

Review Article

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Heart and Lung Dysfunction Prevention Through Rehabilitation and Physical Therapy Education: A Comprehensive Overview

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Cardiovascular and respiratory diseases are among the leading causes of morbidity and mortality worldwide. Physical therapists (PTs) have a unique opportunity to prevent and manage these conditions by providing patient education on cardiopulmonary health. This white paper discusses the essential role of patient education in reducing the risk and impact of heart and lung dysfunction and highlights the toolkit that PTs possess to deliver effective and evidence-based education. It also provides practical strategies and examples for PTs to educate individuals on topics such as exercise, smoking cessation, nutrition, stress management, and self-monitoring. By empowering patients with knowledge and skills, PTs can help them achieve optimal cardiopulmonary health and quality of life.

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Introduction

Cardiac disease remains the leading cause of death and disability in the United States, with chronic obstructive pulmonary disease (COPD) currently ranking third in terms of mortality [1]. Medical rehabilitation medicine must address the needs of patients with debility and renal dysfunction in addition to the cardiopulmonary disorders that an increasing number of patients are now presenting with. The population's aging and the impact of these disorders' combinations on patients' capacity for rehabilitation are significant factors in the prevalence of each of these conditions.

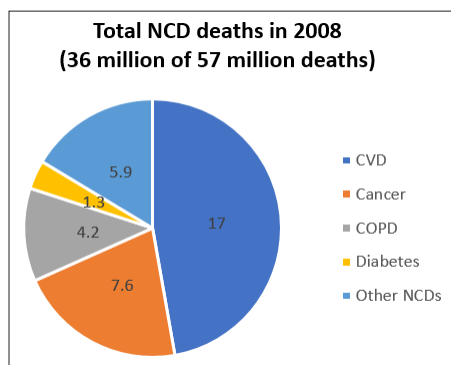
Dual disability patients are more common than ever in rehabilitation because more patients are currently older and have multiple comorbidities. It is important to keep in mind that there are two types of cardiopulmonary patients: people who require cardiac/pulmonary rehabilitation due to primary cardiac and pulmonary disease, as well as people with other impairments who have a secondary cardiac or pulmonary handicap. Rehabilitation specialists need to know how to provide cardiopulmonary rehabilitation in patients with either primary or secondary cardiopulmonary disability because we work with frail older adults and other compromised populations. Recall that cardiopulmonary rehabilitation is one of the most underutilized yet most effective treatments for patients with cardiopulmonary disease [2].

Remember that cardiopulmonary rehabilitation is one of the most underutilized yet most effective treatments for patients with cardiopulmonary disease, and as rehabilitation specialists work with frail older adults and other compromised populations, we must understand how to provide cardiopulmonary rehabilitation in patients with either primary or secondary cardiopulmonary disability [3].

Patient education is an important aspect of managing cardiopulmonary conditions, such as heart failure, chronic obstructive pulmonary disease (COPD), asthma, and pulmonary hypertension. Patient education can help patients understand their condition, prevent and manage symptoms, improve self-care behaviors, and reduce hospital readmissions and mortality rates [4].

Understanding Cardiovascular and Respiratory Risks

Airway flow, volumes and capacities, and oxygenation are all included in lung function. Since the lungs are anatomically and physiologically connected to the heart and vessels, it makes sense that any impairment in any aspect of lung function could affect cardiovascular health. Early necropsy studies demonstrated the co-occurrence of pulmonary diseases, both restrictive and obstructive, and cardiovascular disease (CVD). Although the mechanisms that could link the pathology of these two organ systems were not entirely clear, common risk factors, such as smoking, were identified. In addition to coronary disease, the links between pulmonary diseases and impairments in cardiac function were well established, most notably cor pulmonale [5].



Alwan A. Global Status Report on Non-Communicable Diseases 2010 [6-44].

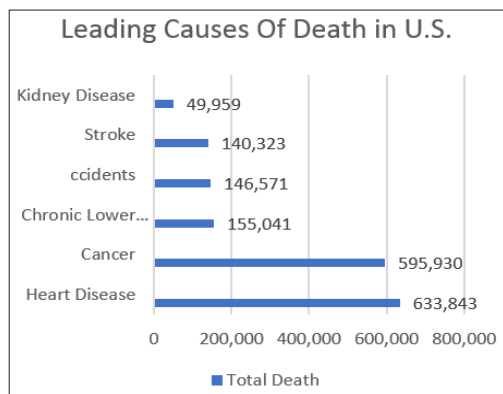
Geneva

World Health Organization; 2011

Subclinical pulmonary dysfunction or milder pulmonary disease can also affect cardiovascular function and cardiovascular disease. One of the most straightforward and accessible ways to measure pulmonary function is through spirometry. Abnormalities in forced vital capacity (FVC), forced expiratory volume in one second (FEV1), and FEV1/FVC ratio are all linked to increased prevalence of cardiovascular risk factors and cardiovascular disease risk. Subclinical lung dysfunction severity, age of onset, and rate of decline have all been linked to increased cardiovascular disease risk. Others have recently conducted a thorough review of the relationship between pulmonary disease and right heart failure [6,7].

