Faculty of Medicine

University of Dhaka

EXPLORE THE RESPIRATORY COMPLICATIONS OF TETRAPLEGIC SCI PATIENTS AT CRP

Farhana Rahman

Bachelor of Science in Physiotherapy (B.Sc. PT)

DU Roll no: 915

Reg. no: 3618

Session: 2015-2016

BHPI, CRP, Savar, Dhaka-1343

Bangladesh Health Professions Institute (BHPI)

Department of Physiotherapy

CRP, Savar, Dhaka-1343

Bangladesh

August, 2020

We the undersigned certify that we have carefully read and recommended to the Faculty of Medicine, University of Dhaka, for the acceptance of this dissertation entitled

EXPLORE THE RESPIRATORY COMPLICATIONS OF TETRAPLEGIC SCI PATIENTS AT CRP

Submitted by **Farhana Rahman,** for the partial fulfilment of the requirement for the degree of Bachelor of Science in Physiotherapy (B.Sc. PT).

.....

Mst. Fatema Akter
Assistant Professor
Department of Physiotherpy
BHPI, CRP, Savar, Dhaka
Supervisor

.....

Professor Md. Obaidul Haque
Vice principal
BHPI, CRP, Savar, Dhaka

.....

Mohammad Anwar Hossain
Associate Professor, Department of Physiotherapy, BHPI
Senior consultant & Head, Department of Physiotherapy
CRP, Savar, Dhaka

.....

Ehsanur Rahman
Associate Professor & MPT coordinator
Department of Physiotherapy
BHPI, CRP, Savar, Dhaka

.....

Md. Shofiqul Islam
Associate Professor & Head,
Department of Physiotherapy
BHPI, CRP, Savar, Dhaka

DECLARATION

I declare that the work presented here is my own. All sources used have been cited appropriately. Any mistakes or inaccuracies are my own. I also declare that same any publication, presentation or dissemination of information of the study. I would bind to take consent from the department of Physiotherapy of Bangladesh Health Profession Institute (BHPI).

Signature: **Date:**

Farhana Rahman
Bachelor of Science in Physiotherapy (B.Sc. PT)
DU Roll no: 915
Reg.no:3618
Session: 2015-2016
BHPI, CRP, Savar, Dhaka-1343

Contents

Acknowledgement

First of all, I would like to pay my gratitude to Almighty who has given me the ability to complete this research project in time with great success. I would like to pay my gratitude towards my parents who constantly encouraged me to carry out this project. My deepest great-fullness goes to my honorable supervisor & respected teacher **Mst. Fatema Akter** Assistant Professor, Department of Physiotherapy, Bangladesh Health Professions Institute (BHPI), CRP, Savar, Dhaka, for her keen supervision and tireless effort with excellent guidance and support without which I could not able to complete this project.

In addition, I am thankful to all of my honorable teachers specially **Md. Obaidul Haque**, Vice-Principle, BHPI; ; **Mohammad Anwar Hossain**, Associate Professor, BHPI, Senior consultant & Head of Physiotherapy Dept; **Md. Shofiqul Islam**, Associate Professor & Head, Department of Physiotherapy, BHPI; **Ehsanur Rahman** Associate Professor & MPT coordinator Department of Physiotherapy, BHPI, CRP, Savar, Dhaka for given me the permission to collect the data from the Spinal Cord Injury Unit of Physiotherapy Department.

I would like to express my admiration to **Muhammad Millat Hossain**, Assistant Professor, Department of Rehabilitation Science, Member Secretary, Institutional Review Board, (IRB), BHPI, CRP, Savar, Dhaka for allowing me to conduct this research. I wish to thanks to all respectable Physiotherapy staff working at CRP Spinal cord injury unit specially honorable teacher **Muzaffor Hossain**, Senior Physiotherapist & In-charge of SCI Unit, CRP, Savar, Dhaka for helping me in collection of my data.

I would also like to give thanks to BHPI librarian Mrs. Mohosina to her heartily help and library assistant Mr. Anis for their positive help, kind support to find out related books, journals and also access to internet during the project study. I thank all of my friends for their direct and indirect inspiration, suggestion as well as support.

Finally, I would like to thanks those people who eagerly participated as study samples in the conduction of my study and the entire individual who are directly or indirectly involve with this study.

Acronyms

ASIA:	American Spinal Cord Injury Association
BHPI :	Bangladesh Health Profession's Institute
BMRC:	Bangladesh Medical Research Council
CRP:	Centre for the Rehabilitation of the Paralysed
HRQoL:	Health Related Quality of Life
IRB:	Institutional Review Board
NITOR:	National Institute of Traumatology and Orthopaedic Rehabilitation
PEFR:	Peak expiratory flow rate
SCI:	Spinal Cord Injury
SPSS:	Statistical Package of the Social Sciences
WHO:	World Health Organization

List of Tables

List of Figures

Abstract

Purpose*:** The purpose of this study was to explore the respiratory complications of tetraplegic SCI patients at CRP. ***Objectives: The objectives of this study were to demonstrate the socio-demography among the tetraplegic patients to explore the knowledge of respiratory complication, status of different type of respiratory complication of tetraplegic SCI patients. The study also find about any association in between respiratory complication and gender, ASIA classification scale. ***Methodology*:** Cross sectional study design was used to conduct the study where 50 participants with SCI who are tetraplegic patients and take treatment from Centre for the rehabilitation of the paralysed (CRP). The data were collected by using a semi structure questionnaire and analysed by descriptive statistics using percentages, pie chart and bar chart. ***Result:*** 50 patients were included as sample. Among them male 94% (n=47) are predominantly higher than female 6% (n=3). Complete-A participants 62 (n=31) are higher and in rural area 68% (n=34) were more affected than the people who lived in urban 32% (n=16) having poor educational status. This study explored respiratory complications of tetraplegic patients of SCI such as participants have complained of cough during day or night 40% (n=20), pneumonia 44% (n=22), Atelectasis 42% (n=21), wheezing 18% (n=9) etc. The mean score of peak flow rate is 226, incentive spirometry rate is 434 and oxygen saturation rate is 96.60. Gender was associated with respiratory complication (pneumonia) which was statistically significant. ***Conclusion:*** Respiratory complications are a common cause of morbidity and mortality in patients with SCI. The results of the study find out the people with spinal cord injury who are suffering badly from respiratory complications. It will be helpful to reduce the morbidity and mortality rate due to respiratory complications of SCI.

Keywords: Spinal cord injury (SCI), Tetraplegic, Respiratory complications.

CHAPTER I INTRODUCTION

1.1 Background

Spinal cord injury (SCI) resulting in tetraplegia has a deepest effect on respiratory function(Bach et al., 2020) Respiratory complications associated with spinal cord injury (SCI) are the most important cause of morbidity and mortality in both the acute phase and chronic phase (Berlly & Shem, 2007) . The level of respiratory complications which is depends on the level of the spinal cord injury and the degree of motor impairment according to the classification of the American Spinal Injury Association (ASIA). Due to the paralysis of inspiratory and expiratory muscle group effect on lung function with secondary respiratory failure, weakened cough strength and secretion stagnation (Tollefsen & Fondenes, 2012).

Respiratory function is not only relevant in association with respiratory infection of spinal cord injury patients but also impaired respiratory function which may affect affected persons health-related quality of life (HRQOL, including physical, mental and social aspects (Voll-Aanerud et al., 2010).

Spinal cord injury patients are most at risk to respiratory complication in the first year after injury but continue to suffer from respiratory complications all over life. In determining the length of stay and hospital costs, the number of respiratory difficulties experienced during the initial admission is more important than the level of injury (Berlowitz et al., 2016). Respiratory difficulties affect up to 80% of patients in the immediate phase following a spinal cord injury. Respiratory issues are the most common cause of death among SCI patients, according to long-term follow-up. Atelectasis, pneumonia, and respiratory failure are the most prevalent consequences. Regardless of the severity of the spinal cord damage, early prevention of breathing problems is required. Determining the requirement for mechanical ventilation both in the acute phase and throughout long-term follow-up, as well as effective secretion mobilization strategies, are critical (Tollefsen & Fondenes, 2012).

In the acute hospitalization phase pulmonary complications are highly common with 84% of patients with C1–4 and 60% of patients those with C5–C8 injuries and experiencing respiratory compromise (Levi et al., 2010). Respiratory care is an important aspect of medical and rehabilitation therapy in the early stages of injury, but it may not be optimal in the chronic phase. After all, respiratory problems such as respiratory infections remain a major cause of hospitalization and early mortality in persons with chronic spinal cord injury (SCI) after the first year (Strauss et al., 2006). The impression of spinal shock on respiratory function can be so critical as to require a transient need for an artificial airway and mechanical ventilatory assistance (Lenehan et al., 2012). As spinal shock resolves the flaccid paralysis of muscles is replaced by spasticity and the chest wall becomes rigid resulting in an improvement in respiratory function particularly during inspiration (Hawryluk et al., 2015; Ryken et al., 2013).

Spinal cord injury (SCI) is an incident which can be traumatic or non-traumatic and that effect in disturbances to normal sensory, motor or autonomic function of person. Ultimately it impacts on physical, psychological and social well-being of patients (Singh et al., 2014). The prevalence of SCI globally varies from 15 to 40 people per million people and the incidence rate ranges from 10.4 to 83 cases per million in one year (Moghimian et al., 2015). The incidence is from 10.4 per million per year to 29.7 per million per year in Europe (Moghimian et al., 2015; Lim et al., 2017) reported that in the US, the highest SCI prevalence is 906 per million. On the other hand, SCI incidence rates range from 12.06 to 61.6 per million in Asia. (Ning et al., 2012).

Major damage to the spinal cord shows to motor, sensory and autonomic changes. Partial or total loss of voluntary movements or sensitivity (tactile, painful, and deep) of the upper and lower limbs arising in decreased mobility and independence, in activities of daily living and these impacts on also patients social and vocational skills. There is also negative effect on respiratory, cardiovascular, urinary, gastrointestinal and reproductive systems with complications including pneumonia, septicemia, urinary tract infections, bowel and bladder incontinence, cardiac diseases and chronic pain as well as the disruption of tasks, goals, and dreams which may worsen their medical condition clinically eventually leads to lower quality of life.(Post, 2014; Lim et al., 2017).

After spinal cord injury, some acute complications are Neurogenic shock (due to severe hypotension and bradycardia), cardiovascular complications such sinus bradycardia, vasodilatation stasis etc. (Injuries to the autonomic nervous system), Respiratory complications and dysphasia (due to injury above C4 and 60% of patients with injuries from C5 toC8,) musculoskeletal and metabolic complication, bowel and bladder dysfunction, Spasticity, Pressure ulcers, anxiety and depression (Hagen, 2015).

In addition to muscle paralysis, a period of spinal shock occurs immediately after a traumatic cervical SCI, resulting in flaccid paralysis of muscles below the level of the cord injury (Siddiqui et al., 2015; Ryken et al., 2013). It can last from a period of 4 weeks up to several months. The severity of spinal shock is dependent on the severity of the injury associated injury, age, pre-existing co morbidities and it is also corresponded with the incidence of pulmonary complications spinal cord injury patients. Flaccid paralysis of muscles is replaced by spasticity is the sign of spinal shock concluded. The Tightness of chest wall becomes occurring an development in respiratory function specially during inspiration (Siddiqui et al., 2015; Hagen, 2015).As a result, respiratory difficulties in the acute phase have a predictable time course, beginning within the first 5 days of injury and lasting up to 5 weeks after spinal shock subsides (Levi et al., 2010).

There are two specialized hospitals in Bangladesh for the treatment of spinal cord injuries (SCI). The National Institute of Traumatology, Orthopedics, and Rehabilitation (NITOR) and the Center for the Rehabilitation of the Paralyzed (CRP) are the two organizations (CRP). The CRP is a non-government organization dedicated to the treatment of patients with spinal cord injuries. CRP provides the treatment and complete rehabilitation training to the SCI patients here and management is multi- and inter-disciplinary, with a focus on the development of community-based rehabilitation programs (Lee et al., 2014).

1.2 Rationale

Spinal cord injury (SCI) is a devastating and life threatening condition that affects every aspect of life. Approximately 15 - 40 people per million people are affected globally in one year. Among the SCI patients Respiratory complications are a common cause of morbidity and mortality in patients with leads to a mismatch between ventilation and perfusion, resulting in hypoxemia and, if untreated, respiratory failure. Low lung volumes and a sluggish cough as a result of respiratory muscle dysfunction characterize respiratory disability after spinal cord injury (SCI) in high cervical injuries.

Respiratory complications must be avoided at all costs for SCI patients. Lung volume and critical capability suggest an injured person's ability to take a deep breath and cough efficiently. If the tetraplegic patient does not locate the right lung function, he or she may suffer from severe respiratory problems.

This study will find out the people with spinal cord injury who are suffering badly from respiratory complications. It will be helpful to reduce the morbidity and mortality rate due to respiratory complications of SCI. This concept aids in the creation of a treatment plan based on the needs of the patient. We can provide patients with better treatment as well as important advice by exploring this complication because before providing treatment it is very important to identify complication properly and need clear knowledge about the condition and problem. It will improve our knowledge as health professionals. Patients will benefit from this research by learning more about their condition. By this study Physiotherapist and other professionals will aware about the respiratory complications and will help to make appropriate treatment plan for respiratory complications for SCI patients on Bangladeshi perspectives.

Physiotherapy is not well known profession in Bangladesh till now. Most of the people do not know about the profession and its services specifically. The Physiotherapists will be able to enrich their knowledge and resource by using this study in Bangladesh.

1.3 Research question

What are the respiratory complications of tetraplegic SCI patients at CRP?

1.4 Objectives

General objective

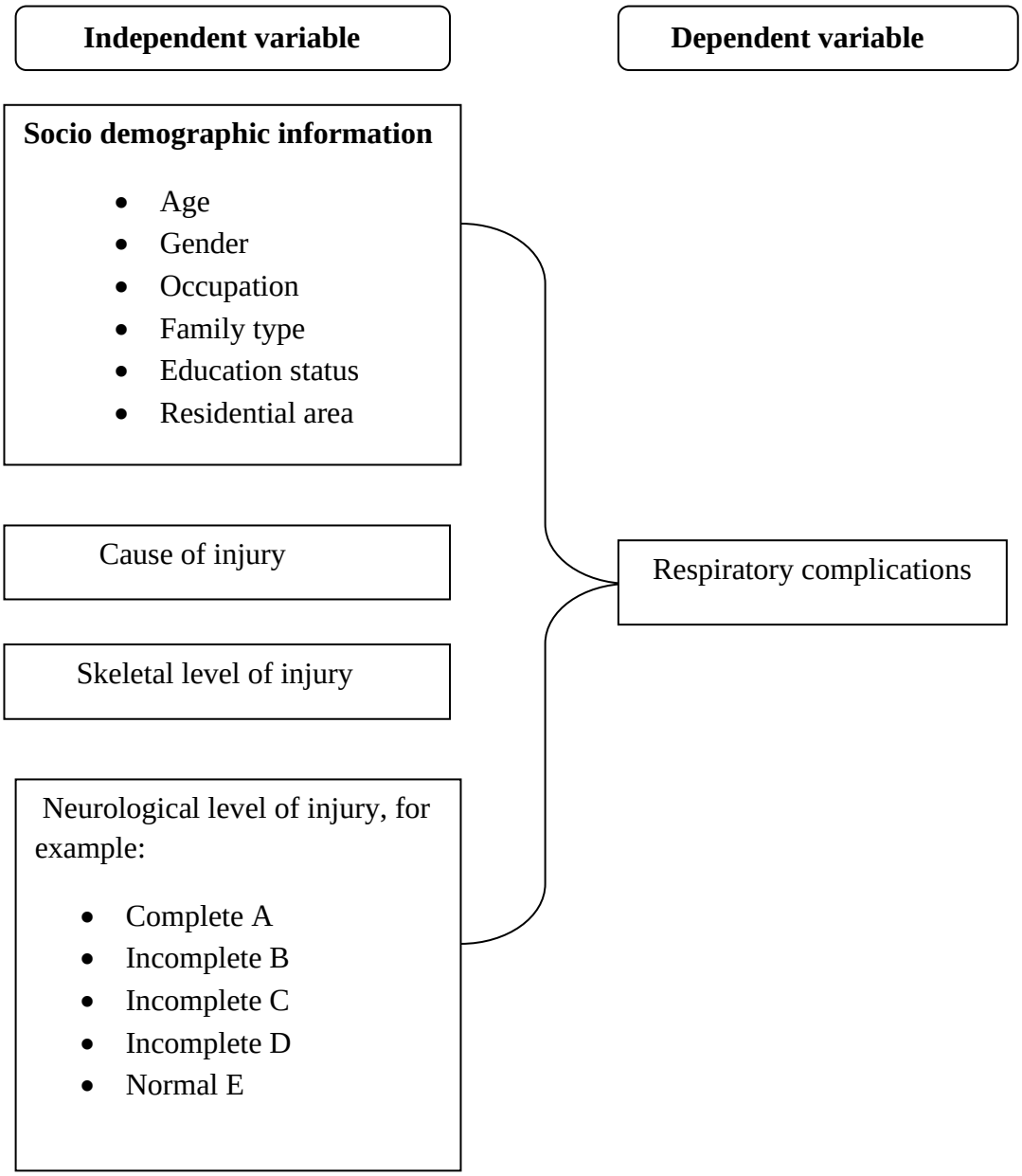
- To explore the respiratory complications of tetraplegic SCI patients at CRP

Specific objectives

- To find out the socio-demographic characteristics of tetraplegic SCI patients.
- To explore the respiratory status of tetraplegic SCI patients.
- To explore the knowledge of respiratory symptoms of tetraplegic SCI patients.
- To know about association in between respiratory complications (cough, wheezing, pneumonia, atelectasis),peak flow meter, incentive spirometry, oxygen saturation, and socio-demographic information (gender, ASIA classification scale).

