https://doi.org/10.1037/amp0000247

Feher, J. (2012). , In Quantitative Human Physiology.

Fondazione Salvatore Maugeri, IRCCS, Respiratory Intensive Care Unit and Pulmonary Rehabilitation Unit, Pavia, Italy, Schreiber, A., Yildirim, F., Ankara Diskapi Yildirim Beyazit Research and Education Hospital, Intensive Care Unit, Ankara, Turkey, Ferrari, G., Ospedale Mauriziano, Department of Respiratory Medicine, Turin Italy, Antonelli, A., Allergologia e Fisiopatologia Respiratoria, ASO S. Croce e Carle Cuneo, Cuneo, Italy, Delis, P. B., Hospital Morales Meseguer, Intensive Care Unit, Murcia, Spain, Gunduz, M., Department of Anaesthesiology and Reanimation, Intensive Care Unit, Cukurova University School of Medicine, Adana, Turkey, Karcz, M., University of Rochester, Department of Anesthesiology, Critical Care Medicine, Rochester, New York, USA, Papadakos, P., University of Rochester, Department of Anesthesiology, Surgery and Neurosurgery, Critical Care Medicine, Rochester, New York, USA, Cosentini, R., Emergency Medicine Department, Gruppo NIV, Fondazione IRCCS Ca' Granda Ospedale Maggiore Policlinico, Milan, Italy, Dikmen, Y., … Hospital Morales Meseguer, Intensive Care Unit, Murcia, Spain. (2018). Non-Invasive Mechanical Ventilation in Critically Ill Trauma Patients: A Systematic Review. Turkish Journal of Anesthesia and Reanimation, 88–95. https://doi.org/10.5152/TJAR.2018.46762

Fujii, M., Iwakami, S., Takagi, H., Itoigawa, Y., Ichikawa, M., Iwakami, N., Ishiwata, T., Seyama, K., & Takahashi, K. (2012). Factors influencing weaning from mechanical ventilation in elderly patients with severe pneumonia. Geriatrics & Gerontology International, 12(2), 277–283. https://doi.org/10.1111/j.1447-0594.2011.00765.x

Ghanbari, A., Mohammad Ebrahimzadeh, A., Paryad, E., Atrkar Roshan, Z., Kazem Mohammadi, M., & Mokhtari Lakeh, N. (2020). Comparison between a nurse-led weaning protocol and a weaning protocol based on physician's clinical judgment in ICU patients. Heart & Lung, 49(3), 296–300. https://doi.org/10.1016/j.hrtlng.2020.01.003

Guler, H., & Kilic, U. (2018). The development of a novel knowledge-based weaning algorithm using pulmonary parameters: A simulation study. Medical &

Biological Engineering & Computing, 56(3), 373–384. https://doi.org/10.1007/s11517-017-1698-7

Gupta, S., Ramasubban, S., Dixit, S., Mishra, R., Zirpe, K. G., Khilnani, G. C., Khatib, K. I., Dobariya, J., Marwah, V., Jog, D. S. A., Kulkarni, A. P., & Sehgal, I. (2020). ISCCM Guidelines for the Use of Non-invasive Ventilation in Acute Respiratory Failure in Adult ICUs. Indian Journal of Critical Care Medicine, 24(S1), S61–S81. https://doi.org/10.5005/jp-journals-10071-G23186

Guzatti, N. G., Klein, F., Oliveira, J. A., Rático, G. B., Cordeiro, M. F., Marmitt, L. P., Carvalho, D. de, Nunes Filho, J. R., & Baptistella, A. R. (2022). Predictive Factors of Extubation Failure in COVID-19 Mechanically Ventilated Patients. Journal of Intensive Care Medicine, 37(9), 1250–1255. https://doi.org/10.1177/08850666221093946

Haaksma, M. E., Smit, J. M., Heldeweg, M. L. A., Nooitgedacht, J. S., De Grooth, H. J., Jonkman, A. H., Girbes, A. R. J., Heunks, L., & Tuinman, P. R. (2022). Extended Lung Ultrasound to Differentiate Between Pneumonia and Atelectasis in Critically Ill Patients: A Diagnostic Accuracy Study. Critical Care Medicine, 50(5), 750–759. https://doi.org/10.1097/CCM.0000000000005303

Hannun, M., Villalba, D., Díaz Ballve, L., Matesa, A., Pedace, P., Tocalini, P., Pérez Calvo, E., Scrigna, M., Collins, J., Areas, L., Gil Rossetti, G., & Planells, F. (2022). [Predictors of weaning and mortality in prolonged mechanical ventilation – surviving survival]. Revista De La Facultad De Ciencias Medicas (Cordoba, Argentina), 79(2), 162–167. https://doi.org/10.31053/1853.0605.v79.n2.33184

Hickey, S. M., & Giwa, A. O. (2023). Mechanical Ventilation. In StatPearls. StatPearls Publishing. http://www.ncbi.nlm.nih.gov/books/NBK539742/

Hirzallah, F. M., Alkaissi, A., & Do Céu Barbieri-Figueiredo, M. (2019). A systematic review of nurse-led weaning protocol for mechanically ventilated adult patients. Nursing in Critical Care, 24(2), 89–96. https://doi.org/10.1111/nicc.12404

Huang, C. (2022a). Gender Differences in Prolonged Mechanical Ventilation Patients—A Retrospective Observational Study. International Journal of General Medicine, 15, 5615–5626. https://doi.org/10.2147/IJGM.S368881