Common Risk Factors

- Heart and lung dysfunction are often related, as they share some common risk factors, such as smoking, diabetes, obesity, and low-grade systemic inflammation [8].
- Smoking is the leading cause of both coronary artery disease and chronic obstructive pulmonary disease (COPD), which are the most common types of heart and lung dysfunction.
- Diabetes and obesity can impair the function of the heart and the blood vessels, as well as reduce the lung capacity and increase the risk of infections.
- Low-grade systemic inflammation is a condition where the body's immune system is constantly activated, causing damage to the tissues and organs. It can result from chronic infections, autoimmune diseases, or environmental factors. It can contribute to the development of atherosclerosis, heart failure, arrhythmias, asthma, COPD, and interstitial lung disease.



Source: Centers for Disease Control and Prevention

Importance of Early Intervention and Prevention

Early intervention and prevention of cardiopulmonary diseases are crucial to maintaining good health [9-43]. According to the American College of Cardiology, cardiovascular disease remains the leading cause of death in America, with well-established and identifiable risk factors. Modifiable risk factors are the primary driver for the first cardiovascular event, and risk factor modification has been a significant driver for the reduction of cardiovascular death in certain populations in recent decades [1]. The data are highly suggestive that appropriate public policy and lifestyle interventions aimed at eliminating tobacco use, limiting salt consumption, encouraging physical exercise, and improving diet can prevent events [9].

Frequent, everyday exercise reduces the risk of heart disease. Exercise also helps you maintain a healthy weight and reduces the risk of developing other heart-related conditions, such as high blood pressure, high cholesterol, and type 2 diabetes [10].

A heart-healthy diet can lessen the risk of type 2 diabetes, improve blood pressure and cholesterol, and protect the heart. Cardiac rehabilitation is also an important part of recovery for patients who have had an ASCVD event or heart failure with reduced ejection fraction (LVEF $\leq 35\%$) [9,10].

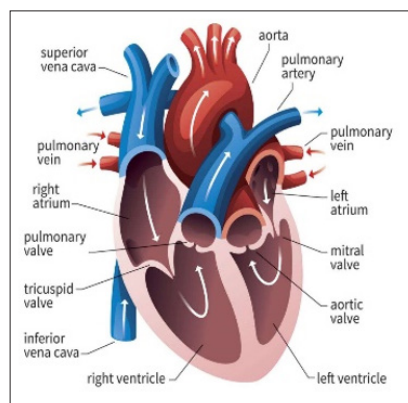
Anatomy and Function of the Heart and Lungs

Anatomy: Your ribcage surrounds and protects your heart, which is situated in the front of your chest, slightly to the left, and behind your sternum (breastbone). The components of your heart are similar to those of a house: walls, chambers, valves, blood vessels, electrical conduction system, and plumbing [11].

Your heart walls are made up of three layers: the **epicardium**, which is a protective outer layer; the **pericardium**, which covers your entire heart and produces fluid to lubricate it and prevent it from rubbing against other organs; and the **myocardium**, which is a muscular middle layer. The muscles in your heart walls contract and relax to pump blood throughout your body. The septum, a layer of muscular tissue, divides your heart walls into the left and right sides.

The **four chambers** of your heart are as follows: two chambers on top (called the atrium, plural atria) and two chambers on bottom (called ventricles), one on each side of the heart.

Right Atrium: Blood that is low in oxygen is brought to your atrium by two large veins: the superior vena cava, which brings blood from your upper body, and the inferior vena cava, which brings blood from your lower body. After that, the blood is pushed into your right ventricle.



Right Ventricle: The lower right chamber pumps the blood that is low in oxygen to your lungs through the pulmonary artery. The lungs then replenish the blood with oxygen.

Left Atrium: After the blood is filled with oxygen, the pulmonary veins carry blood to the left atrium, which is your upper chamber.

Left Ventricle: The left ventricle pumps oxygen-rich blood to the rest of your body. Your heart valves function as doors that open and close to let blood pass through your heart chambers.