.

1.5 Conceptual framework



1.6 Operational Definition

Spinal Cord Injury

Spinal cord injury (SCI) is an event which can be traumatic or non-traumatic that results in disturbance to normal sensory, motor, or autonomic function and ultimately impacts a patient's physical, psychological and social well-being (Singh et al., 2014).

Tetraplegia

The term refers to damage to neural components within the spinal canal causes impairment or loss of motor or sensory function in the cervical portions of the spinal cord. Tetraplegia causes impairment of function in the arms, as well as the trunk, legs, and pelvic organs, affecting all four extremities. It excludes injuries to the brachial plexus or peripheral nerves outside the neural canal (Nas et al., 2015).

Complete Injury

A complete SCI is characterized by the complete absence of sensory and motor function in the lowest sacral segments S4–5 (Burns et al., 2012). .

Incomplete injury

Incomplete injury defined as there is partial preservation of sensory and/or motor function at S4–5 (Burns et al., 2012).

Skeletal level

This word refers to the amount of spinal injury discovered by radiographic testing. Because not all cases of SCI include a bone damage, and because bony injuries may not always correspond with neurological impairment to the spinal cord, the skeletal level is not included in the current ISNCSCI (Kirshblum et al., 2011).

Neurological level

The NLI is the most caudal portion of the spinal cord with normal sensory and antigravity motor function on both sides of the body, assuming normal (intact) sensory and motor function proximally (Kirshblum et al., 2011).

Pneumonia

Pneumonia is an inflammation of the lung tissue that is typically caused by infection. Radiographic indications of parenchymal illness can be used to make a diagnosis (Berlly & Shem, 2007).

Cough

Cough is an important defence mechanism that serves to clear the airways from foreign material (in aspiration) (Postma et al., 2015).

Atelectasis

Atelectasis, or a lack of air in the lungs, can be detected clinically or radiographically. It arises as a result of inadequate lung expansion induced by weak respiratory muscles (Ahuja et al., 2017).

.

CHAPTER – II LITERATURE REVIEW

A spinal cord injury (SCI) is defined as damage to any region of the spinal cord that extends from the spinal cord and causes permanent alterations in motor and sensory capacities as well as other body functions below the location of injury. Physical disabilities from SCI differ depending on the severity and extent of the injury. SCI can impair nearly every element of a person's life, including physical health, employment and occupation, personal relationships, and recreation (Dixon & Budd, 2017). Spinal cord injury has become a big issue across Asia, including Bangladesh. The number of people with SCI and those with disabilities in Bangladesh is steadily increasing (Islam et al., 2011).

The early acute phase is defined as 2-48 hours after damage, the sub-acute period as 2 days to 2 weeks, and the intermediate phase as 2 weeks to 6 months based on pathophysiological changes. Early decompression (24 h or 72 h) resulted in statistically better outcomes than delayed decompression, according to studies (Fehlings & Perrin, 2006). The clinically acute phase, on the other hand, is typically characterized as the first 4-5 weeks following an injury. Acute traumatic SCI begins with a sudden injury to the spine that results in vertebral fractures or dislocations. Immediate injury is caused by displaced bone fragments and disc debris, resulting in irreparable axon damage and damaged neural cell membranes. Ruptured blood vessels in the spinal cord can produce bleeding, which can worsen the injury over time. The overall harm to the spinal cord tissue is caused by several processes (Hagen, 2015).

Yearly death rates following hospital release are continually high, with 3.8 percent of patients dying in the first year after injury, 1.6 percent in the second year, and 1.2 percent in each year after that. With more serious injuries and larger injury levels, the chance of death rises. More severe injuries, greater damage levels (cervical SCIs are associated with higher mortality than lumbar SCIs), and rising patient age all raise the chance of mortality. Patients with traumatic SCI have a much shorter life expectancy, despite current medical treatment. For example, a 40-year-old person's life expectancy after SCI

is reduced to 23 years after a C5–C8 damage, 20 years after a C1–C4 injury, and 8.5 years if they are ventilator dependent (Ahuja et al., 2017).

Global prevalence of traumatic SCI North America (39 per million) has nearly double the rate of Australia (15 per million) and Western Europe (15 per million) (16 per million) Road traffic accidents, mainly involving four-wheeled motor vehicles, are the leading cause of SCI in these areas. North America had a higher rate of violence/self-harm (15%) than Western Europe (6%) or Australia (4%). (2 percent). The largest rate of falls was in Western Europe (37%) followed by Australia and North America (29 and 20 percent, respectively). This could be due to Western Europe's population being older than both Australia and North America (population 460 years: 23.9, 18.9, and 1 respectively) (Cripps et al., 2011).

Razzak (2013) stated that SCI can occur in a matter of seconds, but the terrible effects can be avoided in the final stages of life. The injuries of the spinal cord are classified as either traumatic or non-traumatic. In our nation, there were three primary sources of traumatic injury. 43 percent of the deaths were caused by falling from a height (such as a tree), 20 percent were caused by falling while carrying a heavy load on the head, which is a common practice in Bangladesh, 18 percent were caused by a road traffic accident, and 6% were caused by a variety of causes such as assault, stab injury, sports injury, and bull attack. Pott's disease with a tumor, transverse myelitis, prolapsed intervertebral disc, and Guillain Barre Syndrome are the most common causes of non-traumatic spinal cord lesions (Hagen et al., 2012).

The World Health Organization (WHO) statistics there are 10% of the population are disabled in Bangladesh. A spinal cord lesion (SCL) occurs suddenly and unexpectedly. It can be devastating and costly in terms of human and social costs. SCL is still a major cause of disability in Asia, including Bangladesh. In Bangladesh, there is no specialized government hospital for the treatment and rehabilitation of people with SCL**.** There is only one non-government organization is the Centre for the Rehabilitation of the Paralyzed, which has been working in this field for the last 30 years (Islam et al., 2011).

Injury to the spinal cord (SCI) is characterized as spinal cord damage that causes changes in its function temporarily or permanently. SCI is classified into etiologies that are traumatic and non-traumatic. Traumatic SCI occurs when the spinal has profound implications. Next, dysfunction of the inspiratory muscles affects breathing and lung volumes. Second, the inadequate expiratory muscles impair clearance of cough and secretion. As a result, with a history of chronic respiratory tract infections, respiratory morbidity is high for people with tetraplegia (Boswell-Ruys et al., 2020).

Respiratory problems are one of the major complications and a frequent cause of death, both in the acute and chronic phase after injury and cervical injury has major effects on the pulmonary system (Berney et al., 2011). Studies have found that 67% of acute SCI patients experience severe respiratory complications within the first days after the injury; atelectasis (36.4%), pneumonia (31.4%), and respiratory failure (22.6%). In the acute phase 84% of patients with injuries above C4 and 60% of patients with injuries from C5 to C8, will experience respiratory problems and 75%-80% of tetraplegia above C4 and 60% of tetraplegia caudal to C4 will need invasive mechanical ventilation (Tollefsen and Fondenes, 2012). In patients with cervical or upper thoracic SCI, the ability to cough effectively is significantly hampered. The capacity to perform a forced expiration is lost in patients who have lost innervation to the abdominal muscles and internal intercostals (Berlowitz et al., 2016).

During the first 5 days after an accident, pneumonia and atelectasis are the most prevalent consequences. 17 In the acute period, up to 80% of patients will develop respiratory problems. The severity of motor degeneration and the anatomical and neurological level of SCI all influence the rate of respiratory problems. The death rate can reach 3.5 percent, and it rises as people get older and have pre-existing illness. (Liebscher et al., 2015).

In persons with total tetraplegia, decreased pulmonary function, weaker cough strength, dyspnea, and respiratory infections were more common. Even after factoring for those with associated respiratory infections, same issues occurred in many people with less severe neurological deficits (asthma, chronic obstructive pulmonary disease and a status after lobectomy). As a result, respiratory care during inpatient rehabilitation should not

just be focused on those with complete tetraplegia, but also on everyone who has a damaged respiratory system (Postma et al., 2016).

Close surveillance of respiration is important. In addition a total of 65% of patients with injuries at levels from Th1 to Th12 may have severe respiratory complications. (Hagen, 2015). Tollefsen and Fondenes (2012) stated that 30%-50% reduction of vital capacity is described during the first week post injury in patients with injuries at C5-C6. It is recommended that vital capacity and arterial blood gases should be measured until the patient is stable.

According to the American Spinal Injury Association's (ASIA) the severity of respiratory problems is determined by the stage of spinal cord injury and the degree of motor disability. The paralysis of inspiratory and expiratory muscle groups has an impact on lung function, resulting in secondary respiratory dysfunction, reduced cough strength, and secretion stagnation. Activation of the lung function which is measured in terms of forced vital capacity (FVC) is reduced depending on the level of the injury (Tollefsen and Fondenes, 2012).

The trends and severity of motor, sensory, and autonomic neurological dysfunction are the most significant determinants of the degree of respiratory compromise after SCI. Specific SCIs are classified based on clinical assessment and a two-stage phase that includes determining the neurological extent of impairment (NLI) and then motor and sensory activity. The International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI), established by the American Spinal Injury Association (ASIA) and the International Spinal Cord Society, are used to score motor and sensory dysfunction and to classify the severity of SCI. People who are spinal cord injury patients have the severity of the motor and sensory impairment associated with their injuries scored using first a classification of the Neurological level of injury (NLI) and then International Standards for Neurological and Functional Classification of Spinal Cord Injury (ISNCSCI) (Berlowitz et al., 2016).

There are three types of respiratory muscles: inspiratory muscles, expiratory muscles for coughing (mostly abdominal), and bulbar-innervated muscles (BIM) that protect the airways. Inspiratory and expiratory muscle function can be completely lost in lesions above the C3 level, but BIM function is preserved in lesions that do not reach into the brain stem until intubation and tracheotomy have caused irreversible damage to the neck strap muscles and the glottis. C3 to C5 levels innervate the diaphragm. T1 through T6 levels innervate the parasternal and external intercostal muscles of the upper rib cage, which support the chest wall and prevent paradoxic breathing. The C2 and C3 roots of the spinal accessory nerve innervate the sternocleidomastoids. As the diaphragm lowers, they can elevate the shoulders, lengthen the cervical spine, and expand the upper rib cage to support and lift the chest wall. The scalene muscles, which are innervated by the C3 to C8 nerve roots, also help to expand the chest by lifting the top ribs. Even when the diaphragm is fully paralyzed, these accessory muscles can ventilate the lungs while the patient is standing. Normal tidal breathing and two-thirds of normal inspiratory capacity are controlled by the diaphragm. Even when the diaphragm and other accessory respiratory muscles are intact, impairment of intercostal muscles and pelvic floor muscles that prevent protrusion of abdominal contents into the pelvis when the diaphragm lowers reduces vital capacity (VC). Chronic aspiration due to invasive airway tubes and inadequately prevented and treated upper respiratory infections (URIs) that cause airway mucous congestion, atelectasis, and pneumonia largely due to ineffective cough flows are common causes of pulmonary morbidity and mortality in patients with SCI(Bach et al., 2020; Bach, 2012; Winslow et al., 2002).

Long-term effects after traumatic SCI are related to the age of the patient and the severity of the injury. Septicemia (88.6%), which is usually associated with pneumonia, is the second most significant cause of death among people with SCI (Krishnan et al., 2017). Pneumonia, an inflammatory disease of the lungs, particularly the alveoli, is the most common respiratory problem (66.9% of cases) and one of the leading causes of death after spinal cord injury. Pneumonia affects 30 percent of people with SCI during their acute hospitalization, and 5–20 percent of people with SCI get pneumonia during their initial rehabilitation. The effects of prior anesthesia and increasing levels of SCI on the

respiratory muscles enhance the risk of pneumonia. Lung compliance is reduced and energy expenditure is increased as a result of the changing lung volumes and patterns of respiration, predisposing the individual to respiratory fatigue (DeVivo, 2012).

Dyspnea (a feeling of being out of breath) is frequent in patients with chronic SCI (between 6 and 68 percent depending on the group investigated) (Jensen et al., 2007). Most of these studies, however, only evaluated at one component of respiratory function or infection, and they included participants who had a varied and prolonged mean period following injury (longer than 10 years). As a result, little is known about SCI's impacts and interactions in the early years after initial recovery between different aspect of respiratory function and their relationship with respiratory function (Postma et al., 2016).

Chronic aspiration due to invasive airway tubes and inadequately prevented and treated upper respiratory infections (URIs) that cause airway mucous congestion, atelectasis, and pneumonia largely due to ineffective cough flows are common causes of pulmonary morbidity and mortality in patients with SCI. To prevent pneumonia in adults, cough peak flows (CPFs) of more than 270 to 300 L/m are required to clear airway material (Bach et al., 2020).

After cervical spinal cord injury respiratory function changes. Inspiratory muscle paralysis and Upper rib cage distortion during inspiration and Reduced lung compliance Reduced vital capacity. Intercostals muscle tone has increased which reduced chest wall compliance. Functional residual capacity is low, repeated respiratory infections. Surfactant properties have been altered and reduce lung compliance. Abdominal muscle paralysed which reduced vital capacity and impaired cough (Arora et al., 2012).

.The severity of the damage and the degree of motor completeness are closely connected to the development of respiratory problems. Completely injured people have more frequent and severe respiratory problems. The likelihood of various respiratory problems varies depending on the severity of the injury. That instance, pneumonia was the most common consequence in the C1 to C4 group, affecting more than 63 percent of patients, followed by ventilatory failure (40 percent) and atelectasis (40 percent). Atelectasis

(34%) was the most prevalent consequence in the C5 to C8 group, followed by pneumonia (28%) and ventilatory failure (23%). 65 percent of people with T1-T12 had atelectasis (Berlly & Shem, 2007).