Huang, C. (2022b). Gender Differences in Prolonged Mechanical Ventilation Patients—A Retrospective Observational Study. International Journal of General Medicine, 15, 5615–5626. https://doi.org/10.2147/IJGM.S368881

Jain, S., & Iverson, L. M. (2023). Glasgow Coma Scale. In StatPearls. StatPearls Publishing. http://www.ncbi.nlm.nih.gov/books/NBK513298/

Jones, A. E., Trzeciak, S., & Kline, J. A. (2009). The Sequential Organ Failure Assessment score for predicting outcome in patients with severe sepsis and evidence of hypoperfusion at the time of emergency department presentation. Critical Care Medicine, 37(5), 1649–1654. https://doi.org/10.1097/CCM.0b013e31819def97

Kallet, R. H., Zhuo, H., Yip, V., Gomez, A., & Lipnick, M. S. (2018). Spontaneous Breathing Trials and Conservative Sedation Practices Reduce Mechanical Ventilation Duration in Subjects With ARDS. Respiratory Care, 63(1), 1–10. https://doi.org/10.4187/respcare.05270

Kao, H.-C., Lai, T.-Y., Hung, H.-L., Chen, Y.-M., Chou, P.-A., Wang, C.-C., Lin, M.-C., & Fang, W.-F. (2013). Sequential oxygenation index and organ dysfunction assessment within the first 3 days of mechanical ventilation predict the outcome of adult patients with severe acute respiratory failure. TheScientificWorldJournal, 2013, 413216. https://doi.org/10.1155/2013/413216

Kishore, R., & Jhamb, U. (2021). Effect of Protocolized Weaning and Spontaneous Breathing Trial vs Conventional Weaning on Duration of Mechanical Ventilation: A Randomized Controlled Trial. Indian Journal of Critical Care Medicine: Peer-Reviewed, Official Publication of Indian Society of Critical Care Medicine, 25(9), 1059–1065. https://doi.org/10.5005/jp-journals-10071-23944

Kwong, M. T., Colopy, G. W., Weber, A. M., Ercole, A., & Bergmann, J. H. M. (2019). The efficacy and effectiveness of machine learning for weaning in mechanically ventilated patients at the intensive care unit: A systematic review. Bio-Design and Manufacturing, 2(1), 31–40. https://doi.org/10.1007/s42242-018-0030-1

Lee, J. M., Lee, S.-M., Song, J. H., & Kim, Y. S. (2020). Clinical outcomes of difficult-to-wean patients with ventilator dependency at intensive care unit discharge. Acute and Critical Care, 35(3), 156–163. https://doi.org/10.4266/acc.2020.00199

Lellouche, F., Mancebo, J., Jolliet, P., Roeseler, J., Schortgen, F., Dojat, M., Cabello, B., Bouadma, L., Rodriguez, P., Maggiore, S., Reynaert, M., Mersmann, S., & Brochard, L. (2006). A multicenter randomized trial of computer-driven protocolized weaning from mechanical ventilation. American Journal of Respiratory and Critical Care Medicine, 174(8), 894–900. https://doi.org/10.1164/rccm.200511-1780OC

Ma, C., Park, S. H., & Shang, J. (2018). Inter- and intra-disciplinary collaboration and patient safety outcomes in U.S. acute care hospital units: A cross-sectional study. International Journal of Nursing Studies, 85, 1–6. https://doi.org/10.1016/j.ijnurstu.2018.05.001

Mandelzweig, K., Leligdowicz, A., Murthy, S., Lalitha, R., Fowler, R. A., & Adhikari, N. K. J. (2018). Non-invasive ventilation in children and adults in low- and low-middle income countries: A systematic review and meta-analysis. Journal of Critical Care, 47, 310–319. https://doi.org/10.1016/j.jcrc.2018.01.007

Mart, M. F., Pun, B. T., Pandharipande, P., Jackson, J. C., & Ely, E. W. (2021). ICU Survivorship—The Relationship of Delirium, Sedation, Dementia, and Acquired Weakness. Critical Care Medicine, 49(8), 1227–1240. https://doi.org/10.1097/CCM.0000000000005125

McConville, J. F., & Kress, J. P. (2012). Weaning Patients from the Ventilator. New England Journal of Medicine, 367(23), 2233–2239. https://doi.org/10.1056/NEJMra1203367

Merchán-Tahvanainen, M. E., Romero-Belmonte, C., Cundín-Laguna, M., Basterra-Brun, P., San Miguel-Aguirre, A., & Regaira-Martínez, E. (2017). Patients' experience during weaning of invasive mechanical ventilation: A review of the literature. Enfermería Intensiva (English Ed.), 28(2), 64–79. https://doi.org/10.1016/j.enfie.2016.11.001

Morton, P. G., & Fontaine, D. K. (2018). Critical care nursing: A hostolic approach ((11th ed.)).