These include the atrioventricular (AV) valves, which open to let blood pass between your upper and lower heart chambers; these include the mitral valve, which opens between your left atrium and left ventricle, and the tricuspid valve, which opens between your right atrium and right ventricle. The semilunar (SL) valves open when blood exits your ventricles; these include the following: Aortic valve: opens to allow blood to flow from your left ventricle to your aorta, the artery that carries oxygen-rich blood to your body. The pulmonary valve opens when blood flows from your right ventricle to your pulmonary arteries, which are the only arteries that carry oxygen-poor blood to your lungs. Your heart pumps blood through three different blood vessel types: capillaries, which are small blood vessels where oxygen-rich and oxygen-poor blood are exchanged, arteries that carry oxygen-rich blood from your heart to your body's tissues, and coronary arteries, which run along the surface of your heart, serve the heart itself [11].

Function

The primary purpose of the heart is to pump blood throughout the body. It also regulates the rhythm and speed of your heart rate and keeps your blood pressure stable. The heart collaborates with other bodily systems to control these functions. These systems include the nervous system, which helps control your heart rate by sending signals that instruct your heart to beat faster during times of stress and slower during times of rest. The endocrine system releases hormones that cause your blood vessels to dilate or expand, which influences your blood pressure. The thyroid gland can also release hormones that cause your heart to beat faster or slower [11].

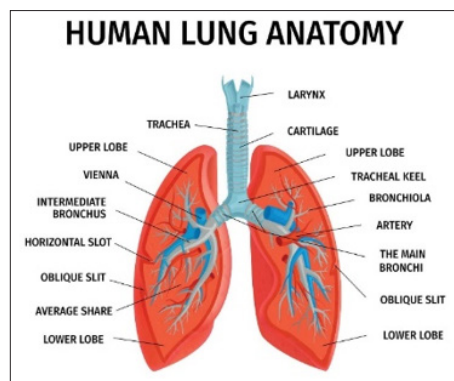
Lung

Anatomy: The lungs are paired, pyramid-shaped organs that are connected to the trachea by the right and left bronchi; the diaphragm borders the inferior surface of the lungs; the diaphragm is the flat, dome-shaped muscle at the base of the lungs and thoracic cavity; the pleurae, which are attached to the mediastinum, enclose the lungs; the left lung occupies a smaller volume than the right; the left lung has an indentation on its surface called the cardiac notch, which provides room for the heart [12].

The superior region of the lung is the lung, while the base is the opposite region near the diaphragm. The lung's costal surface borders the ribs, while its mediastinal surface faces the midline. Each lung is made up of smaller units called lobes, which are separated from one another by fissures. The left lung has two lobes, the superior and inferior lobes, while the right lung has three lobes, the middle, and inferior lobes.

A lobe is divided into multiple bronchopulmonary segments, each of which is supplied with blood by its artery and receives air from its tertiary bronchus. An interlobular septum is a wall made of connective tissue that separates lobules from one another. A subdivision known as a pulmonary lobule is created when the bronchi divide into bronchioles. Each lobule has its own big

bronchiole with many branches. Certain lung diseases usually affect one or more bronchopulmonary segments. In certain cases, the diseased segments can be surgically removed with little effect on neighboring segments [12].



Function: When you breathe in through your mouth or nose, air travels down your pharynx (back of your throat), passes through your larynx (voice box), and ends up in your trachea (windpipe). Your trachea is divided into two air passages called bronchial tubes, one of which leads to your left lung and the other to your right lung. For your lungs to function as best they can, your airways must be open during both inhalation and exhalation, free of abnormal amounts of mucus, and open during both inhalation and exhalation [13].

Your bronchial tubes lead to smaller air passages called bronchi, which in turn lead to bronchioles, which terminate in tiny air sacs called alveoli, which resemble clusters of small round fruits and are responsible for transferring oxygen from the inhaled air to your blood. Blood leaves your lungs after absorbing oxygen and is carried to your heart, where it is pumped throughout your body to supply oxygen to the cells of your tissues and organs. As cells use oxygen, they produce carbon dioxide, which is then transferred to your blood and carried by your bloodstream back to your lungs, where it is expelled [13].

Mucus is produced in your trachea and bronchial tubes to keep air passages moist and help catch dust, bacteria, and other substances. The sweeping motion of cilia (small hairs in your respiratory tract) to keep air passages clean. One of the reasons that cigarette smoke is dangerous is that it stops cilia from working properly. These are how your respiratory system prevents harmful substances from entering your lungs [13].