Patients who have early spinal surgery have a lesser risk of developing pulmonary problems (i.e. within 24 hours). Clinical monitoring data shows that lung function drops dramatically in the first several days after an injury. Following the spinal shock phase, lung function improves. Pneumonia had no effect on the duration of time spent in the ICU, according to the findings. This is most likely due to the continuation of pneumonia treatment or weaning in the peripheral wards. In addition, pneumonia had no effect on the overall length of stay in the hospital. Additional therapeutic alternatives for improving coughing in our patients included physical therapy, suctioning, and mechanical insufflation. Recent evidence suggests that, in addition to manually aided cough training, active respiratory muscle workouts or electrical stimulation of the expiratory muscles can help enhance airway clearance (Liebscher et al., 2013).

Five years following inpatient therapy, 137 patients with SCI took part in a Dutch multicenter prospective cohort study. All of the participants were able to breathe without (partial) mechanical assistance and without the use of a tracheotomy. Chronic obstructive pulmonary disease (n=4), asthma (n=1), and status after lobectomy owing to lung cancer (n=2) were all present in nine patients. The % projected that FVC changed between cough strength groups based on the distribution of percent predicted: P=0.000, strong: 101.4 percent (interquartile range) (89.6–112.4), pretty strong: 86.3 percent (77.1–103.9), moderate: 86.3 percent (76.9–94.3), and poor: 72.9 percent (52.1–83.4). There was no discernible difference between the dyspnea categories. There was a high prevalence of deteriorated respiratory function. Severe impairments, on the other hand, were uncommon: only 8.8% of people had severely impaired FVC (60 percent predicted value), 15.8% gave their cough strength the lowest possible rating (poor), and only 3% of people (3 percent in sit and 5% in activity) experienced dyspnea on a regular or frequent basis. Our study's dyspnea prevalence rates are higher than those obtained in a major European general population survey (5.7 percent dyspnea at rest and 17.5 percent after exercise),10 but lower than those identified in prior SCI investigations. 6–8 A detailed

comparison with other SCI research was carried out. The rate of respiratory infection-related hospitalization (3.7%) was around ten times greater. This, combined with the fact that eight people from the original cohort (n=225) died from respiratory complications prior to the measurement, indicates that people with chronic SCI are not only more susceptible to respiratory complications, but that these complications also appear to have more serious consequences (Postma et al., 2016) .

Pneumonia according to Centers for Disease Control criteria occurred in 51% of cases within 21±32 days of injury, and in 3% at a later date. The number of pre-existing conditions was significantly associated with pneumonia. Length of ICU stay was 25±34 days, and average total hospital duration was 230±144 days. Significant factors affecting the duration of ventilation were the number of pre-existing conditions and tetraplegia-specific complications (Liebscher et al., 2014)

CHAPTER – III METHODOLOGY

3.1 Study Design

A cross- sectional study was selected with structured questionnaire (Questionnaire on respiratory symptoms) which was modified according to my study. and interviews were conducted with person having spinal cord injury to carry out the research. In this study a cross sectional study design used to explore the respiratory complications among the patient with spinal cord injury who are tetraplegic. This study design was appropriate to find out the objectives. The data was collected all at the same time or within a short time frame**.**

3.2 Study Site

Data which was collected from patients with spinal cord injury attending at Centre for the Rehabilitation of the Paralysed (CRP), Savar, Dhaka in SCI Unit; the only specialized & largest hospital in Bangladesh.

3.3 Study Population and Sample Population

A population is the total group or set of events or totality of the observation on which a research is carried out. It is the group of interest to the researcher, the group whom the researcher would like to generalize the result of the study. In this study the SCI people taking treatment at CRP was chosen as a sample population to carry out this study. About 50 samples were selected for this study.

3.4 Sampling Technique

The samples were selected through convenience sampling technique due to time limitation and it was one of the easiest, cheapest and quicker methods of sample selection. Sample will meet the inclusion and exclusion criteria and participate in the study voluntarily

3.5 Sample Size

The equation of finite population correction in case of cross sectional study is:

$$n = \frac{Z^2 pq}{d^2}$$

$$\frac{(1.96)^2 \times 0.5 \times 0.5}{(0.5)^2}$$

=384

Here,

Z (confidence interval) = 1.96

P (prevalence) =50% (Geyh et al., 2010)

d= degree of accuracy

And, q= (1-p)

= (1-0.5)

=0.5

The actual sample size was, n= 384.

As it is an academic thesis, self-funding and data was collected from a single specialized

Hospital by considering the feasibility and time limitation 50 sample were selected conveniently.

3.6 Data Collection Tools

Data was collected by using a semi structured type of semi structured questionnaire paper, that was developed by the investigators and conducting interview which is used to collect information. Questionnaire would provide information about demographic information (age, sex, educational status, occupations and residential area), injury related information, different types of Respiratory complications after Spinal cord injury. The data collection tools used in collecting data were pen and pencils, paper, approved forms and consent forms and bag for storing these tools.

3.7 Data Collection Procedure

The authors gave permission for these data collection tools to be used in this study. Participants who were able to read administered the questionnaire to themselves. The study's aims and purpose were explained to the participants prior to data collection. The information sheet and consent form are read by the participants or careers (if they are able). Those who were unable to read the information sheet and consent form were explained to by the researcher. All participants were given the opportunity to ask any study-related questions, and if they expressed an interest in participating in the study, they were able to sign the consent form willingly. The structured questionnaire, pen, pencil, and paper were used by the researcher to collect data.

3.8 Data Analysis

Data was entered into Statistical Package for Social Science (SPSS) software Version 20 and excel spread sheet. Data also analyzed by SPSS software. Semi structured type of Bengali questionnaire was analyzed and discussed about the socio-demographic factors such as age, gender, educational status, occupation, residential area etc. And this questionnaire was also discussed about injury related information, different types of respiratory complications after spinal cord injury. Researcher found out the results by SPSS software-version 20 that analyzed in excel. The data were analyzed by descriptive statistics and results were presented with the use of percentage (%).

Chi square (χ2) Test

Chi square (χ2) Test is the most popular discrete data hypothesis testing method. It is a non-parametric test of statistical significance for bivibrate tabular analysis with a contingency table. In this study Chi square (χ2) test was done to measure the associations between two variables. It was used to test the statistical significance of results reported in bivariate tables.

Assumption

Different and Independent variable

Variables were quantitative

Normal Distribution of the variable

Formula: the test statistics follow-

$\chi 2 = \sum_{i=1}^{k} (0 - E)^2 / E$

Here,

χ2 = Chi square value

∑ = The sum of

O = Observed count

E = Expected count

Chi square is the sum of the squared differences between observed (O) and the expected (E) data divided by expected (E) data in all possible categories.

Level of significance

The researcher has used 5% level of significant to test the hypothesis. If the p value for the calculated $\chi 2$ is $p<0.05$ conclude that there is significant association between the two variables. The $\chi 2$ value and the level of significance are presented through table.

3.9 Inclusion Criteria

- Persons with Spinal Cord Injury attending at CRP with respiratory complication.
- Both male and female patients with SCI.
- Spinal cord injury- induced tetraplegia between C2 and C8 with related respiratory deficits during the initial level of hospitalization.
- People who willingly participate in the study.
- Medically stable as deemed by treating physician.

3.10 Exclusion Criteria

- SCI patients with head injury.
- Significant chest trauma such as flail ribs or pneumothorax.
- Patient who are suffering from serious pathological disease e.g. tumors, tuberculosis etc.

3.11 Ethical Consideration

The proposal was submitted and prepared for the Institutional Review Board (IRB) and the Bangladesh Health Profession Institute (BHPI), and the board approved it. The study was carried out in accordance with the World Health Organization (WHO) and Bangladesh Medical Research Council (BMRC) guidelines. Before collecting data, participants provided written or verbal consent. The samples who were interested in the study had given consent forms during the course of the study, and the purpose of the research and the consent form were explained to them verbally. Their jobs were not interfered by the study. They were told that their participation was entirely voluntary. They had the option to withdraw or discontinue participation in the study at any time. They were also informed that their information would be kept confidential. The participant should be assured that his or her name and address will not be used. The participants were also told that the study's findings would not be harmful to them.

3.12 Informed Consent

Written consent was given to all participants prior to completion of the questionnaire. The investigator explains to the participants about his or her role in this study. The investigator received a written consent form every participants including signature. So the participant assured that they could understand about the consent form and their participation was on voluntary basis. The participants were informed clearly that their information would be kept confidential. The investigator assured the participants that the study would not be harmful to them. It was explained that there might not a direct benefit from the study for the participants but in the future cases like them might get benefit from it. The participants had the rights to withdraw consent and discontinue participation at any time without prejudice to present or future care at the community. Information from this study was anonymously coded to ensure confidentiality and was not personally identified in any publication containing the result of this study**.**

3.13 Rigor of the study

The rigorous manner was maintained to conduct the study. The study was conducted in a clean and systemic way. During the data collection it was ensured that participants were not influenced by experience. The answers were accepted whether they were in negative or positive impression. No leading questions were asked. The participant information was coded accurately checked by the supervisor to eliminate any possible errors. The entire information was handled with confidentiality. In the result section, outcome was not influenced by showing any personal interpretation. Every section of the study was checked & rechecked by research supervisor.

CHAPTER – IV RESULTS

The cross sectional study was conducted to achieve the research objectives. The main objective of the study was to explore the respiratory complications of tetraplegic of spinal cord injury patients at CRP. The collected data were calculated as percentages and presented by using graph (bar chart, pie chart, column chart).

Socio- demographic information (n= 50)

Variable	n (%)	Variable	n (%)
Age of participants		Rural	34(68%)
Mean	34.30	Urban	16(32%)
Standard deviation	±14.227	**Cause of injury**	
6-30 years	23(46%)	Motor vehicle injury	11(22%)
31-55 years	23 (46%)	Fall From Height	20(40%)
56-80 years	4(8%)	Fall carrying heavy Load	13(26%)
Gender of participants		Sports related	1(2%)
Male	47(94%)	Fall heavy object on back	3(6%)
Female	3(6%)	Others	2(4%)
Occupation		**Diagnosis**	
Rickshaw puller	1(2%)	Complete A	31(62%)
Agriculture	11(22%)	Incomplete B	11(22%)
Garment worker	1(2%)	Incomplete C	6(12%)
Driver	2(4%)	Incomplete D	2(4%)
Businessman	13(26%)	**Neurological level**	
Day labour	6(12%)	C2	7(14%)
Unemployed	2(4%)	C3	5(10%)
Student	1(2%)	C4	26(52%)
Teacher	9(8%)	C5	7(4%)
Other	4(4%)	C6	4(8%)
Education level		C7	1(2%)
Illiterate	31(62%)		
Literate	11(22%)		
Well educated	8(16%)		
Residential area			

50 tetraplegic spinal cord injury patients were included as sample of the study, among them 94% (n=47) were male and about 6% (n=3).The participants with 6-30 years were 46.0% (n=23), 31-55 years were 46.0% (n=23), 56-80 years were 8% (n=4).In this study, 62% (n=31) patients were illiterate (those who cannot sign), about 22% (n=11) patients were literate (those who only can read and write) and about 16% (n=8) were well educated (those who have at least one board certificate). The study demonstrated that people with lower educational level were more in spinal cord injury. Among them 22% (n=11) were agriculture, 12% (n=6) were day labor, 4% (n=2) were driver, 26% (n=13) were businessman, 4% (n=2) unemployed, 2% (n=1) were teacher, 18% (n=9) were students, 2% (n=1) rickshaw puller, 2% (n=1) were garment worker and 8 % (n=4) were others. About 68% (n=34) people were lived in rural area and leads poor qualities of life, about 32% (n=16) people were from urban areas. The research shows that spinal cord injury is more common in the rural people who had lower educational status. In this study it was found that, 40% (n=20) were injured by fall from height, 22% (n=11) were by motor vehicle or road traffic accident, Fall while carrying heavy load were 26% (n=13), fall of heavy objects on back were 6% (n=3) sports related were 2%(n=1) and others were 4% (n=2). The percentage of neurological level C2 14%(n=7), C3 10%(n=5), C4 52%(n=26), C5 14%(n=7), C6 8%(n=4), C7 2%(n=1). Researcher found that 62% (n=31) were complete A spinal cord injured, 22% (n=11) were incomplete B, 12% (n=6) were incomplete C, 4% (n=2) were incomplete D. In this study, it is shown that complete spinal cord injuries are higher than incomplete spinal cord injury also most of them were complete A according to ASIA impairment scale.

4.1 Pneumonia

Among 50 tetraplegic spinal cord injury patients, the researcher found that about 44% (n=22) was complained of Pneumonia and 56% (n=28) has no complain of Pneumonia

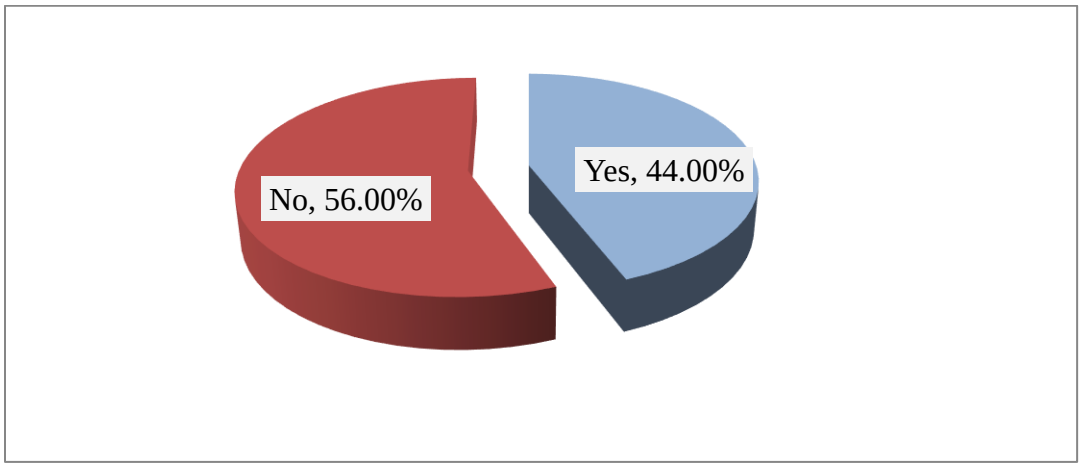


Figure 1: Percentage of Pneumonia

4.2 Atelectasis

From the data of the present study, the researcher was found that about 42% (n=21) spinal cord injury patient have atelectasis and 58% (n=29) patient have no atelectasis**.**

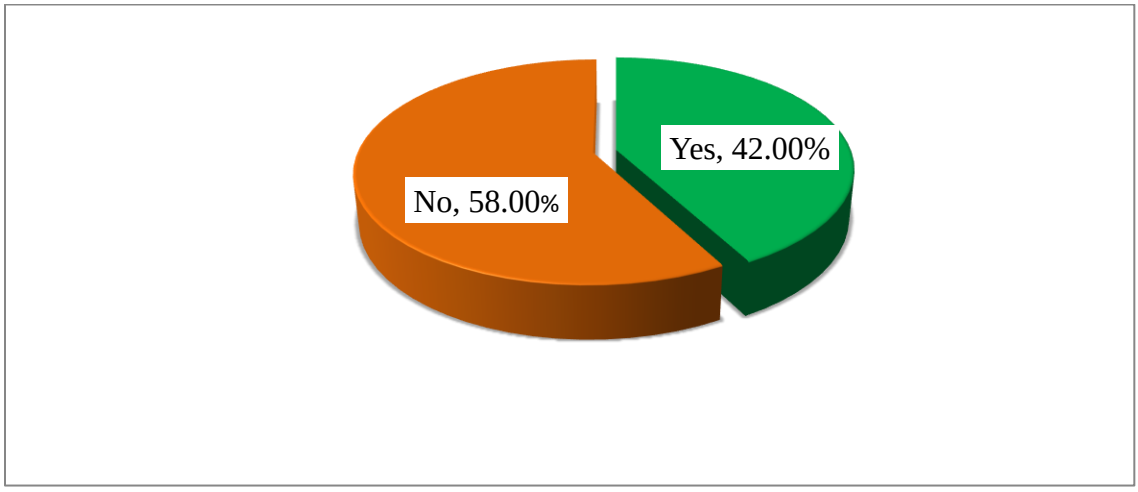


Figure 2: Percentage of atelectasis

4.3 Cough first thing in the morning

Out of 50 tetraplegic spinal cord injury participants, there were 62% (n=31) had complain of cough during the day or night and 38% (n=19) had no complain of cough during the day or night.