Musheyev, B., Borg, L., Janowicz, R., Matarlo, M., Boyle, H., Singh, G., Ende, V., Babatsikos, I., Hou, W., & Duong, T. Q. (2021). Functional status of mechanically ventilated COVID-19 survivors at ICU and hospital discharge. Journal of Intensive Care, 9(1), 31. https://doi.org/10.1186/s40560-021-00542-y

Na, S. J., Ko, R.-E., Nam, J., Ko, M. G., & Jeon, K. (2022). Factors associated with prolonged weaning from mechanical ventilation in medical patients. Therapeutic Advances in Respiratory Disease, 16, 17534666221117004. https://doi.org/10.1177/17534666221117005

Nitta, K., Okamoto, K., Imamura, H., Mochizuki, K., Takayama, H., Kamijo, H., Okada, M., Takeshige, K., Kashima, Y., & Satou, T. (2019). A comprehensive protocol for ventilator weaning and extubation: A prospective observational study. Journal of Intensive Care, 7(1), 50. https://doi.org/10.1186/s40560-019-0402-4

Oliveira, S. M. R., Novais, R. M. F., & Carvalho, A. A. D. S. (2019). IMPACT OF A VENTILATORY WEANING PROTOCOL IN AN INTENSIVE CARE UNIT FOR ADULTS. Texto & Contexto - Enfermagem, 28, e20180287. https://doi.org/10.1590/1980-265x-tce-2018-0287

Otaguro, T., Tanaka, H., Igarashi, Y., Tagami, T., Masuno, T., Yokobori, S., Matsumoto, H., Ohwada, H., & Yokota, H. (2021). Machine Learning for Prediction of Successful Extubation of Mechanical Ventilated Patients in an Intensive Care Unit: A Retrospective Observational Study. Journal of Nippon Medical School, 88(5), 408–417. https://doi.org/10.1272/jnms.JNMS.2021_88-508

Pathak, S., & Shrestha, N. (2020). Comparison of Pressure Support Ventilation and T-Tube as Spontaneous Breathing Trial to Wean From Mechanical Ventilation. https://www.njehns.org.np/index.php/njehns/article/view/230

Payen, V., Jouvet, P., Lacroix, J., Ducruet, T., & Gauvin, F. (2012). Risk factors associated with increased length of mechanical ventilation in children: Pediatric Critical Care Medicine, 13(2), 152–157. https://doi.org/10.1097/PCC.0b013e3182257a24

Peng, M., Liu, X., Li, J., Ren, D., Liu, Y., Meng, X., Lyu, Y., Chen, R., Yu, B., & Zhong, W. (2020). Successful management of seven cases of critical COVID-19 with early noninvasive-invasive sequential ventilation algorithm and bundle pharmacotherapy. Frontiers of Medicine, 14(5), 674–680. https://doi.org/10.1007/s11684-020-0796-3

Peres, I. T., Hamacher, S., Oliveira, F. L. C., Thomé, A. M. T., & Bozza, F. A. (2020). What factors predict length of stay in the intensive care unit? Systematic review and meta-analysis. Journal of Critical Care, 60, 183–194. https://doi.org/10.1016/j.jcrc.2020.08.003

Popat, B., & Jones, A. T. (2012). Invasive and non-invasive mechanical ventilation. Medicine, 40(6), 298–304. https://doi.org/10.1016/j.mpmed.2012.03.010

Pu, L., Zhu, B., Jiang, L., Du, B., Zhu, X., Li, A., Li, G., He, Z., Chen, W., Ma, P., Jia, J., Xu, Y., Zhou, J., Qin, L., Zhan, Q., Li, W., Jiang, Q., Wang, M., Lou, R., & Xi, X. (2015). Weaning critically ill patients from mechanical ventilation: A prospective cohort study. Journal of Critical Care, 30(4), 862.e7-862.e13. https://doi.org/10.1016/j.jcrc.2015.04.001

Rahimzadeh, P., Amniati, S., Farahmandrad, R., Faiz, S. H. R., Hedayati Emami, S., & Habibi, A. (2020). Clinical Characteristics of Critically Ill Patients Infected with COVID-19 in Rasoul Akram Hospital in Iran: A Single Center Study. Anesthesiology and Pain Medicine, 10(5), e107211. https://doi.org/10.5812/aapm.107211

Raza, A., Shoukat, U., Lashari, B., Nadeem, N., Arslan, A., Chan, V., & Patel, R. (2020). IMPLEMENTATION OF RESPIRATORY THERAPIST DRIVEN PROTOCOL TO DECREASE THE WEANING TIME OF INTUBATED PATIENTS IN MEDICAL ICU: A POST-INTERVENTION ANALYSIS. Chest, 158(4), A650. https://doi.org/10.1016/j.chest.2020.08.611

Rivera, R., & Tibballs, J. (1992). Complications of endotracheal intubation and mechanical ventilation in infants and children: Critical Care Medicine, 20(2), 193–199. https://doi.org/10.1097/00003246-199202000-00008

Sadegh, M. J., Rafiei, M., Hazrati, E., Namazi, M., & Afsahi, M. (2022). Weaning of septic patients from the ventilator in the intensive care unit by attention approach to common antibiotic regimens. Journal of Family Medicine and Primary Care, 11(3), 1169–1173. https://doi.org/10.4103/jfmpc.jfmpc_1290_21

Saeed, F., & Lasrado, S. (2023). Extubation. In StatPearls. StatPearls Publishing. http://www.ncbi.nlm.nih.gov/books/NBK539804/

Saiphoklang, N., & Auttajaroon, J. (2018). Incidence and outcome of weaning from mechanical ventilation in medical wards at Thammasat University Hospital. PLOS ONE, 13(10), e0205106. https://doi.org/10.1371/journal.pone.0205106

Salam, A., Smina, M., Gada, P., Tilluckdharry, L., Upadya, A., Amoateng-Adjepong, Y., & Manthous, C. A. (2003). The effect of arterial blood gas values on extubation decisions. Respiratory Care, 48(11), 1033–1037.