Exercise Prescription: Empowering Patients with Physical Activity Knowledge

Physical therapy encompasses various specializations, such as neuromuscular, musculoskeletal, and cardiopulmonary physical therapy. Recognized as a clinical specialty in 1978, cardiopulmonary physical therapy focuses on managing physical and functional impairment, activity limitations, and participation restrictions resulting from impairment of body functions. Additionally, it treats structural impairments of the cardiovascular and pulmonary system caused by disease, injury, or other conditions. Physiotherapy interventions play a crucial role in managing acute and chronic cardiac and respiratory diseases. Exercise prescription and behavior modification are essential components of these interventions. There are three phases to cardiac rehabilitation [14-17].

Phase I

Clinical phase. This phase starts in the inpatient setting shortly after

a cardiovascular event or after an intervention is completed. It starts with evaluating the patient's capacity and willingness to tolerate rehabilitation. Initially, therapists and nurses may guide patients through gentle exercises in bed or at the bedside, emphasizing range of motion and minimizing hospital deconditioning.

The rehabilitation team may also concentrate on activities of daily living (ADLs) and educate the patient about preventing excessive stress. Patients are encouraged to stay relatively rested until the treatment of comorbid conditions, or post-operative complications. The rehabilitation team evaluates patient needs, including assistive devices.

Phase II

Outpatient cardiac rehabilitation. Following stabilization and clearance by cardiology, patients may proceed to outpatient cardiac rehabilitation. This phase usually lasts three to six weeks, but in some cases, it may last up to twelve weeks. Patients first undergo an assessment aimed at identifying physical function limitations, participation restrictions due to comorbidities, and activity limitations. A more comprehensive patient-centered therapy plan is then created, consisting of three components: information/advice, a customized training program, and a relaxation program. The treatment phase's goal is to encourage independence and lifestyle modifications to get patients back to their homes.

Phase III

Post-cardiac rehab. Maintenance During this phase, patients become more independent and self-monitoring. Phase III focuses on strengthening, flexibility, and aerobic conditioning. Goals include facilitating long-term maintenance of lifestyle changes, monitoring changes in risk factors, and secondary prevention [14]. Options include educational sessions, support groups, telephone follow-up, clinic reviews, outreach programs, and an exercise program led by a qualified phase IV gym instructor. Links with GPs and primary health care teams are established, and partners, spouses, and families are continuously involved. A randomized controlled study demonstrates the efficacy of the internet-based remote home-based cardiac rehabilitation program [15].

NB There is also a pre-surgery period during which the patient begins cardiovascular therapy. A small number of research show that patients tolerate the post-surgical pathway better [16].

There are Many Factors to Consider When Planning an Exercise Regimen for Cardiopulmonary Patients, Such As

- The type, severity, and stability of the disease
- The patient's symptoms, functional limitations, and comorbidities
- The patient's exercise capacity, assessed by clinical tests or cardiopulmonary exercise testing (CPX)
- The patient's motivation, readiness, and barriers to exercise
- The availability and accessibility of exercise facilities and equipment
- The safety and feasibility of exercise monitoring and supervision

Aerobic Exercises for Cardiopulmonary Health

Aerobics are exercises that increase the heart rate and breathing rate, such as walking, cycling, or swimming. Aerobics can help in cardiopulmonary dysfunction by improving the function and flexibility of the heart and blood vessels, as well as the oxygen delivery and utilization by the muscles and organs. Some of the benefits of aerobics for cardiopulmonary dysfunction are [17-46].

- Lowering blood pressure and reducing the risk of developing diabetes
- Keeping a healthy weight and decreasing inflammation throughout the body
- Enhancing the muscles' ability to pull oxygen out of the blood, reducing the need for the heart to pump more blood to the muscles
- Reducing stress hormones, which can put additional strain on the heart
- Working like a beta blocker to slow the heart rate and lower blood pressure
- Increasing high-density lipoprotein (HDL) and helping control triglycerides
- Reversing the "stiffening" of the heart muscle caused by diastolic dysfunction, a condition that affects the relaxation phase of the heartbeat and limits the amount of blood the heart can pump with each beat
- Improving exercise capacity, symptoms of shortness of breath with exertion, and quality of life measures

To get the most benefit from aerobics, experts recommend combining aerobic exercise with resistance training, such as moderate weightlifting. This can help improve the endurance and strength of the heart and muscles, as well as the overall fitness and performance. The general guidelines are to do at least 30 minutes of aerobic exercise five days a week, and moderate weightlifting twice a week, or frequently enough to cover the major muscle groups. However, the type, intensity, and duration of exercise may vary depending on the individual's condition, goals, and preferences.