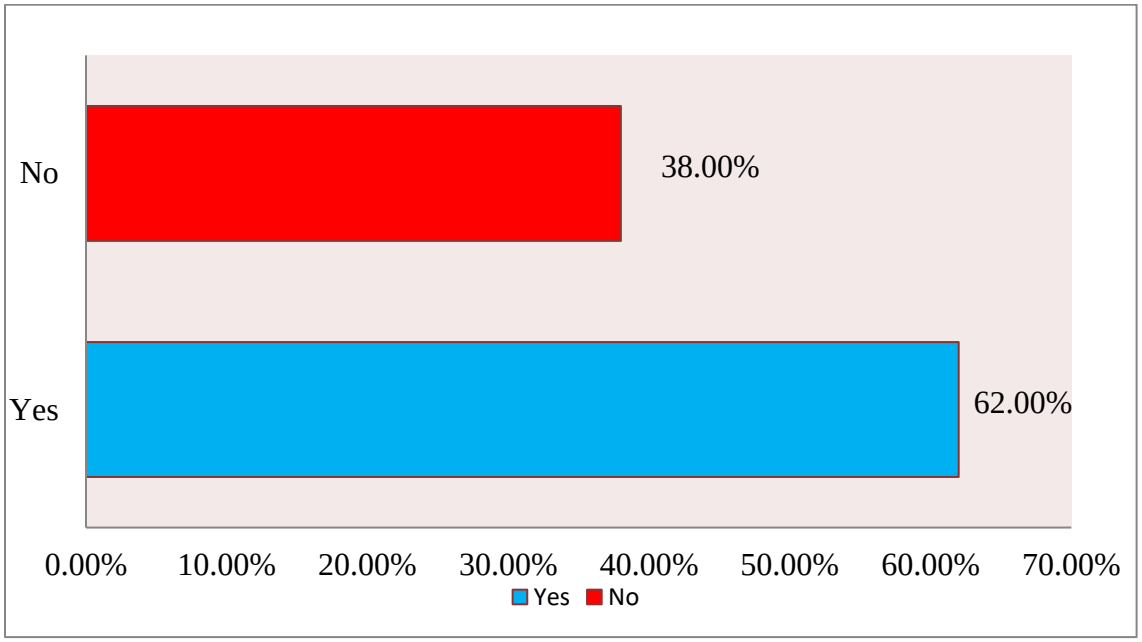


Figure 3: Percentage of cough first thing in the morning

4.4 Cough during the day or night

Out of 50 tetraplegic spinal cord injury participants, there were 60% (n=30) had no complain of cough during the day or night 40% (n=20) had complain of cough during the day or night.

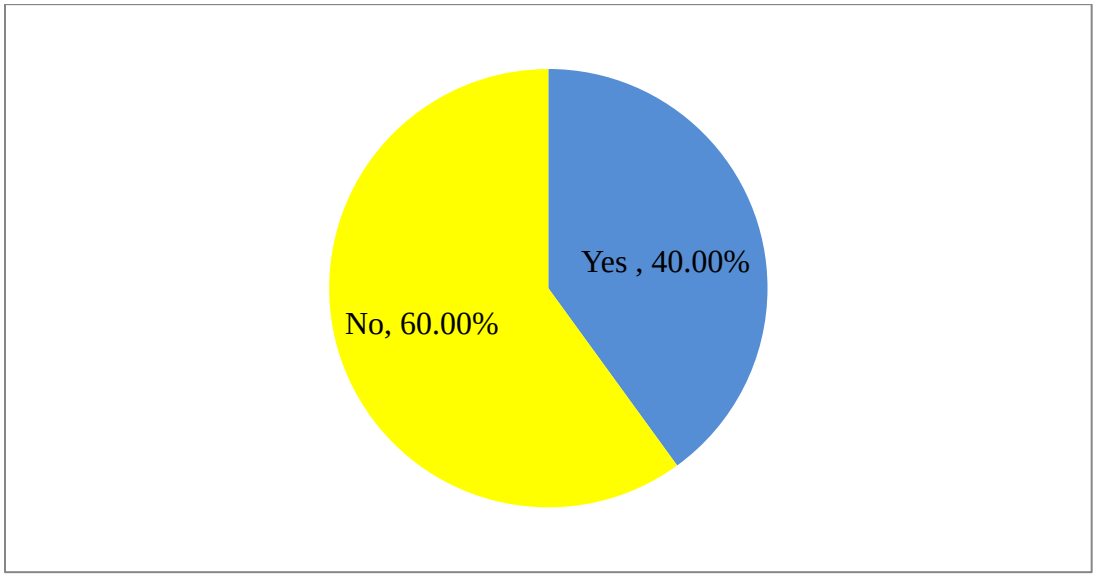


Figure 4: Percentage of cough during day or night

4.5 Shortness of breath during walking

From the data of the present study, among 50 participants the researcher was found that about 98% (n=49) spinal cord injury patient have no shortness of breath 2% (n=1) patient have shortness of breath.

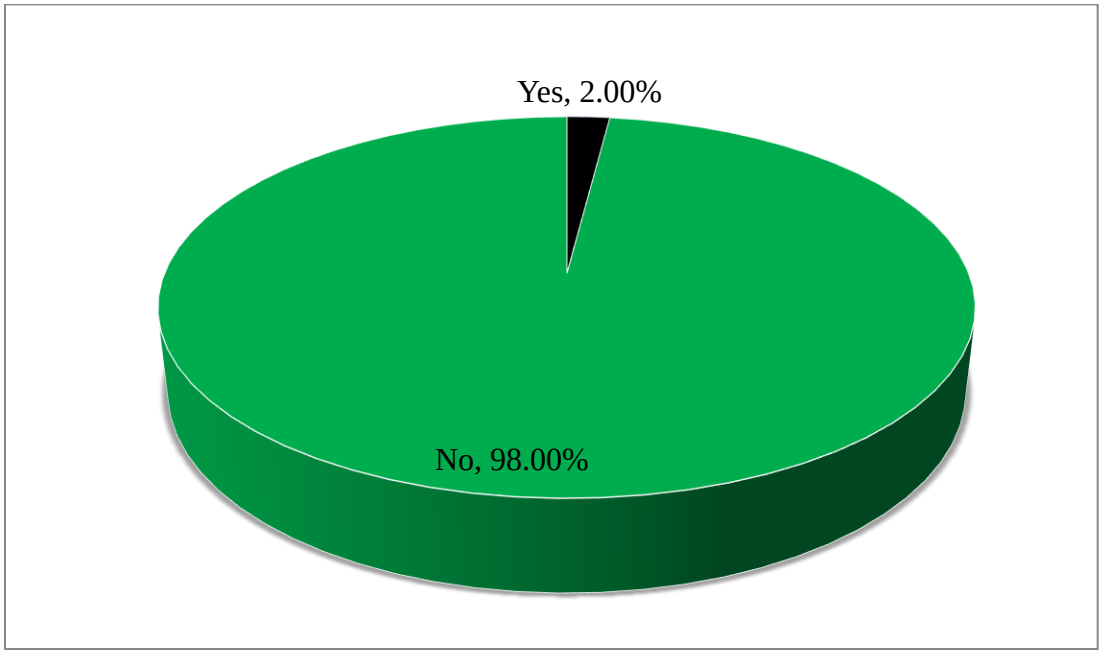


Figure 5: Percentage of shortness of breath during walking

4.6 Wheezing or whistling

50 tetraplegic spinal cord injury participants were used as sample in this study. Among them, the researcher found that 82% (n=41) has no complain of wheezing or whistling and rest of 18% (n=9) has complain of wheezing or whistling.

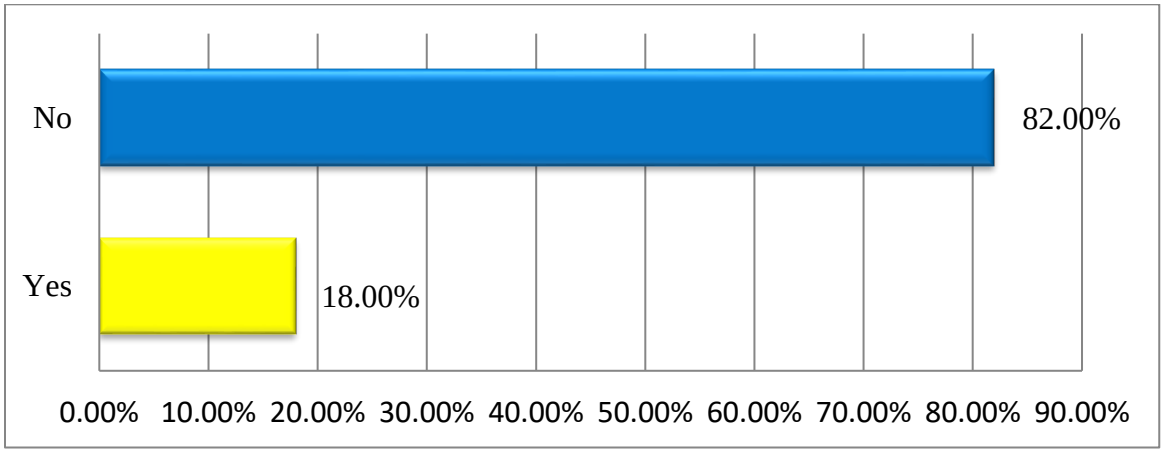


Figure 6: Percentage of wheezing and whistling

4.7 Heart trouble

50 tetraplegic spinal cord injury participants were used as sample in this study. Among them, the researcher found that 86% (n=43) has no heart trouble and rest of 14% (n=7) has complain of heart trouble. In this study older people have more heart trouble.

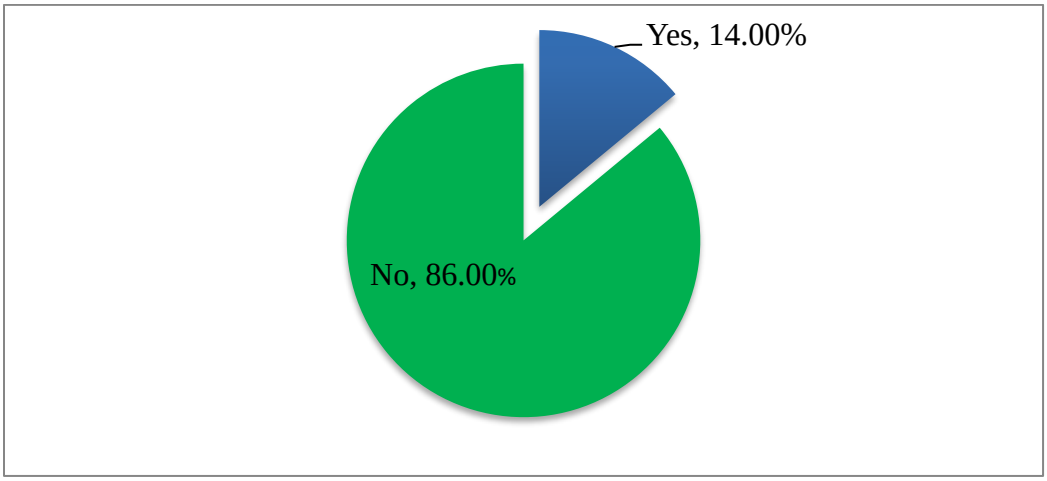


Figure 7: Percentage of heart trouble

4.8 A deep or satisfying breath

In this study among 50 tetraplegic spinal cord injury patients it is found that about 62% (n=31) participants has deep or satisfying breath and rest of 38% (n=19) participants has no deep or satisfying breath.

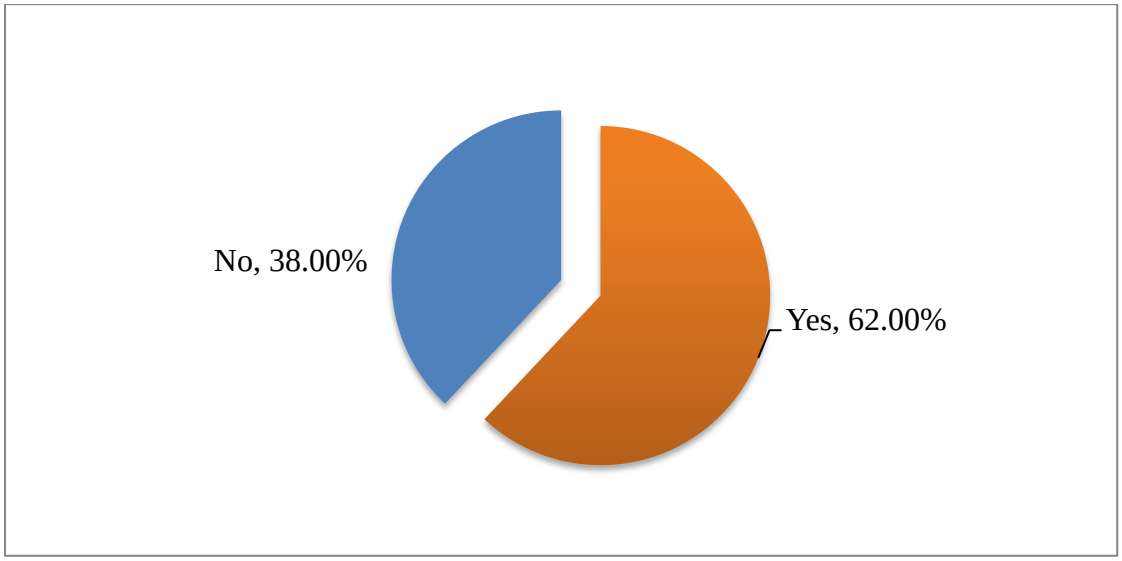


Figure 8: Percentage of a deep or satisfying breath

4.9 Smoking

50 tetraplegic spinal cord injury participants were used as sample in this study. Among them, the researcher found that 60% (n=30) were smoker and rest of 40% (n=20) were not smoker. In this study the number of smoker people are more in younger than others people.

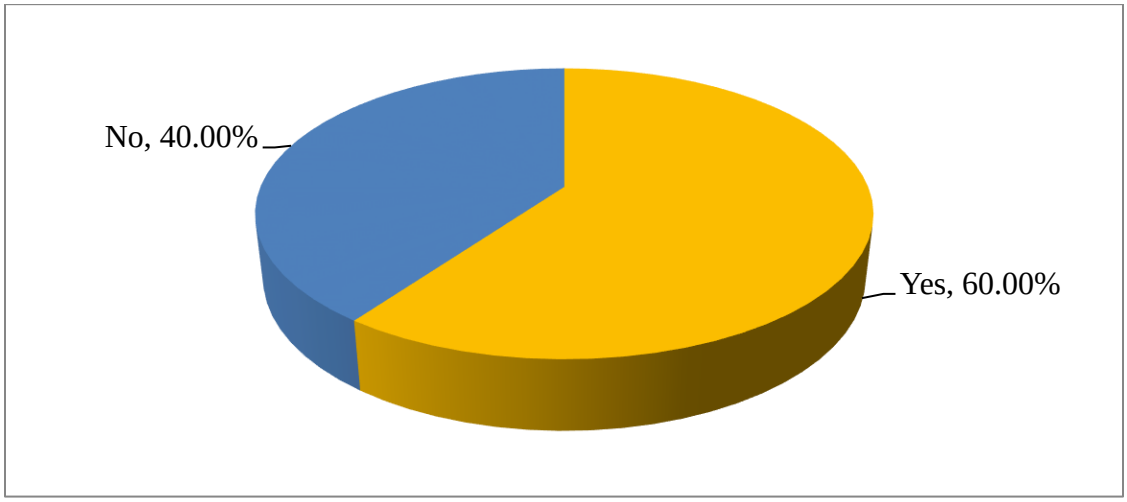


Figure 10: Percentage of smoking

4.10 Respiratory rate

Out of 50 patients, percentage of respiratory rate are 14% (n=7) has respiratory rate 18breath/min, 38% (n=19) has respiratory rate 20 breath/min, 36% (n=18) has respiratory rate 12% (n=6) has respiratory rate 24 breath/min.