Sánchez Sánchez, C. D. M., Molina-Peña, M. E., & Rodriguez-Triviño, C. Y. (2021). Comprehensive assessment of respiratory function, a step towards early weaning from the ventilator. Advances in Respiratory Medicine, 89(3), 299–310. https://doi.org/10.5603/ARM.a2021.0055

Seneff, M. G., Zimmerman, J. E., Knaus, W. A., Wagner, D. P., & Draper, E. A. (1996). Predicting the duration of mechanical ventilation. The importance of disease and patient characteristics. Chest, 110(2), 469–479. https://doi.org/10.1378/chest.110.2.469

Sessler, C. N., Gosnell, M. S., Grap, M. J., Brophy, G. M., O’Neal, P. V., Keane, K. A., Tesoro, E. P., & Elswick, R. K. (2002). The Richmond Agitation-Sedation Scale: Validity and reliability in adult intensive care unit patients. American

Journal of Respiratory and Critical Care Medicine, 166(10), 1338–1344. https://doi.org/10.1164/rccm.2107138

Subirà, C., Hernández, G., Vázquez, A., Rodríguez-García, R., González-Castro, A., García, C., Rubio, O., Ventura, L., López, A., De La Torre, M.-C., Keough, E., Arauzo, V., Hermosa, C., Sánchez, C., Tizón, A., Tenza, E., Laborda, C., Cabañes, S., Lacueva, V., … Fernández, R. (2019). Effect of Pressure Support vs T-Piece Ventilation Strategies During Spontaneous Breathing Trials on Successful Extubation Among Patients Receiving Mechanical Ventilation: A Randomized Clinical Trial. JAMA, 321(22), 2175. https://doi.org/10.1001/jama.2019.7234

Suparman Rustam, J., Kongsuwan, W., & Kitrungrote, L. (2018). Comfort in Patients Receiving Mechanical Ventilation: A Literature. Jccnursing, 11(2), 1–7.

Surani, S., Sharma, M., Middagh, K., Bernal, H., Varon, J., Ratnani, I., Anjum, H., & Khan, A. (2020). Weaning from Mechanical Ventilator in a Long-term Acute Care Hospital: A Retrospective Analysis. The Open Respiratory Medicine Journal, 14, 62–66. https://doi.org/10.2174/1874306402014010062

Teasdale, G., Maas, A., Lecky, F., Manley, G., Stocchetti, N., & Murray, G. (2014). The Glasgow Coma Scale at 40 years: Standing the test of time. The Lancet Neurology, 13(8), 844–854. https://doi.org/10.1016/S1474-4422(14)70120-6

Telias, I., Brochard, L. J., Gattarello, S., Wunsch, H., Junhasavasdikul, D., Bosma, K. J., Camporota, L., Brodie, D., Marini, J. J., Slutsky, A. S., & Gattinoni, L. (2022). The physiological underpinnings of life-saving respiratory support. Intensive Care Medicine, 48(10), 1274–1286. https://doi.org/10.1007/s00134-022-06749-3

Tingsvik, C., Johansson, K., & Mårtensson, J. (2015). Weaning from mechanical ventilation: Factors that influence intensive care nurses' decision-making: Intensive care nurses' decision-making when weaning from mechanical ventilation. Nursing in Critical Care, 20(1), 16–24. https://doi.org/10.1111/nicc.12116

Toptas, M., Sengul Samanci, N., Akkoc, İ., Yucetas, E., Cebeci, E., Sen, O., Can, M. M., & Ozturk, S. (2018). Factors Affecting the Length of Stay in the Intensive Care Unit: Our Clinical Experience. BioMed Research International, 2018, 1–4. https://doi.org/10.1155/2018/9438046

Trivedi, V., Bleeker, H., Kantor, N., Visintini, S., McIsaac, D. I., & McDonald, B. (2019). Survival, Quality of Life, and Functional Status Following Prolonged ICU Stay in Cardiac Surgical Patients: A Systematic Review. Critical Care Medicine, 47(1), e52–e63. https://doi.org/10.1097/CCM.0000000000003504

Trudzinski, F. C., Neetz, B., Bornitz, F., Müller, M., Weis, A., Kronsteiner, D., Herth, F. J. F., Sturm, N., Gassmann, V., Frerk, T., Neurohr, C., Ghiani, A., Joves, B., Schneider, A., Szecsenyi, J., von Schumann, S., & Meis, J. (2022). Risk Factors for Prolonged Mechanical Ventilation and Weaning Failure: A Systematic Review. Respiration; International Review of Thoracic Diseases, 101(10), 959–969. https://doi.org/10.1159/000525604

Vallverdú, I., Calaf, N., Subirana, M., Net, A., Benito, S., & Mancebo, J. (1998). Clinical characteristics, respiratory functional parameters, and outcome of a two-hour T-piece trial in patients weaning from mechanical ventilation. American Journal of Respiratory and Critical Care Medicine, 158(6), 1855–1862. https://doi.org/10.1164/ajrccm.158.6.9712135

Vieira, J. M., Castro, I., Curvello-Neto, A., Demarzo, S., Caruso, P., Pastore, L., Imanishe, M. H., Abdulkader, R. C. R. M., & Deheinzelin, D. (2007). Effect of acute kidney injury on weaning from mechanical ventilation in critically ill patients*: Critical Care Medicine, 35(1), 184–191. https://doi.org/10.1097/01.CCM.0000249828.81705.65

Vignon, P. (2018). Cardiovascular failure and weaning. Annals of Translational Medicine, 6(18), 354. https://doi.org/10.21037/atm.2018.05.46

Villalba, D., Gil Rossetti, G., Scrigna, M., Collins, J., Rocco, A., Matesa, A., Areas, L., Golfarini, N., Pini, P., Hannun, M., Boni, S., Grimaldi, S., Pedace, P., Díaz-Ballve, L., Andreu, M., Buñirigo, P., Noval, D., & Planells, F. (2020). Prevalence of and Risk Factors for Mechanical Ventilation Reinstitution in Patients Weaned From Prolonged Mechanical Ventilation. Respiratory Care, 65(2), 210–216. https://doi.org/10.4187/respcare.06807

Wagner, D. P., & Draper, E. A. (1984). Acute physiology and chronic health evaluation (APACHE II) and Medicare reimbursement. Health Care Financing Review, Suppl(Suppl), 91–105.