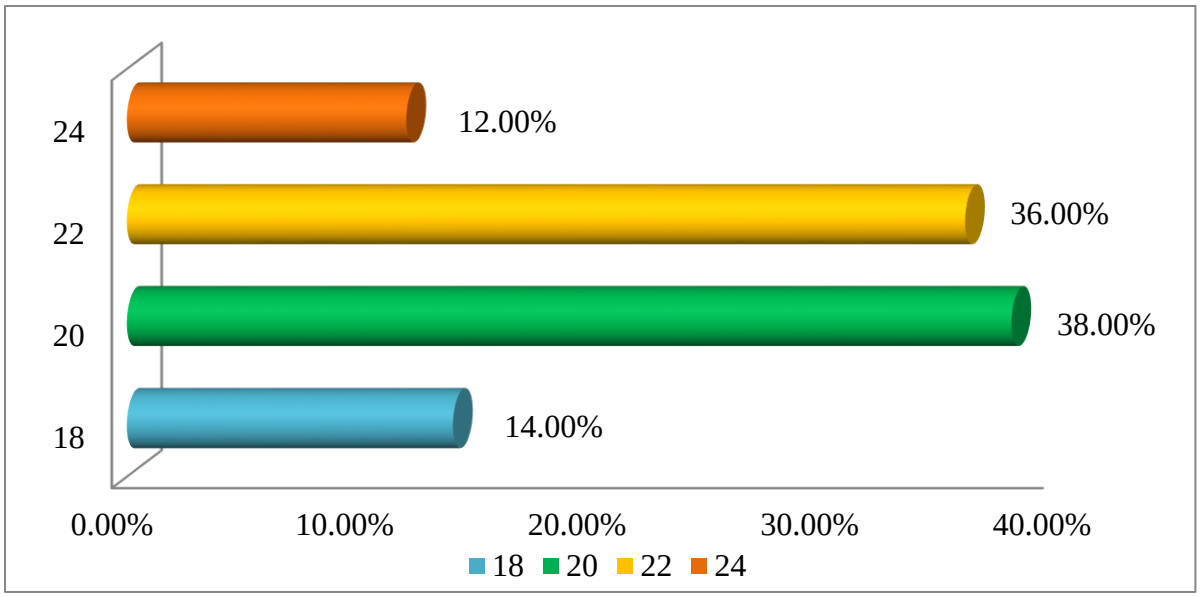


Figure 11: Percentage of respiratory rate

4.11 Breathing pattern

There were 50 patients who participate in this study. Most of them have Abdomino thoracic breathing pattern 68% (n=34) and Thoraco abdominal breathing pattern 32% (n=16).

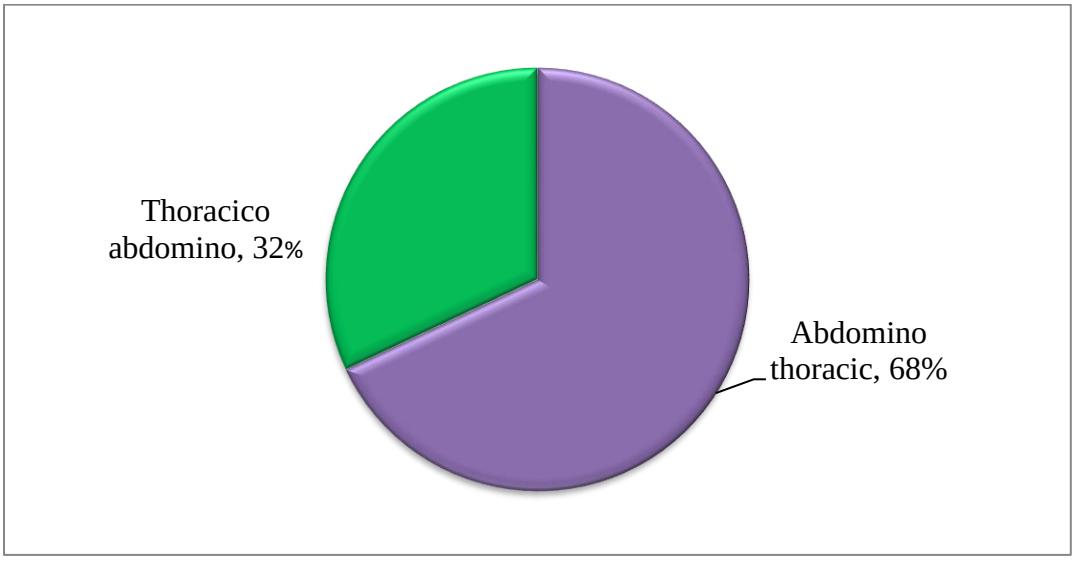


Figure 12: Percentage of breathing pattern

4.12 Peak flow meter

In this study among 50 tetraplegic spinal cord injury patients it is found that about 22%(n=11) participants peak flow rate is 150 , 28% (n=14) participants peak flow rate is 200, 26%(n=13)participants peak flow rate is 250, 24%(n=12) participants peak flow rate is 300.

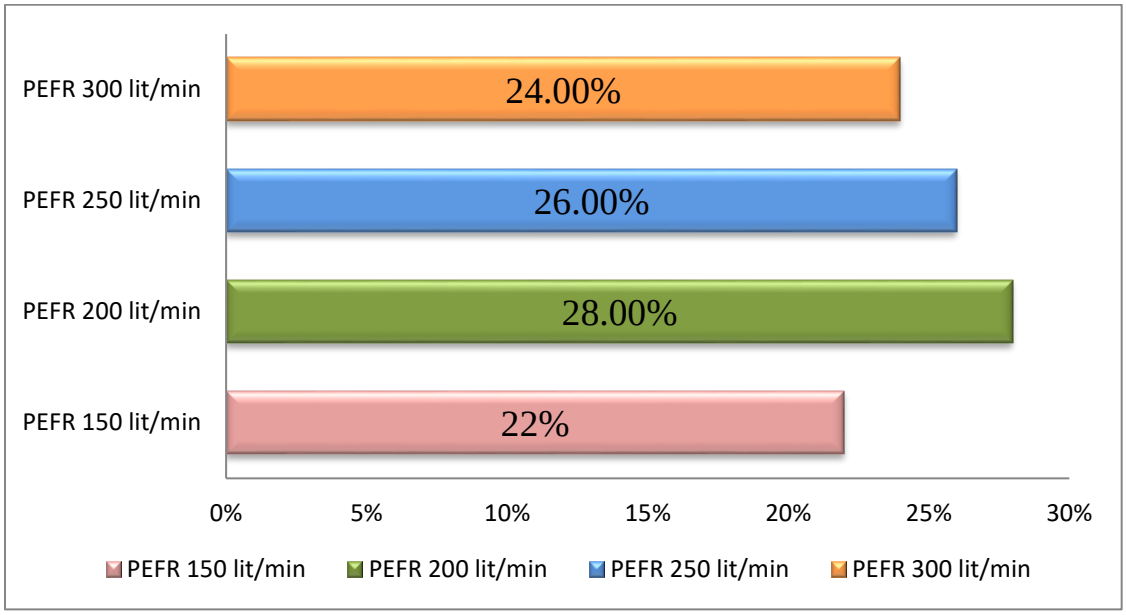


Figure 13: Percentage of peak flow meter

4.13 Incentive spirometry

50 tetraplegic spinal cord injury participants were used as sample in this study. Among them, the researcher found that only 30% (n=15) participants incentive spirometry rate is 300, 26% (n=13) participants incentive spirometry rate is 400, 18% (n=18) participants incentive spirometry rate is 500, 12% (n=12) participants incentive spirometry rate is 550, 14% (n=7) participants incentive spirometer rate is 600.

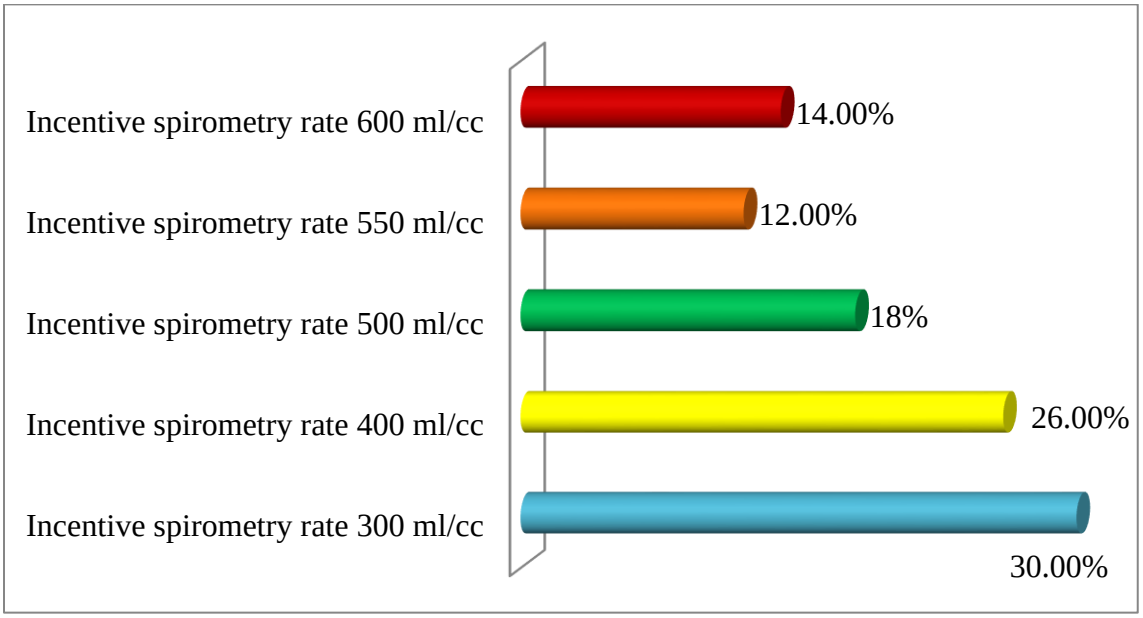


Figure 14: Percentage of Incentive spirometry

4.15 Oxygen saturation

Out of 50 patients, percentage of oxygen saturation are 16% (n=8) has oxygen saturation rate 94, 18% (n=9) has respiratory rate 95, 14% (n=7) has oxygen saturation rate 96, 6% (n=3) has oxygen saturation rate 97, 34% (n=17) has oxygen saturation rate 98, 12% (n=6) has oxygen saturation rate 99.

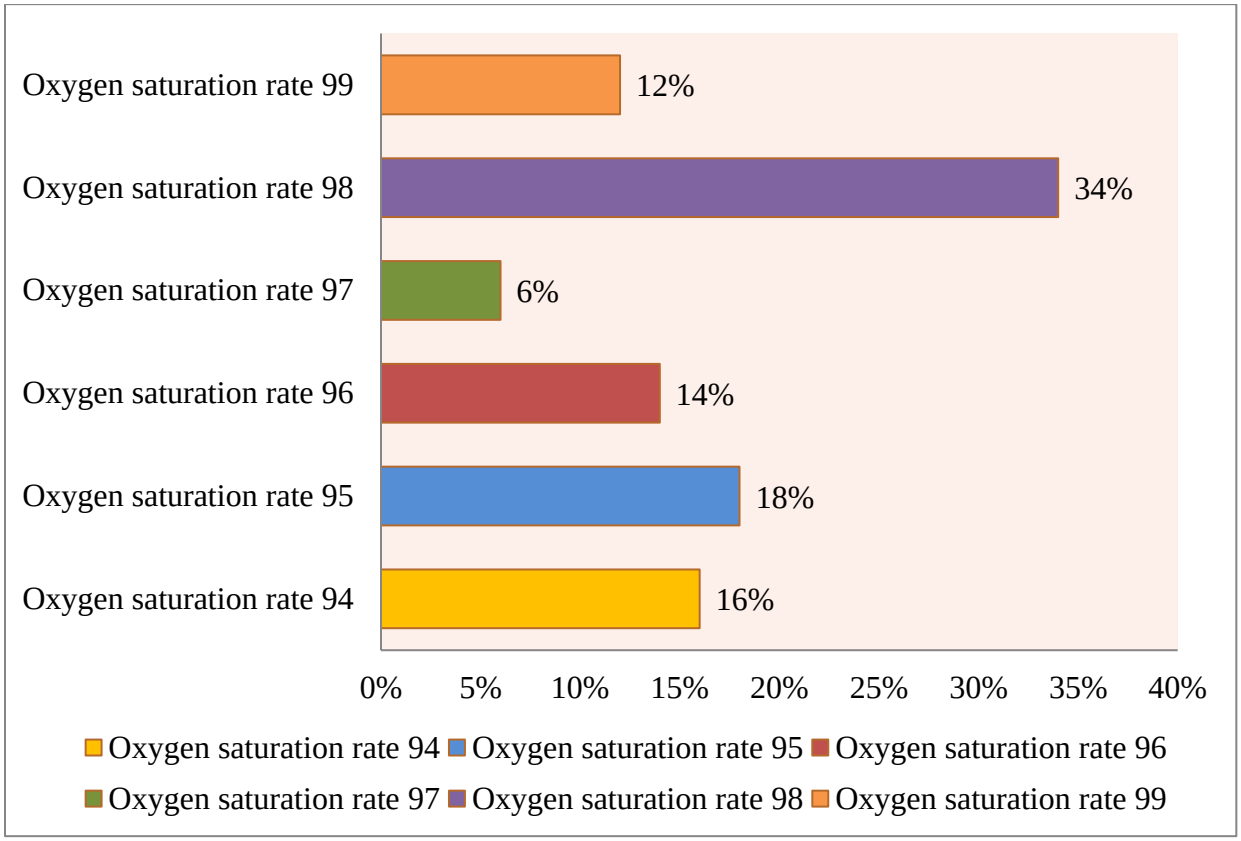


Figure 15: Percentage of oxygen saturation

4.16 Mean, minimum and maximum 0f PEFR, Incentive spirometry, oxygen saturation

Dimensions	Mean score & range
Peak expiratory flow rate	226 (150-300)
Incentive spirometer rate	434 (300-600)
Oxygen saturation rate	96.60 (94-99)

According to the analysis mean score of peak flow rate is 226 and the minimum to maximum range of peak flow rate is (150-300). The mean score of incentive spirometry rate is 434 and the minimum to maximum range of incentive spirometer is (300-600). The mean score of oxygen saturation rate is 96.60 and minimum to maximum range of oxygen saturation is (94-99).

4.17 Percentage of PEFR according to age range

Age	PEFR			
	150lit/min	200lit/min	250lit/min	300lit/min
6-30 years	54.5%	42.9%	61.5%	25.0%
31-55 years	27.3%	57.1%	30.8%	66.7%
56-80 years	18.2%	0.0%	7.7%	8.3%
Total	100%	100%	100%	100%

The table demonstrated that among 50 participants, 6-30 years of people have peak flow rate 150 lit/min= 54.5%, 200 lit/min= 42.9%, 250 lit/min= 61.5% and 300 lit/min= 25%. 31-55 years of people have peak flow rate 150 lit/min= 27.3%, 200 lit/min= 57.1%, 250 lit/min= 30.8% and 300 lit/min= 66.7%. 56-80 years of people have peak flow rate 150 lit/min= 18.2%, 200 lit/min= 0.0%, 250 lit/min= 7.7% and 300 lit/min= 8.3%.