Warnke, C., Heine, A., Müller-Heinrich, A., Knaak, C., Friesecke, S., Obst, A., Bollmann, T., Desole, S., Boesche, M., Stubbe, B., & Ewert, R. (2020). Predictors of survival after prolonged weaning from mechanical ventilation. Journal of Critical Care, 60, 212–217. https://doi.org/10.1016/j.jcrc.2020.08.010

Wong, J. W., Chiew, Y. S., Desaive, T., & Chase, J. G. (2021). Model-based Patient Matching for in-parallel Multiplexing Mechanical Ventilation Support. IFAC-PapersOnLine, 54(15), 121–126. https://doi.org/10.1016/j.ifacol.2021.10.242

Yagi, K. (2018). Mechanical Ventilation. In C. L. Norkus (Ed.), Veterinary Technician's Manual for Small Animal Emergency and Critical Care (1st ed., pp. 417–438). Wiley. https://doi.org/10.1002/9781119536598.ch21

Yeung, J., Couper, K., Ryan, E. G., Gates, S., Hart, N., & Perkins, G. D. (2018). Non-invasive ventilation as a strategy for weaning from invasive mechanical ventilation: A systematic review and Bayesian meta-analysis. Intensive Care Medicine, 44(12), 2192–2204. https://doi.org/10.1007/s00134-018-5434-z

Yi, L.-J., Tian, X., Chen, M., Lei, J.-M., Xiao, N., & Jiménez-Herrera, M. F. (2021). Comparative Efficacy and Safety of Four Different Spontaneous Breathing Trials for Weaning From Mechanical Ventilation: A Systematic Review and Network Meta-Analysis. Frontiers in Medicine, 8, 731196. https://doi.org/10.3389/fmed.2021.731196

Yousefi, H., Toghyani, F., Yazdannik, A. R., & Fazel, K. (2015). Effect of using Richmond Agitation Sedation Scale on duration of mechanical ventilation, type and dosage of sedation on hospitalized patients in intensive care units. Iranian Journal of Nursing and Midwifery Research, 20(6), 700–704. https://doi.org/10.4103/1735-9066.170008

Zarrabian, B., Wunsch, H., Stelfox, H. T., Iwashyna, T. J., & Gershengorn, H. B. (2022). Liberation from Invasive Mechanical Ventilation with Continued Receipt of Vasopressor Infusions. American Journal of Respiratory and Critical Care Medicine, 205(9), 1053–1063. https://doi.org/10.1164/rccm.202108-2004OC

Zhang, J.-B., Zhu, J.-Q., Cao, L.-X., Jin, X.-H., Chen, L.-L., Song, Y.-K., Zhou, S.-F., Ma, J.-H., Fu, H., Xu, J.-Z., Dong, M.-P., Yan, L.-C., Wu, X.-D., Wang, H.-P., Zhou, J.-Y., & Wang, Y.-Q. (2020). Use of the modified Glasgow Coma Scale score to guide sequential invasive-noninvasive mechanical ventilation weaning in patients with AECOPD and respiratory failure. Experimental and Therapeutic Medicine, 20(2), 1441–1446. https://doi.org/10.3892/etm.2020.8884

Zhang, X.-C., Zhang, Z.-D., & Huang, D.-S. (2012). Prediction of length of ICU stay using data-mining techniques: An example of old critically Ill postoperative gastric cancer patients. Asian Pacific Journal of Cancer Prevention: APJCP, 13(1), 97–101. https://doi.org/10.7314/apjcp.2012.13.1.097

Zhou, Y., Yang, J., Wang, B., Wang, P., Wang, Z., Yang, Y., Liang, G., Jing, X., Jin, X., Zhang, Z., Deng, Y., Hu, C., Liao, X., Yin, W., Tang, Z., Tian, Y., Tao, L., & Kang, Y. (2022). Sequential use of midazolam and dexmedetomidine for long-term sedation may reduce weaning time in selected critically ill, mechanically ventilated patients: A randomized controlled study. Critical Care (London, England), 26(1), 122. https://doi.org/10.1186/s13054-022-03967-5.

Appendices

Appendix A

Data Collection Tool

Patient file number	
Age	
Gender	
Smoking	
Date of hospital admission	
Date of ICU admission	
Date of ICU discharge	
Date of hospital discharge	
Source of admission: 1-Emergency department 2- In-patient floor 3- Operation room(OR) 4-Other ICU	
Diagnosis on admission: 1-Medical case 2-Surgical case	
Body mass index (BMI)	
Duration of ventilation	Date of int: date of ext: (days)
Antibiotics for respiratory infection	Yes No
SOFA score before extubation	
APACHE II score before extubation	
Richmond Agitation Sedation Scale (RASS)	
RSBI(breath/min/l)	
Past medical history:	