4.18 Percentage of PEFR according to ASIA

ASIA	PEFR			
	150lit/min	200lit/min	250lit/min	300lit/min
Complete A	81.8%	50.0%	69.2%	50.0%
Incomplete B	18.2%	14.3%	23.1%	33.3%
Incomplete C	0.0%	35.7%	0.0%	8.3%
Incomplete D	0.0%	0.0%	7.7%	8.3%
Total	100%	100%	100%	100%

According to ASIA complete A patients have peak flow rate 150 lit/min=81.8%, 200 lit/min= 50.0%, 250lit/min=69.2%, 300lit/min= 50.0%. Incomplete B have peak flow rate 150 lit/min=18.2%, 200 lit/min= 14.3%, 250lit/min=23.1%, 300lit/min= 33.3%. Incomplete C have peak flow rate 150 lit/min=0.0%, 200 lit/min= 35.7%, 250lit/min=0.0%, 300lit/min= 8.3%. Incomplete D have peak flow rate 150 lit/min=0.0%, 200 lit/min= 0.0%, 250lit/min=7.7%, 300lit/min= 8.3%.

4.19 Percentage of Incentive spirometry according to age range

Age	Incentive spirometry				
	300ml/cc	400ml/cc	500ml/cc	550ml/cc	600ml/cc
6-30 years	40.0%	30.8%	55.6%	50.0%	71.4%
31-55 years	53.3%	46.2%	44.4%	50.0%	28.6%
56-80 years	6.7%	23.1%	0.0%	0.0%	0.0%
Total	100%	100%	100%	100%	100%

The table demonstrated that among 50 participants 6-30 years have incentive spirometry rate 300ml/cc=40.0%, 400ml/cc= 30.8%, 500ml/cc=55.6%, 550ml/cc=50.0%, 600ml/cc=71.4%. 31-55 years have incentive spirometry rate 300ml/cc=53.3%, 400ml/cc= 46.2%, 500ml/cc=44.4%, 550ml/cc=0.0%, 600ml/cc=0.0%. 56-80 years have incentive spirometry rate 300ml/cc=6.7%, 400ml/cc= 23.1%, 500ml/cc=0.0%, 550ml/cc=0.0%, 600ml/cc=0.0%.

4.20 Percentage of incentive spirometry according to ASIA

ASIA	Incentive spirometry				
	300ml/cc	400ml/cc	500ml/cc	550ml/cc	600ml/cc
Complete A	73.3%	53.8%	55.6%	66.7%	57.1%
Incomplete B	13.3%	38.5%	22.2%	0.0%	28.6%
Incomplete C	13.3%	7.7%	11.1%	16.7%	14.3%
Incomplete D	0.0%	0.0%	11.1%	16.7%	0.0%
Total	100%	100%	100%	100%	100%

In the table according to ASIA, complete A patients have incentive spirometry rate 300ml/cc=73.3%,400ml/cc=53.8%, 500ml/cc=55.6%, 550ml/cc=66.7%, 600ml/cc =57.1%. Incomplete B patients have incentive spirometry rate 300ml/cc=13.3%, 400ml/cc=38.5%, 500ml/cc=22.2%, 550ml/cc=0.0%, 600ml/cc =28.6%. Incomplete C patients have incentive spirometry rate 300ml/cc=13.3%, 400ml/cc=7.7%, 500ml/cc =11.1%, 550ml/cc=16.7%, 600ml/cc =0.0%. Incomplete D patients have incentive spirometry rate 300ml/cc=0.0%, 400ml/cc=0.0%, 500ml/cc=11.1%, 550ml/cc=16.7%, 600ml/cc =0.0%.

4.21 Percentage of oxygen saturation according to age range

Age	Oxygen saturation					
	94	95	96	97	98	99
6-30 years	50.0%	33.3%	28.6%	100%	41.2 %	66.7
31-55 years	50.0%	55.6%	71.4%	0.0%	47.1%	16.7
56-80 years	0.0%	11.1%	0.0%	0.0%	11.8%	16.7
Total	100%	100%	100%	100%	100%	100

Among 50 participants, 6-30yrs patients have oxygen saturation rate 94=50%, 95=33.3%, 96=28.6%, 97=100%, 98=41.2%, 99=66.7%. 31-50yrs patients have oxygen saturation rate 94=50%, 95=55.6%, 96=71.4%, 97=0.0%, 98=11.8%, 99=16.7%. 56-80yrs patients have oxygen saturation rate 94=0.0%, 95=11.1%, 96=0.0%, 97=0.0%, 98=11.8%, 99=16.7%.

4.22 Percentage of Oxygen saturation according to ASIA

ASIA	Oxygen Saturation					
	94	95	96	97	98	99
Complete A	37.5%	66.7%	42.9%	100%	76.5%	50.0%
Incomplete B	50.0%	22.2%	28.6%	0.0%	11.8%	16.7%
Incomplete C	0.0%	0.0%	28.6%	0.0%	11.8%	33.3%
Incomplete D	12.5%	11.1%	0.0%	0.0%	0.0%	0.0%
Total	100%	100%	100%	100%	100%	100%

In this study, among 50 participants, complete A patients have oxygen saturation rate 94=37.5%, 95=66.7%, 96=42.9%, 97=100%, 98=76.5%, 99=50.0%. Incomplete B patients have oxygen saturation rate 94=50.0%, 95=22.2%, 96=28.6%, 97=0.0%, 98=11.8%, 99=16.7%.Incomplete C patients have oxygen saturation rate 94=0.0%, 95=0.0%, 96=28.6%, 97=0.0%, 98=11.8%, 99=33.3%. Incomplete D patients have oxygen saturation rate 94=12.5%, 95=11.1%, 96=0.0%, 97=0.0%, 98=0.0%, 99=0.0%.

4.23 Association between respiratory complications and socio demographic information

Association in between gender and cough

Socio demographic variable	Respiratory complication	Chi-square value ($\chi 2$)	P-value
Gender	Cough	0.059	0.808

In the study, there was no association in between gender and cough. In this statement chi-square ($\chi 2$) value was 0.059 which was not statistically significant ($p<0.808$) with gender.

Association in between gender and wheezing

Socio demographic variable	Respiratory complication	Chi-square value ($\chi 2$)	P-value
Gender	Wheezing	0.709	0.403

In the study, there was no association in between gender and wheezing. In this statement chi-square ($\chi 2$) value was 0.709 which was not statistically significant ($p<0.403$) with gender.

Association in between gender and pneumonia

Socio demographic variable	Respiratory complication	Chi-square value ($\chi 2$)	P-value
Gender	Pneumonia	4.062	0.044*

In the study, there was association in between gender and pneumonia. In this statement chi-square ($\chi 2$) value was 4.062 which was not statistically significant ($p<0.044$) with gender.

Association in between gender and atelectasis

Socio demographic variable	Respiratory complication	Chi-square value ($\chi 2$)	P-value
Gender	Atelectasis	0.797	0.372

In the study, there was association in between gender and atelectasis. In this statement chi-square ($\chi 2$) value was 0.797 which was not statistically significant ($p<0.372$) with gender.

Association in between ASIA classification scale and cough

Socio demographic variable	Respiratory complication	Chi-square value ($\chi 2$)	P-value
ASIA scale	Cough	0.415	0.937

In the study, there was association in between ASIA scale and cough. In this statement chi-square ($\chi 2$) value was 0.415 which was not statistically significant ($p<0.937$) with ASIA scale.

Association in between ASIA classification scale and wheezing

Socio demographic variable	Respiratory complication	Chi-square value ($\chi 2$)	P-value
ASIA scale	Wheezing	2.197	0.533

In the study, there was association in between ASIA scale and wheezing. In this statement chi-square ($\chi 2$) value was 2,197 which was not statistically significant ($p<0.533$) with ASIA scale.

Association in between ASIA classification scale and Pneumonia

Socio demographic variable	Respiratory complication	Chi-square value ($\chi 2$)	P-value
ASIA scale	Pneumonia	0.965	0.810

In the study, there was association in between ASIA scale and wheezing. In this statement chi-square ($\chi 2$) value was 2,197 which was not statistically significant ($p<0.533$) with ASIA scale.

Association in between ASIA classification scale and Atelectasis

Socio demographic variable	Respiratory complication	Chi-square value ($\chi 2$)	P-value
ASIA scale	Atelectasis	2.296	0.513

In the study, there was association in between ASIA scale and atelectasis. In this statement chi-square ($\chi 2$) value was 2.296 which was not statistically significant ($p<0.513$) with ASIA scale.

CHAPTER – V DISCUSSION

Respiratory complications are a common and well-known problem in SCI. Respiratory insufficiency can result from paresis or paralysis of the respiratory muscles, depending on the severity and extent of the damage. Spinal cord injuries frequently results in respiratory system dysfunction and, as a result, restrictive respiratory alterations (Galeiras et al., 2013).In this study a semi structured questionnaire used to explore respiratory complication of tetraplegic patients at CRP.

This study was found, male participants 94% (n=47) were higher than the female participants 6% (n=3). Most of the injured participants of this study were male following injury. According to Razzak, (2013) found that, among 56 participants 84% were male and 16.0% were female. In this study most of the participants were from 6-30yrs and 31-55yrs ages of people. Among the study of Bangladeshi most common age group between 25-29 years in spinal cord injured patients (Islam et al., 2011).

In this study patient who lived in rural were more affected than the people who lived in urban. Among these approximately 68% (n=34) were in rural and 32% (n=16) were in urban area. Out of 50 participants in this study, 62% (n=31) patients were illiterate (those who only can sign), about 22% (n=11) patients were literate (those who only can read and write) and about 16% (n=8) were well educated (those who have at least one board certificate). The study demonstrated that people with lower educational level were more prone to have a spinal cord injury. In Canadian study, 43% (n=62) participants were complete education from high school, 49% (n=71) complete from college education or under graduation and 8% (n=12) were graduate (Noonan et al., 2010).

In this study 22% (n=11) were agriculture, 12% (n=6) were day labor, 4% (n=2) were driver, 26% (n=13) were businessman, 4% (n=2) unemployed, 2% (n=1) were teacher, 18% (n=9) were students, 2% (n=1) rickshaw puller, 2% (n=1) were garment worker and 8 % (n=4) were others. A Brazilian study showed that of the 60 patients, 38 (63.3%) had

complete or incomplete primary education, 19 (31.7%) had complete or incomplete secondary education and 3 (5%) had college education (Blanes et al., 2009).

In this study, researcher found that 62% (n=31) were complete A spinal cord injured, 22% (n=11) were incomplete B, 12% (n=6) were incomplete C, 4% (n=2) were incomplete D. It is shown that complete spinal cord injuries are higher than incomplete spinal cord injury also most of them were complete A according to ASIA impairment scale. Siddall et al. (2017) found the similar type of result in their study that 58.49% (n=31) participants had complete spinal cord injury and 41.50% (n=22) patients had incomplete spinal cord injury. Postma et al. (2016) found that motor complete (AIS A and B) tetraplegia 33 (22.4%), Incomplete (AIS C and D) tetraplegia 21 (14.3%) Motor complete (AIS A and B) paraplegia 67 (45.6%) and Incomplete (AIS C and D) paraplegia 26 (17.7%).

In this study it was found that among 50 participant 40% (n=20) were injured by fall from height, 22% (n=11) were by motor vehicle or road traffic accident, Fall while carrying heavy load were 26% (n=13), fall of heavy objects on back were 6% (n=3) sports related were 2%(n=1) and others were 4% (n=2). In the developed country, road traffic accident is the leading cause of SCI followed by fall and then sports injury (Rathore, 2010). SCI is most commonly caused by falls from trees and rooftops in Western Europe and North America, whereas falls from trees and rooftops are the most common cause in South-East Asia and Oceania (Cripps et al., 2011). Razzak, (2013) found that the most common causes of injury were falls (50%), followed by road traffic accidents (RTA) and carrying loads on the head.

In this study researcher tried to explore respiratory complications of tetraplegic patients of SCI. such as cough during day or night yes= 40% (n=20) no=60%(n=30), pneumonia yes= 44% (n=22) no=56% (n=28). Atelectasis yes=42% (n=21) no=58% (n=29). Liebscher et al. (2015) reported that according to Centers for Disease Control criteria Pneumonia occurred in 51% of the cases within 21 ± 32 days after injury, and in 3% of the cases at a later date. The number of pre-existing conditions was significantly associated with pneumonia. Sezer et al. (2015) reported that Due to paralysis of the respiratory muscles below the level of injury, patients with cervical and upper thoracic

SCI are more likely to develop atelectasis and pneumonia, resulting in a weak cough mechanism. In the study researcher explored that Wheezing yes=18% (n=9) no=82% (n=41), deep satisfying breath yes=62% (n=31) no=38% (n=19), Smoking yes=30 (n=60) no=20% (n=40). Spungen et al. (1997) reported that sixty-eight percent of those polled experienced at least one respiratory problem. Breathlessness, the most common symptom, was linked with lesion level: HT=73 percent, LT=58 percent, HP=43 percent and LP=29 percent, but cough, phlegm, cough with phlegm, and wheeze did not differ significantly among patients in the four groups.. The awareness of phlegm or wheeze was observed to be more common in persons with tetraplegia who had full injuries. Respiratory problems did not differ significantly between current smokers, past smokers, and nonsmokers in participants with tetraplegia, however phlegm and wheeze were reported more often among current smokers in persons with paraplegia.

In this study, Breathing pattern abdomino thoracic=68% (34), thoraco abdominal=32% (16), Smoking yes=60% (n=30) no=40% (n=20). The mean score of peak flow rate is 226, incentive spirometry rate is 434 and oxygen saturation rate is 96.60. The study was carried out 50 patients. Among them. Berlowitz et al. (2016) reported that in a group of patients with high tetraplegia, peak expiratory flow rate was <50% of predicted normal values. Shin et al. (2016) The mean values of peak cough flow (L/min) were 88.3±78.9 (82.1%) in tetraplegic and 80.4±90.0 (32.1%) in paraplegic patients; 81.0±69.0 (37.5%) in complete and 86.5±86.4 (70.4%) in incomplete groups; and 41.4±53.9 (14.9%) in acute, 113.4±94.8 (104.8%) in sub-acute, and 70.9±67.9 (37.8%) in chronic groups. In this study among 50 tetraplegic patients, association found only between gender and respiratory complication (pneumonia) which was statistically significant (P>.044).

5.1 Limitation of the Study

There were a number of limitations and barriers in this research project which had affect the accuracy of the study, these are as follow:

The samples were collected only from the CRP at Savar and the sample size was small, so the result of the study could not be generalized to the whole population of Spinal Cord Injury in Bangladesh. There was little evidence to back up the project's findings in the context of Bangladesh. A convenience sample was chosen, which did not represent the larger population under research. An undergraduate student completed the research study, which was her first research project. As a result, the researcher had little expertise with procedures and tactics in terms of study methodology. Because this was the researcher's first survey, there may have been some errors that were ignored by the supervisor and the esteemed teacher.

CHAPTER – VI CONCLUSION AND RECOMMENDATION

6.1 Conclusion

Spinal cord injury is one of life's most traumatic events. In many nations, the annual incidence of SCI ranges from 15 to 40 cases per million. There is also a dearth of understanding of damage, particularly that induced by SCI, in this country. In Asia as well as Bangladesh, it is a leading cause of disability.

Many people are impacted by spinal cord injury every year, whether due to a traumatic or non-traumatic cause. . It has such a negative impact on a person's ability to operate in daily life after a spinal cord injury. It can aggravate pain, make sleep difficult. Spinal cord damage can impact anybody, at any age, at any time, although active younger males are more likely than females to sustain a spinal cord injury which detract from enjoyment, and make it harder to maintain good health.

Respiratory complications following acute SCI are common and predictable, depending on cognitive disability, concomitant injuries, and pre-injury medical factors. The greater the severity and extent of the damage, the more respiratory muscles are affected, and the more respiratory function may be hampered. After a lower cervical spinal cord trauma (C4–C8), the initial phase (up to 4 weeks) is marked by a high risk of respiratory problems.

The study also explored the respiratory complication. Such as cough, shortness of breath, pneumonia. atelectasis, wheezing, deep satisfying breath, breathing without assistance, breathing pattern, respiratory rate, peak expiratory flow rate, incentive spirometer rate, oxygen saturation rate etc of tetraplegic patients of spinal cord injury patients. In the acute period of SCI, respiratory problems are the leading cause of morbidity and mortality. During the acute phase of the injury, respiratory problems were observed.

The severity of respiratory difficulties is determined by the degree of spinal cord damage and motor disability. Pulmonary issues linked with spinal cord injury respiratory complications are the most common cause of mortality among SCI patients, according to long-term follow-up. A large-scale epidemiological assessment in the county is needed to examine the illness burden and the factors that contribute to this deadly condition. So

assessing respiratory difficulties in patients with spinal cord injury and developing a good treatment plan during the rehabilitation phase is critical and should always be prioritized.

6.2 Recommendation

The context in which the study was done informs the recommendation. It is suggested that, if at all possible, someone overcome the existing barrier to allow for further research. If possible, undertake additional research in this area.

Despite the fact that the study has significant limitations such as The samples were collected only from the CRP at Savar and the sample size was small, so the result of the study could not be generalized to the whole population of Spinal Cord Injury in Bangladesh. There was little evidence to support the result of this project in the context to Bangladesh. It has revealed several additional steps that could be taken to improve the success of future research.

For the cross sectional study, it is recommended that a bigger sample be chosen at random to ensure the research's generalizability. The sample should be representative of the population as a whole. The results will be more significant if the researcher does a long-term study. Last but not least, the entire research team proposed that the study be conducted across the entire country of Bangladesh in order to generalize the findings.

REFERENCE

Ahuja, C.S., Wilson, J.R., Nori, S., Kotter, M.R., Druschel, C., Curt, A. and Fehlings, M.G., (2017). Traumatic spinal cord injury. Nature Reviews Disease primers, 3(1):1-21.

Arora, S., Flower, O., Murray, N.P. and Lee, B.B., (2012). Respiratory care of patients with cervical spinal cord injury: a review. Critical Care and Resuscitation, 14(1):64-73.

Bach, J.R., (2012). Noninvasive respiratory management of high level spinal cord injury. The journal of spinal cord medicine, 35(2):72-80.

Bach, J.R., Burke, L. and Chiou, M., (2020). Conventional Respiratory Management of Spinal Cord Injury. Physical Medicine and Rehabilitation Clinics, 31(3):379-395.

Berlly, M. and Shem, K., (2007). Respiratory management during the first five days after spinal cord injury. The journal of spinal cord medicine, 30(4):309-318.

Berlowitz, D.J., Wadsworth, B. and Ross, J., (2016). Respiratory problems and management in people with spinal cord injury. Breathe, 12(4):328-340.

Berney, S., Bragge, P., Granger, C., Opdam, H. and Denehy, L., (2011). The acute respiratory management of cervical spinal cord injury in the first 6 weeks after injury: a systematic review. Spinal cord, 49(1):17-29.

Blanes, L., Lourenço, L., Carmagnani, M.I.S. and Ferreira, L.M., (2009). Clinical and socio-demographic characteristics of persons with traumatic paraplegia living in São Paulo, Brazil. Arquivos de neuro-psiquiatria, 67(2):388-390.

Boswell-Ruys, C.L., Lewis, C.R., Wijeysuriya, N.S., McBain, R.A., Lee, B.B., McKenzie, D.K., Gandevia, S.C. and Butler, J.E., (2020). Impact of respiratory muscle training on respiratory muscle strength, respiratory function and quality of life in individuals with tetraplegia: a randomised clinical trial. Thorax, 75(3):279-288.

Burns, A. S., Marino, R. J., Flanders, A. E., & Flett, H. (2012). Clinical diagnosis and prognosis following spinal cord injury. Handbook of Clinical Neurology, 109:47-62.

Casha, S. and Christie, S., (2011). A systematic review of intensive cardiopulmonary management after spinal cord injury. Journal of neurotrauma, 28(8):1479-1495.

Cripps, R. A., Lee, B. B., Wing, P., Weerts, E., Mackay, J., & Brown, D. (2011). A global map for traumatic spinal cord injury epidemiology: towards a living data repository for injury prevention. Spinal cord, 49(4):493-501.

DeVivo, M. J. (2012). Epidemiology of traumatic spinal cord injury: trends and future implications. Spinal cord, 50(5): 365-372.

Dixon, T.M. and Budd, M.A., (2017). Spinal Cord Injury. In practical psychology in medical rehabilitation, 12(4): 127-136.

Fehlings, M. G., & Perrin, R. G. (2006). The timing of surgical intervention in the treatment of spinal cord injury: a systematic review of recent clinical evidence. Spine, 31(11):S28-S35.

Fehlings, M.G., Tator, C.H., Shaffrey, C.I., Harkema, S.J. and Hodes, J.E., (2012). Incidence and severity of acute complications after spinal cord injury. Journal of Neurosurgery: Spine, 17(1):119-128.

Geyh, S., Fellinghauer, B.A., Kirchberger, I. and Post, M.W., (2010). Cross-cultural validity of four quality of life scales in persons with spinal cord injury. Health and Quality of Life Outcomes, 8(1):1-16.

Hagen, E.M., (2015). Acute complications of spinal cord injuries. World journal of orthopedics, 6(1):17.

Hagen, E.M., Rekand, T., Gilhus, N.E. and Grønning, M., (2012). Traumatic spinal cord injuries–incidence, mechanisms and course. Tidsskrift for Den norske legeforening, 132(7): 831-837.

Hawryluk, G., Whetstone, W., Saigal, R., Ferguson, A., Talbott, J., Bresnahan, J., Dhall, S., Pan, J., Beattie, M. and Manley, G., (2015). Mean arterial blood pressure correlates with neurological recovery after human spinal cord injury: analysis of high frequency physiologic data. Journal of neurotrauma, 32(24):1958-1967.

Islam, M.S., Hafez, M.A., and Akter, M., (2011). Characterization of spinal cord lesion in patient attending a specialized rehabilitation center in Bangladesh, Spinal cord, 49(7):783- 6

Jensen, M. P., Kuehn, C. M., Amtmann, D., & Cardenas, D. D. (2007). Symptom burden in persons with spinal cord injury. Archives of physical medicine and rehabilitation, 88(5):638-645.

Kirshblum, S. C., Burns, S. P., Biering-Sorensen, F., Donovan, W., Graves, D. E., Jha, A., & Waring, W. (2011). International standards for neurological classification of spinal cord injury (revised 2011). The journal of spinal cord medicine, 34(6):535-546.

Krishnan, S., Karg, P. E., Boninger, M. L., & Brienza, D. M. (2017). Association between presence of pneumonia and pressure ulcer formation following traumatic spinal cord injury. The journal of spinal cord medicine, 40(4):415-422.

Lee, B.B., Cripps, R.A., Fitzharris, M. and Wing, P.C., (2014). The global map for traumatic spinal cord injury epidemiology: update 2011, global incidence rate. Spinal cord, 52(2):110-116.

Lenehan, B., Street, J., Kwon, B.K., Noonan, V., Zhang, H., Fisher, C.G. and Dvorak, M.F., (2012). The epidemiology of traumatic spinal cord injury in British Columbia, Canada. Spine, 37(4):321-329.

Levi, A.D., Casella, G., Green, B.A., Dietrich, W.D., Vanni, S., Jagid, J. and Wang, M.Y., (2010). Clinical outcomes using modest intravascular hypothermia after acute cervical spinal cord injury. Neurosurgery, 66(4):670-677.

Liebscher, T., Niedeggen, A., Estel, B. and Seidl, R.O., (2015). Airway complications in traumatic lower cervical spinal cord injury: A retrospective study. The journal of spinal cord medicine, 38(5):607-614.

Lim, S.W., Shiue, Y.L., Ho, C.H., Yu, S.C., Kao, P.H., Wang, J.J. and Kuo, J.R., (2017). Anxiety and depression in patients with traumatic spinal cord injury: a nationwide population-based cohort study. *PLoS One*, *12*(1), p.e0169623.

Moghimian, M., Kashani, F., Cheraghi, M. A., & Mohammadnejad, E. (2015). Quality of life and related factors among people with spinal cord injuries in Tehran, Iran. Archives of trauma research, 4(3).

Ning, G.-Z., Wu, Q., Li, Y.-L., & Feng, S.-Q. (2012). Epidemiology of traumatic spinal cord injury in Asia: A systematic review. The Journal of Spinal Cord Medicine, 35(4):229–239.

Noonan, V., Kopec, J., Mâsse, L. and Dvorak, M., (2010). Measuring participation among persons with spinal cord injury: comparison of three instruments. Topics in Spinal Cord Injury Rehabilitation, 15(4):49-62.

Post, M., (2014). Definitions of quality of life: what has happened and how to move on. Topics in spinal cord injury rehabilitation, 20(3):167-180.

Postma, K., Post, M. W. M., Haisma, J. A., Stam, H. J., Bergen, M. P., & Bussmann, J. B. J. (2016). Impaired respiratory function and associations with health-related quality of life in people with spinal cord injury. Spinal Cord, 54(10):866-871.

Postma, K., Vlemmix, L. Y., Haisma, J. A., De Groot, S., Sluis, T. A., Stam, H. J., & Bussmann, J. B. (2015). Longitudinal association between respiratory muscle strength and cough capacity in persons with spinal cord injury: an explorative analysis of data from a randomized controlled trial. Journal of rehabilitation medicine, 47(8): 722-726.

Razzak, A.T.M.A., (2013). Early care following traumatic spinal cord injury (TSCI) in a rehabilitation centre in Bangladesh-an analysis. Disability, CBR & Inclusive Development, 24(2):64-78.

Ryken, T.C., Hurlbert, R.J., Hadley, M.N., Aarabi, B., Dhall, S.S., Gelb, D.E., Rozzelle, C.J., Theodore, N. and Walters, B.C., (2013). The acute cardiopulmonary management of patients with cervical spinal cord injuries. Neurosurgery, 72(3):84-92.

Shin, J. C., Han, E. Y., Cho, K. H., & Im, S. H. (2019). Improvement in pulmonary function with short-term rehabilitation treatment in spinal cord injury patients. Scientific reports, 9(1):1-8.

Siddall, P.J., McIndoe, L., Austin, P. and Wrigley, P.J., (2017). The impact of pain on spiritual well-being in people with a spinal cord injury. Spinal Cord, 55(1):105-111.

Siddiqui, A.M., Khazaei, M. and Fehlings, M.G., (2015). Translating mechanisms of neuroprotection, regeneration, and repair to treatment of spinal cord injury. Progress in brain research, 218:15-54.

Singh, A., Tetreault, L., Kalsi-Ryan, S., Nouri, A., & Fehlings, M. G. (2014). Global prevalence and incidence of traumatic spinal cord injury. Clin Epidemiol, 6(1):309-331.

Spungen, A. M., Grimm, D. R., Lesser, M., Bauman, W. A., & Almenoff, P. L. (1997). Self-reported prevalence of pulmonary symptoms in subjects with spinal cord injury. Spinal Cord, 35(10): 652-657.

Strauss, D.J., DeVivo, M.J., Paculdo, D.R. and Shavelle, R.M., (2006). Trends in life expectancy after spinal cord injury. Archives of physical medicine and rehabilitation, 87(8):1079-1085

Sun, X., Jones, Z.B., Chen, X.M., Zhou, L., So, K.F. and Ren, Y., (2016). Multiple organ dysfunction and systemic inflammation after spinal cord injury: a complex relationship. Journal of neuroinflammation, 13(1):1-11.

Tollefsen, E. and Fondenes, O., (2012). Respiratory complications associated with spinal cord injury. Tidsskrift for Den norske legeforening, 30(4):307-308.

Voll-Aanerud, M., Eagan, T.M., Plana, E., Omenaas, E.R., Bakke, P.S., Svanes, C., Siroux, V., Pin, I., Antó, J.M. and Leynaert, B., (2010). Respiratory symptoms in adults are related to impaired quality of life, regardless of asthma and COPD: results from the European community respiratory health survey. Health and quality of life outcomes, 8(1):1-8.

Winslow, C., Bode, R.K., Felton, D., Chen, D. and Meyer Jr, P.R., (2002). Impact of respiratory complications on length of stay and hospital costs in acute cervical spine injury. Chest, 121(5):1548-1554.

World Health Organization, & International Spinal Cord Society. (2013). International perspectives on spinal cord injury. World Health Organization.

APPENDIX

VERBAL CONSENT STATEMENT

Assalamualaikum/Namasker, my name is Farhana Rahman, I am conducting this study for a Bsc. in Physiotherapy project study dissertation titled "**Explore the respiratory complications of tetraplegic SCI patients at CRP**" under Bangladesh Health Professions Institute (BHPI), University of Dhaka. I would like to know about some personal and other related information regarding Spinal Cord Injury (SCI). You will perform some tasks which are mention in this form. This will take approximately 20-30 minutes.

I would like to inform you that this is a purely academic study and will not be used for any other purpose. The researcher is not directly related with this area (spinal cord injury), so your participation in the research will have no impact on your present or future treatment in this area (spinal cord injury unit). All information provided by you will be treated as confidential and in the event of any report or publication it will be ensured that the source of information remains anonymous and also all information will be destroyed after completion of the study. Your participation in this study is voluntary and you may withdraw yourself at any time during this study without any negative consequences. You also have the right not to answer a particular question that you don't like or do not want to answer during interview.

If you have any query about the study or your right as a participant, you may contact with me, researcher and/or Mst, Fatema Akter, Assistant Professor of department of physiotherapy, Bangladesh Health Professions Institute (BHPI), CRP-Savar, Dhaka-1343
Do you have any questions before I start?

So, may I have your consent to proceed with the interview or work?

Yes ☐

No ☐

Signature of the Participant _____

Signature of the Interviewer _____

মৌখিক অনুমতি পত্র/ সম্মতি বাংলা

আসসালামুআলাইকুম/ নমস্কার,

আমার নাম ফারহানা রহমান। আমি এই গবেষণা প্রকল্পটি বাংলাদেশ হেলথ প্রফেশনাল ইনষ্টিটিউট (বিএইচপিআই) এ পরিচালনা করছি যা আমার ৪র্থ বর্ষ বি এস সি ইন ফিজিওথেরাপী কোর্সের অধিভুক্ত। আমার গবেষণার শিরোনাম হল-"মেরুরজ্জে আঘতপ্রাপ্ত রোগীদের শ্বাস প্রশ্বাসের সমস্যাবলীর বিশ্লেষন"। আমি এক্ষেত্রে আপনাকে কিছু ব্যাক্তিগত এবং আনুষঙ্গিক প্রশ্ন মেরুরজ্জু ক্ষতিগ্রস্থ সম্পর্কে করতে চাইবো। আপনাকে কিছু কাজ করতে হবে যা ফর্মটিতে উল্লেখ আছে। কাজটি সম্পন্ন হতে আনুমানিক ২০-৩০ মিনিট সময় লাগবে।

আমি আপনাকে জানাতে চাই এটি শুধুমাত্র আমার অধ্যয়নের অংশ এবং যা অন্য কোন উদ্দেশ্যে ব্যবহৃত হবে না। গবেষক সরাসরি এই স্নায়ু জ্ঞান অধ্যয়নের সাথে সম্পৃক্ত নয় । তাই এই গবেষনায় আপনার অংশগ্রহন বর্তমান ও ভবিষ্যৎ চিকিৎসায় কোন প্রকার প্রভাব ফেলবে না। আপনি যেসব তথ্য প্রদান করবেন তার গোপনীয়তা বজায় থাকবে এবং আপনার প্রতিবেদনের ঘটনা প্রবাহে এটা নিশ্চিত করা হবে যে এই তথ্যের উৎস অপ্রকাশিত থাকবে।

এই অধ্যয়নে আপনার অংশগ্রহন স্বপ্রনদীত এবং আপনি যে কোন সময় এই অধ্যয়ন থেকে কোন নেতিবাচক ফলাফল ছাড়াই নিজেকে প্রত্যাহার করতে পারবেন। এছাড়াও কোন নির্দিষ্ট প্রশ্ন অপছন্দ হলে উত্তর না দেওয়ার এবং সাক্ষাৎকারের সময় কোন উত্তর না দিতে চাওয়ার অধিকারও আপনার আছে।

এই অধ্যয়নের অংশগ্রহণকারী হিসেবে যদি আপনার কোন প্রশ্ন থাকে তাহলে আপনি আমাকে অথবা/এবং মোসাঃ ফাতেমা আক্তার, সহকারী অধ্যাপক, ফিজিউথেরাপী বিভাগ, বাংলাদেশ হেলথ প্রফেশনাল ইনষ্টিটিউট (বিএইচপিআই), সিআরপি সাভার, ঢাকা-১৩৪৩

সাক্ষাৎকার শুরু করার আগে আপনার কি কোন প্রশ্ন আছে?