Hypertension Renal dysfunction Diabetic Cardiac Disease Psychiatric Disease Thyroid disease Trauma Cancer Pulmonary Disease GI bleeding	
Causes for intubation : ARDS COPD Congestive heart failure Post-cardiac arrest Sepsis Coronary artery disease Chronic renal failure Diabetes mellitus Hypertension Post operation ( ) Trauma Brain hemorrhages others………	
Ventilation parameters prior to spontaneous breathing trial:	
Total respiratory rate	Fio2
Positive end-expiratory pressure	Tidal volume
Pressure support	
Arterial blood gas before extubations:	
pH	Hco3
PaCO2	Pao2/fio2
Vital signs before extubation :	
MAP	RR
SAT	HR
T	
GCS before extubation	
Use of vasopressor	>5 mic <5mic (name:)
Septic work up: 1- Blood cx 2- Urine cx 3- Sputum cx 4- swab cx( )	

Adverse Events: respiratory infection(VAP) Sepsis Self extubation Reintubation Tracheostomy Death before ICU discharge Dysrhythmias Nasal/skin/mouth sores or irritation Non respiratory infection Bed source Gastric distension Barotrauma (eg, pneumothorax)	
Weaning outcome: Extubation success Extubation failure Non-weaned	
Patients needed sedation: Yes No Fentanyl Midazolam Propofol	
Weaning duration, hours	
Total MV duration, days	
Total ICU duration, days	
Total hospitalization duration, days	
ICU mortality	
Reason of discharge: 1- Go home 2-Transfer to ward (In-patient floor) 3-Transfer to other ICU 4-Transfer to other hospital 5-death	

Appendix B

SOFA Scores

Sequential [Sepsis-Related] Organ Failure Assessment (SOFA) Score

System	0	1	2	3	4
Respiration PaO2/FiO2, mmHg (kPa)	≥400 (53.3)	<400 (53.3)	<300 (40)	<200 (26.7) with respiratory support	<100 (13.3) with respiratory support
Coagulation Platelets, x10³/uL	≥150	<150	<100	<50	<20
Liver Bilirubin, mg/dL (umol/L)	<1.2 (20)	1.2 - 1.9 (20 - 32)	2.0 - 5.9 (33 - 101)	6.0 - 11.9 (102 - 204)	>12.0 (204)
Cardiovascular	MAP ≥70mmHg	MAP <70mmHg	Dopamine <5 or Dobutamine (any dose)	Dopamine 5.1 - 15 or Epinephrine ≤0.1 or Norepinephrine ≤0.1	Dopamine >15 or Epinephrine >0.1 or Norepinephrine >0.1
CNS GCS Score	15	13 - 14	10 -12	6 - 9	<6
Renal Creatinine, mg/dL (umol/L) Urine Output, mL/d	<1.2 (110)	1.2 - 1.9 (110 - 170)	2.0 - 3.4 (171 - 299)	3.5 - 4.9 (300 - 440) <500	>5.0 (440) <200

*Catecholamine Doses = ug/kg/min for at least 1hr

Appendix C

Glasgow Coma Scale (GCS)

Appendix D

The APACHE II Score

The APACHE II Score

Physiologic Variable	High Abnormal Range							Low Abnormal Range	
	+4	+3	+2	+1	0	+1	+2	+3	+4
Rectal Temp (°C)	≥41	39-40.9		38.5-38.9	36-38.4	34-35.9	32-33.9	30-31.9	≤29.9
Mean Arterial Pressure (mmHg)	≥160	130-159	110-129		70-109		50-69		≤49
Heart Rate	≥100	140-179	110-139		70-109		50-69	40-54	≤39
Respiratory Rate	≥50	35-49		25-34	12-24	10-11	6-9		≤5
Oxygenatation a) $FIO_2 \geq 0.5$ record $A\text{-}aDO_2$ b) $FIO_2 < 0.5$ record PaO_2	≥500	350-499	200-349		<200 PO_2>70	PO_2 61-70		PO_2 55-60	PO_2<55
Arterial pH	≥7.7	7.6-7.69		7.5-7.59	7.33-7.49		7.25-7.32	7.15-7.24	<7.15
HCO_3 (mEq/l)	≥52	41-51.9		32-40.9	22-31.9		18-21.9	15-17.9	<15
K (mEq/l)	≥7	6-6.9		5.5-5.9	3.5-5.4	3-3.4	2.5-2.9		<2.5
Na (mEq/l)	≥100	160-179	155-159	150-154	130-149		120-129	111-119	≤110
S. Creat (mqm/dl)	≥3.5	2-3.4	1.5-1.9		0.6-1.4		<0.6		
Hematocrit (%)	≥60		50-59.9	46-49.9	30.45.9		20-29.9		<20
TLC (10^3/cc)	≥40		20-39.9	15-19.9	3-14.9		1-2.9		<1
GCS									

Age -score
<44 → 0
45-54 → 2
55-64 → 3
65-74 → 5
≥75 → 6

GCS:		
15 → 0	14 → 1	13 → 2
12 → 3	11 → 4	10 → 5
9 → 6	8 → 7	7 → 8
6 → 9	5 → 10	4 → 11
3 → 12		

JAMA 1993;270(24):2957-2963

fppt.com

Appendix E

Richmond Agitation Sedation Scale (RASS)

Richmond Agitation Sedation Scale (RASS)

Target RASS	RASS Description
+ 4	Combative, violent, danger to staff
+ 3	Pulls or removes tube(s) or catheters; aggressive
+ 2	Frequent nonpurposeful movement, fights ventilator
+ 1	Anxious, apprehensive , but not aggressive
0	Alert and calm
- 1	awakens to voice (eye opening/contact) >10 sec
- 2	light sedation, briefly awakens to voice (eye opening/contact) <10 sec
- 3	moderate sedation, movement or eye opening. No eye contact
- 4	deep sedation, no response to voice, but movement or eye opening to physical stimulation
- 5	Unarousable, no response to voice or physical stimulation

Appendix F

Permission from Ministry of Health

State of Palestine
Ministry of Health
General Directorate of Education in Health and Scientific Research

دولة فلسطين
وزارة الصحة
الإدارة العامة للتعليم الصحي والبحث العلمي

Ref.: ………………
Date:………………

الرقم: ١٦٢/٨٢٤/٢٠٢٣
التاريخ: ١٣/٤/٢٠٢٣

ق. أ. الوكيل المساعد لشؤون المستشفيات والطوارئ المحترم،،،

تحية واحترام...

<u>الموضوع: تسهيل مهمة بحث</u>

يرجى تسهيل مهمة الطالب: **فراس احمد عبد الفتاح اطميزة**– ماجستير تمريض عناية مكثفة– الجامعة العربية الامريكية، لعمل بحث بعنوان:

The Outcomes of ventilator weaning process for adult patient in intensive care departments in Hebron governorate hospitals (Retrospective Observational Study)

حيث يحتاج الطالب للحصول على معلومات من ملفات المرضى عينة الدراسة وذلك في اقسام العناية المكثفة، باشراف مسؤولي الملفات الالكترونية للمرضى، وذلك في:

– **مستشفى عاليه**

مع العلم ان البحث باشراف د. جمال قدومي.

على ان يتم الالتزام بالمحافظة على اخلاقيات البحث العلمي وسرية المعلومات.

على ان يتم تزويد الوزارة بنسخة PDF من نتائج البحث، التعهد بعدم النشر لحين الحصول على موافقة وزارة الصحة.

مع الاحترام...

د. عبد الله القواسمي
رئيس وحدة التعليم الصحي والبحث العلمي

نسخة: عميد كلية الدراسات العليا المحترم/ الجامعة العربية الامريكية

Telfax.:09-2333901 scientificresearch.dep@gmail.com لفاكس: 09-2333901

Appendix G

Permission from Ministry of Health

State of Palestine
Ministry of Health
Education in Health and Scientific
Research Unit

دولة فلسطين
وزارة الصحة
وحدة التعليم الصحي
والبحث العلمي

Ref.: ....
Date:..................

الرقــم: ١٦٤/٨١٣/٢٠٢٣
التـاريخ: ١٢/٤/٢٠٢٣

الأخ مدير عام الادارة العامة لتكنولوجيا المعلومات المحترم،،،

تحية واحتـرام...

الموضــوع: تسهيل مهمة بحث

يرجى تسهيل مهمة الطالب: **فراس احمد عبد الفتاح اطميزة**- ماجستير تمريض عناية مكثفة- الجامعة العربية الامريكية، لعمل بحث بعنوان:

The Outcomes of ventilator weaning process for adult patient in intensive care departments in Hebron governorate hospitals (Retrospective Observational Study)

حيث يحتاج الطالب للحصول على معلومات من ملفات المرضى عينة الدراسة وذلك في اقسام العناية المكثفة، باشراف مسؤولي الملفات الالكترونية للمرضى، وذلك في:

- **مستشفى عاليه**

مع العلم ان البحث باشراف د. جمال قدومي.

على ان يتم الالتزام بالمحافظة على اخلاقيات البحث العلمي وسرية المعلومات.
على ان يتم تزويد الوزارة بنسخة PDF من نتائج البحث، التعهد بعدم النشر لحين الحصول على موافقة وزارة الصحة.

مع الاحترام...

د. عبد الله القواسمي
رئيس وحدة التعليم الصحي والبحث العلمي

نسخة: عميد كلية الدراسات العليا المحترم/ الجامعة العربية الامريكية

Appendix H

IRP Approval

Arab American University- Palestine
Deanship of Scientific Research
IRB committee
Tel: 04-241-8888, ext 1196
E-mail: irb.aaup@aaup.edu

الجامعة العربية الامريكية- فلسطين
عمادة البحث العلمي
لجنة أخلاقيات البحث العلمي
تلفون: 04-241-8888 ext 1196
البريد الالكتروني: irb.aaup@aaup.edu

IRB Approval Letter

Study Title: The Outcome of ventilator weaning process for adult patient in intensive care departments in Hebron governorate hospitals.

Submitted by: Feras Ahmad Abed El Fattah Itmaiza

Date received: 21/03/2023

Date reviewed: 16/04/2023

Date approved: 19/04/2023

Your Study titled "**The Outcome of ventilator weaning process for adult patient in intensive care departments in Hebron governorate hospitals**" With archived number 2023/A/71/N was reviewed by the Arab American University IRB committee and was approved on 19th April 2023.

Reham Khalaf-Nazzal, MD, PhD
IRB committee chairman
Arab American University of Palestine

General Conditions:

1. Valid for four months from date of approval.
2. It is important to inform the committee with any modification of the approved study protocol.
3. The committee appreciates a copy of the research when accomplished.