আমি কি আপনার অনুমতি নিয়ে সাক্ষাৎকার শুরু করতে পারি?

হ্যাঁ ☐

না ☐

১। অংশগ্রহণকারীর স্বাক্ষর .....

২। সাক্ষাৎগ্রহণকারীর স্বাক্ষর.....

Questionnaire-English

Explore the respiratory complications of tetraplegic SCI patients at CRP

Interview Schedule Part- I: Patient's Identification (to be provided by patient or attendant)		
1.1	Identification number:	Date of Interview:
1.2	Address:	Contact no:
1.3	Consent Taken :	

Part- II: Patient's Socio-demographic Information (To be collected from Record/Patient/Care giver)			
2.1	Age (In year): ……. Yrs		
2.2	Sex	Female Male	01 02
2.3	Marital status:	Married Unmarried	01 02
2.4	Educational level	Illiterate Literate Well educated	01 02 03
2.5	Occupation	Rickshaw puller Agriculture Factory/garments worker Driver Businessman Day laborer Unemployed	01 02 03 04 05 06 07

		Housewife Teacher Student Other(Specify):_____	08 09 10 11
2.6	What is the average monthly income of your household?	_____ (Taka)	
2.7	Residential Area	Rural Urban	01 02

Part-III: Physiotherapy related Information (To be collected from Record/ Care provider/Clinical examination)		
3.1	Date of injury:	
3.2	Causes of injury:	1. Motor Vehicle Injury 2. Fall From Height 3. Fall while carrying heavy Load 4. Sports related 5. Fall of heavy object on back 6. Other (Please Specify)
3.3	Skeletal level :	
3.4	Neurological level :	
3.5	ASIA classification scale :	1. Complete A 2. Incomplete B 3. Incomplete C 4. Incomplete D 5. Normal E
3.6	Types of paralysis:	1. Tetraplegic 2. Peraplegic

Use the actual wording of each question. Put 1= Yes. 2=No, or other code as indicated in boxes. When in doubt record as No.

I am going to ask you some questions, mainly about your respiratory condition. I should like you to answer **Yes** or **No** whenever possible.

Cough

1. Do you usually cough first thing in the morning? ☐
2. Do you usually cough during the day or night? ☐

Phlegm

3. Do you usually bring up any phlegm from your chest first thing in the morning? ☐
4. Do you usually bring up any phlegm from your chest during the day or night? ☐

Breathlessness

If the patient disable from walking by any condition omit question 5 and enter 1 here. ☐

5. Do you get shortness of breath during walking? ☐
6. Do you have to stop walking for shortness of breath? ☐

Wheezing

7. Have you had attack of wheezing or whistling in your chest at any time? ☐
8. Have you ever had attack of shortness of breath with wheezing? ☐

If yes

9. Is your breathing absolutely normal between attack? ☐

Have you ever had or been told that you have had:

10. An injury or operation affecting your chest? ☐

11. Heart trouble ☐

12. Pneumonia ☐

13. Atelectasis ☐

14. Hypoventilation ☐

15. Hey fever ☐

16. Other chest trouble ☐

17. Do you feel a deep or satisfying breath? ☐

18. Do you breathe independently without assistance or device? ☐

19. Do you feel your rib cage is tight and cannot expand? ☐

20. Do you smoke? ☐

21. Do you find yourself breathing through your mouth during the day? ☐

22. Do you find yourself breathing through your mouth at night while you sleep? ☐

23. Do you take chest physiotherapy before admit at CRP? ☐

24. Do you feel better after taking chest physiotherapy? ☐

Weight	☐
Temperature	☐
Respiratory rate	☐
Peak expiratory flow (PEFR litres/min)	☐
Incentive Spirometer	☐
Breathing Pattern	☐
Oxygen saturation	☐

মেরুরজ্জে আঘাতপ্রাপ্ত রোগীদের শ্বাস প্রশ্বাসের সমস্যাবলীর বিশ্লেষন

সাক্ষাৎকারের সময়সূচী **পর্ব ১: রোগীর সনাক্তকরন/ পরিচয়** (রোগী অথবা রোগীর সহকারী তথ্য প্রদান করবেন)		
১.১	সনাক্তকরন নম্বর:	সাক্ষাতের তারিখ:
১.২	ঠিকানা:	যোগাযোগ/ফোন নম্বরঃ
১.৩	সম্মতি নেওয়া হয়েছে: হ্যাঁ ☐ না ☐	

পর্ব ২: রোগীর আর্থসামাজিক অবস্থার তথ্যবলী (রোগী অথবা রোগীর সহকারী তথ্য প্রদান করবেন)			
২.১	বয়স _____ বছর		
২.২	লিঙ্গ	নারী পুরুষ	০১ **০২**
২.৩	বৈবাহিক অবস্থা	বিবাহিত অবিবাহিত	০১ ০২
২.৪	শিক্ষাগত যোগ্যতা	অক্ষর জ্ঞান সম্পন্ন নিরক্ষর সুশিক্ষিত	০১ ০২ **০৩**
২.৫	পেশা	রিক্সা চালক কৃষি কাজ ফ্যাক্টরী/ পোশাক কারখানা শ্রমিক গাড়ী চালক ব্যবসায়ী দিন মজুর বেকার গৃহিণী শিক্ষক	০১ ০২ ০৩ ০৪ ০৫ ০৬ ০৭ ০৮ ০৯ ১০

		ছাত্র/ছাত্রী অন্যান্য:_____	**১১**
২.৬	মাসিক গড় আয় কত?	_____ টাকা	
২.৭	আবাসিক এলাকা	গ্রাম **শহর**	০১ **০২**

পর্ব ৩: ফিজিউথেরাপী সম্পর্কিত তথ্যাবলী		
৩.১	আঘাত পাওয়ার তারিখ:	
৩.২	আঘাতের কারন:	১. মটর যানের আঘাত ২. উপর থেকে পড়ে ৩. ভাড়ী কিছু বহন করার সময় পরে গিয়ে ৪. খেলাধুলার কারনে ৫. পিঠে ভারী কিছু পরেছে ৬. অন্যান্য
৩.৩	স্কেলিটাল লেভেল:	
৩.৪	স্নায়ুবিক অবস্থা:	
৩.৫	এশিয়া ক্লাসিফিকেশন স্কেল:	১. সম্পূর্ন এ ২. অসম্পূর্ন বি ৩. অসম্পূর্ন সি ৪. অসম্পূর্ন ডি ৫. স্বাভাবিক ই
৩.৬	পক্ষাঘাতের ধরন:	১. টেট্রাপ্লেজিক ২. প্যারাপ্লেজিক

প্রতিটি প্রশ্নের সঠিক উত্তর দিন। উত্তর হ্যাঁ হলে বক্সে ১ আর না হলে ২ লিখবেন। অনিশ্চিত হলে না হিসেবে বিবেচনা করবেন।

আমি আপনাকে আপনার শ্বাসযন্ত্রের অবস্থা নিয়ে কিছু প্রশ্ন করছি। আপনি হ্যাঁ অথবা না বলে উত্তর দিবেন।

কাশি

১. আপনার কি সকাল বেলা কাশি হয়? ☐

২. আপনার কি দিনে অথবা রাতে কাশি হয়? ☐

কফ

১. সকালে ঘুম থেকে উঠে বুক থেকে কফ টেনে আনেন? ☐

২. দিনে অথবা রাতে আপনি কি বুক থেকে কফ টেনে আনেন? ☐

ঊর্ধবশ্বাস

রোগী যদি হাটতে অসমর্থ হন তাহলে প্রশ্ন নং ৫ এড়িয়ে যান এবং বক্সে ১ লিখুন। ☐

৫. আপনার কি হাটার সময় শ্বাসকষ্ট হয়? ☐

৬. আপনার কি শ্বাসকষ্টের জন্য হাটা বন্ধ করতে হয়? ☐

আওয়াজ করে শ্বাস ফেলা

৭. শ্বাস নেওয়ার সময় বুকের মধ্যে কি সা সা বা বাশির মত আওয়াজ হয়? ☐

৮. কখনো কি বুকের মধ্যে বাশির মত আওয়াজ করে শ্বাস ফেলার সাথে শ্বাসকষ্টও হয়? ☐

যদি হ্যাঁ হয়

৯. এমন আক্রান্ত হওয়ার সময় শ্বাস প্রশ্বাস কি স্বাভাবিক থাকে? ☐

কখনও পেয়েছিলেন বা পেয়েছিলেন বলে শোনেছেন:

১০. বুকে কোন আঘাত বা অপারেশন? ☐

১১. হৃদপিন্ডের জটিলতা ☐

১২. নিউমোনিয়া ☐

১৩. এটেলেক্টাসিস ☐

১৪. হাইপোভেন্টিলেশন ☐

১৫. ধুলাবালি জনিত এলার্জি ☐

১৬. বুকের অন্যান্য জটিলতা ☐

১৭. শ্বাস প্রশ্বাস কি পরিপূর্ন? ☐

১৮. কোন কিছুর সাহায্য ছাড়া শ্বাস নিতে পারেন? ☐

১৯. আপনার কি বুকের অস্থি সমূহ সংকুচিত মনে হয় এবং প্রসারিত করতে পারেন না? ☐

২০. আপনি কি ধূমপান করেন? ☐

২১. দিনের বেলা কখনও কি মুখ দিয়ে নিশ্বাস নিতে হয়? ☐

২২. রাতে ঘুমানোর সময় কি মুখ দিয়ে নিশ্বাস নিতে হয়? ☐

```1A২৩. সি আর পি তে ভর্তি হওয়ার পূর্বে কি কখনও চেস্ট ফিজিউথেরাপী নেওয়া হয়েছে? ☐

২৪. চেস্ট ফিজিউথেরাপী নেওয়ার পর কি আপনি ভাল অনুভব করেন? ☐
```

ওজন	
তাপমাত্রা	
শ্বাস প্রশ্বাসের মাত্রা	
পিক এক্সপাইরেটরি ফ্লো (লিটার/মিনিট)	
ইন্সেন্টিভ স্পাইরোমিটার	
শ্বাসের ধরন	
অক্সিজেনের সেচুরেশন	

Permission Letter

Date: 15.06.2021

Head

Department of Physiotherapy

Centre for the Rehabilitation of the Paralysed (CRP)

Chapain, Savar, Dhaka-1343

Through: Head, Department of Physiotherapy, BHPI.

Subject: Prayer for seeking permission to collect data for conducting research project.

Sir,

With due to respect and humble submission to state that I am Farhana Rahman, a student of 4th year B.Sc. in physiotherapy at Bangladesh Health Professions Institute (BHPI). The Ethical committee has approved my research project entitled: "**Explore the respiratory complications of tetraplegic SCI patients at CRP**" under the supervision of Mst. Fatema Akter, Assistant Professor, Department of Physiotherapy, BHPI. I want to collect data for my research project from the SCI Unit at CRP. So, I need permission for data collection from the Spinal Cord Injury Unit of Physiotherapy Department at CRP-Savar. I would like to assure that anything of the study will not be harmful for the participants and the Department itself.

I, therefore pray and hope that you would be kind enough to grant my application and give me permission for data collection and oblige thereby.

Yours faithfully,

Farhana Rahman

Farhana Rahman

4th Year B.Sc. in Physiotherapy

Class Roll: 14; Session: 2015-16

Bangladesh Health Professions Institute (BHPI)

(An academic Institution of CRP)

Forward
15.06.2021

Recommended
15.06.21
Md. Shofiqul Islam
Associate Professor & Head
Department of Physiotherapy
Bangladesh Health Professions Institute (BHPI)
CRP, Chapain, Savar, Dhaka-1343

Approved
16/06/21
MOHAMMAD ANWAR HOSSAIN
Senior Consultant &
Head of Physiotherapy Dept.
Associate Professor, BHPI
CRP Savar, Dhaka-1343

BANGLADESH HEALTH PROFESSIONS INSTITUTE

বাংলাদেশ হেল্‌থ প্রফেশন্স ইনস্টিটিউট (বিএইচপিআই)
Bangladesh Health Professions Institute (BHPI)
(The Academic Institute of CRP)

Ref:

CRP/BHPI/IRB/06/2021/477

Date:

17/06/2021

To,
Farhana Rahman
4th year B.Sc. in Physiotherapy
Session: 2015-2016, Student ID: 112150285
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

Subject: Approval of the thesis proposal **"Explore the Respiratory Complications of Tetraplegic SCI Patients at CRP"** by ethics committee.

Dear Farhana Rahman,
Congratulations.
The Institutional Review Board (IRB) of BHPI has reviewed and discussed your application to conduct the above-mentioned dissertation, with yourself, as the Principal investigator. The following documents have been reviewed and approved

Sr. No. Name of the Documents
1. Dissertation proposal
2. Questionnaire (Bengali & English version)
3. Information sheet and consent form

The purpose of the study is to Explore the Respiratory Complications of Tetraplegic SCI Patients at CRP. The study involves use of a questionnaire to explore that may take 20 to 30 minutes to answer the questionnaire and there is no likelihood of any harm to the participants. The members of the Ethics committee have approved the study to be conducted in the presented from at the meeting held at 8.30AM on 1st March, 2020 at BHPI (23rd IRB Meeting).

The Institutional Ethics committee expects to be informed about the progress of the study, any changes occurring in the course of the study, any revision in the protocol and patient information or informed consent and ask to be provided a copy of the final report. This Ethics committee is working accordance to Nuremberg Code 1947, World Medical Association Declaration of Helsinki, 1964-2013 and other applicable regulation.

Best regards

Muhammad Millat Hossain
Assistant Professor, Dept. of Rehabilitation Science
Member Secretary, Institutional Review Board (IRB)
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

CRP-Chapain, Savar, Dhaka-1343, Tel : 7745464-5, 7741404
E-mail : principal-bhpi@crp-bangladesh.org, Web: bhpi.edu.bd, www.crp-bangladesh.org

Date: June 15, 06, 2021.

The Chairman

Institutional Review Board (IRB)

Bangladesh Health Professions Institute (BHPI)

CRP-Savar, Dhaka-1343, Bangladesh

Subject: Application for review and ethical approval

Sir,

With due respect and humble submission to state that I am Farhana Rahman, student of 4th Professional B.Sc. in Physiotherapy at Bangladesh Health Professions Institute (BHPI). This is a 4(four) year full time course. Conducting thesis project is partial fulfillment of the requirement for the degree of B.Sc. in physiotherapy. I have to conduct a thesis entitled "**Explore the respiratory complications of tetraplegic SCI patients at CRP**" under the supervision of Mst Fatema Akter, Assistant Professor, Department of Physiotherapy, BHPI, CRP Savar, Dhaka-1343. The purpose of this study is to explore the respiratory complications of tetraplegic SCI patients. I would like to assure that anything of my study will not be harmful for the participants. Informed consent will be received from all participants, data will be kept confidential.

I, therefore pray and hope that your honor would be kind enough to approve my thesis proposal and give me permission to start data collection and oblige thereby.

Sincerely,

Farhana Rahman

Farhana Rahman

4th professional B.Sc. in Physiotherapy

Roll: 14, Session: 2015-16, ID: 112150285

BHPI, CRP, Savar, Dhaka-1343, Bangladesh

Recommendation from the thesis supervisor: 15.06.2021

Mst Fatema Akter

Assistant Professor, Department of Physiotherapy,

BHPI, CRP Savar, Dhaka-1343.

Attachments: Questionnaire (Bengali & English version), informed consent.