لجنة أخلاقيات البحث العلمي في الجامعة العربية الامريكية

IRB at Arab American University

نتائج عملية فطام المرضى البالغين عن اجهزة التنفس الاصطناعي في قسم العناية المكثفة في مستشفى الخليل الحكومي

اعداد

فراس أحمد اطميزه

إشراف

دكتور جمال القدومي

الملخص

الخلفية

تتعلق نتيجة عملية فطام المرضى الذين احتاجوا بالسابق الى جهاز تنفس اصطناعي بعملية فصل او تقليل الاعتماد عليه . من أجل مساعدة المريض على التنفس من تلقاء نفسه، يتم تقليل مستوى دعم جهاز التنفس الصناعي الذي يوفره جهاز التنفس الصناعي تدريجيًا. وعلى الرغم من أنه يلعب دورًا أساسيًا في إنقاذ الأرواح، إلا أنه قد يسبب عددًا من المشكلات التي تتراوح بين البسيطة والخطيرة. ولذلك، من الضروري تقليل المخاطر التي ينطوي عليها الأمر وتقليل اعتماد المرضى على هذه التكنولوجيا من أجل ضمان سلامتهم. تلعب الظروف الطبية وحالة المريض، وتأثيرات العناية المركزة، بالإضافة إلى تجارب المتخصصين في الرعاية الصحية دورًا في عملية الفطام المعقدة. الغرض من هذه الدراسة هو فهم أفضل لكيفية تفاعل المرضى مع إجراء الفطام في أماكن الرعاية الحرجة. بالإضافة إلى ذلك، تسعى الدراسة إلى تعزيز الوعي بعملية الفطام.

الهدف

تهدف الدراسة الى التعرف على مدى تجاوب المريض الموصول بجهاز التنفس الاصطناعي الى عملية الفطام المتبعة في قسم العناية المكثفة.

المنهجية

شملت هذه الدراسة بأثر رجعي 230 مريضاً في حالة حرجة وتم وضعهم على اجهزة التنفس الاصطناعي كعينة. وكان مستشفى الخليل الحكومي في الخليل هو موقع الدراسة. ضمت وحدة العناية المركزة جميع المرضى الذين تم وضعهم على جهاز التنفس الاصطناعي وإدخالهم إلى المستشفى في الفترة ما بين 2022/1/1 إلى 2023/6/1 (17 شهرًا). الذين خضعوا لعملية الفطام وفقًا للممارسة المقبولة.

النتائج

شملت الدراسة 60.9% منهم رجال و 39.1% منهم نساء. كان عمر أكثر من ثلثي المشاركين في العينة 60 عامًا أو أكبر. 10.9% فقط من المرضى الموضوعين على أجهزة التنفس الصناعي كانوا مصابين بكوفيد-19. وعلى النقيض من تشخيص الحالات الجراحية، تم استخدام التشخيص الطبي الباطني في معظم الحالات (85.2%). وفقا لنتائج قياس الغازات، كان أكثر من نصف العينة يعاني من قلاء الجهاز التنفسي، و 75% منهم يعانون من الحمض الاستقلابي، و 42% لديهم درجة حموضة منخفضة. كان العمر وطول مدة المكوث على جهاز التنفس مختلفين بشكل كبير ، وكذلك التشخيص الطبي ونتائج الفطام/خطر النتائج السلبية، ونقاط SOFA ونقاط APACHE/معدل الوفيات المتوقع، ونتائج الفطام / خطر الأحداث السلبية. لم يظهر أن الإصابة بكوفيد-19 ومعدل الوفيات في وحدة العناية المركزة، وكذلك المضادات الحيوية لفشل الجهاز التنفسي وخطر الأحداث الضارة، مرتبطة بشكل كبير . إلى جانب استخدام التخدير، كان هناك فرق ذو دلالة إحصائية بين مدة استخدام جهاز التنفس الاصطناعي ونجاح الفطام ، وكذلك بين الاثنين. ومع ذلك، لم يكن هناك أي دليل على وجود علاقة بين استخدام قابضات الأوعية الدموية/درجة GCS وطول مدة استخدام جهاز التنفس الاصطناعي ، أو أسبابه، أو طول الفطام. ولذلك، كان طول مدة استخدام جهاز التنفس الاصطناعي مرتبطاً بطول الفطام. وفي الوقت نفسه، كان طول مدة التهوية مرتبطًا بكل من المدة الإجمالية للإقامة في وحدة العناية المركزة والاقامة في المستشفى.

الخاتمة

وبناءً على نتائج الدراسة، ننصح بأخذ التشخيص الطبي بعين الاعتبار عند تقييم نجاح الفطام ومخاطر النتائج السلبية. لتقليل الحاجة إلى استخدام جهاز التنفس الاصطناعي، يحتاج الأفراد الذين عانوا من توقف القلب والرئتين إلى تدخل سريع وعلاج متخصص. يمكن استخدام نتائج SOFA وAPACHE بشكل منفصل للتنبؤ بمعدل الوفيات في وحدة العناية المركزة. من المهم جدًا إبقاء عملية توصيل المريض بجهاز التنفس الاصطناعي قصيرة المدى لتقليل احتمالية حدوث نتائج غير مرغوب فيها. ونظراً لتأثيره على طول مدة مكوث المريض على جهاز التنفس الاصطناعي ونجاح عملية الفطام، ينبغي إعطاء التخدير بحذر. لا ينصح بتناول المضادات الحيوية بانتظام لعلاج التهابات الجهاز التنفسي إلا في حالة الضرورة السريرية. لا يبدو أن مدة مكوث المريض على جهاز التنفس الاصطناعي تتأثر باستخدام قابض الأوعية. ومع كل هذا

يجب إنشاء بروتوكولات الفطام وتنفيذها خصيصًا لكل مريض، مع مراعاة احتياجاته ومشاكله الطبية.

الكلمات المفتاحية

تمريض العناية الحرجة، المرضى، الفطام عن جهاز التنفس الصناعي، أجهزة التنفس الصناعي.