Some Examples of Aerobic Exercises that can Boost your Cardiopulmonary Health are Running or Jogging: This exercise can increase your heart rate and improve your blood circulation and oxygen delivery. You can do it on a treadmill, outdoors, or in place [45].

Swimming: This exercise can work your whole body and strengthen your heart and lungs. You can swim in a pool, lake, or ocean.

Cycling: This exercise can improve your leg muscles and cardiovascular endurance. You can cycle on a stationary bike, a regular bike, or an elliptical machine.

Jumping Rope: This exercise can burn calories and enhance your coordination and agility. You can use a real or an imaginary jump rope.

Dancing: This exercise can be fun and creative, while also increasing your heart rate and mood. You can dance to any music you like, with or without a partner.

Based on These Factors, the Exercise Plan Should Include the Following Components

The mode of exercise, which can be aerobic, resistance, or combined, depending on the patient's needs and preferences [18,19]. Aerobic exercise is the most important part of training, as it improves cardiovascular and respiratory function, but resistance training can also be beneficial, as it enhances muscle strength and endurance.

The intensity of exercise can be prescribed using various methods, such as heart rate, oxygen uptake, rating of perceived exertion,

or metabolic equivalents. The intensity should be moderate to vigorous, but not exceeding the patient's ischemic or ventilatory threshold.

The duration of exercise can range from 10 to 60 minutes per session, depending on the patient's tolerance and endurance. The duration should be gradually increased over time, as the patient adapts to the exercise stimulus.

The frequency of exercise can vary from 2 to 7 times per week, depending on the patient's availability and recovery. The frequency should be sufficient to achieve the desired benefits, but not excessive to cause overtraining or adverse effects.

The progression of exercise can be adjusted by modifying the intensity, duration, frequency, or mode of exercise, depending on the patient's response and improvement. The progression should be individualized and based on objective and subjective indicators of exercise performance and tolerance.

In addition to the exercise plan, the patient should also receive education, counseling, and support to enhance their adherence and motivation to exercise. The patient should be informed about the benefits and risks of exercise, the signs and symptoms of exercise intolerance or complications, and the appropriate actions to take in case of emergency. The patient should also be encouraged to set realistic and achievable goals, monitor their progress, and reward their achievements.

Breathing Easy: Respiratory Health Strategies for Patients

The two most beneficial breathing exercises—pursed lip breathing and belly breathing—are taught by pulmonary rehabilitation specialists to people with chronic lung diseases like asthma and COPD. Just as aerobic exercise strengthens your muscles and improves heart function, breathing exercises can increase the efficiency of your lungs [20].

Here are Some of the Effective Breathing Techniques

Diaphragmatic Breathing

Diaphragmatic breathing is a way of using the diaphragm to breathe more oxygen [21]. It is good for people with COPD and lung problems. A study in 2020 showed that it can increase lung capacity, reduce breathlessness, and make respiratory muscles stronger.

To do diaphragmatic breathing, follow these steps:

- Let your shoulders drop as you sit or lie down.
- Place one hand on your belly, the other on your chest.
- Inhale through your nose for 2 seconds and feel your belly rise.
- Exhale through your mouth and press your belly down.
- Repeat this as often as desired.

Pursed Lip Breathing

Pursed lip breathing is a simple technique to slow down and control your breathing. It helps you breathe more oxygen and less carbon dioxide. It also relaxes your airways and makes it easier to do physical activities. It is especially helpful for people with lung conditions like COPD.

To do Pursed Lip Breathing, Follow These Steps:

- Breathe in through your nose.
- Make your lips like you are blowing something.
- Take two times as long to exhale through your lips as you

did to inhale.

- Repeat this as often as desired.

Equal Breathing

Equal breathing is a type of pranayama/yoga breathing that balances your inhales and exhales. It helps you relax, breathe more deeply, and improve your mental and physical health. It can be done anywhere and at any time.

The science A 2017 study showed that pranayama, which includes equal breathing, helped young swimmers breathe better and swim faster. They had more lung power and endurance than those who did not do pranayama.

Here's how to do it Close your eyes and notice your breathing. Inhale through your nose for 4 seconds. Exhale through your nose for 4 seconds. Keep breathing in and out evenly and feel your lungs.

Humming Bee Breath

Humming bee breath is a type of pranayama/yoga breathing that uses humming to boost your lung function. It helps you breathe more oxygen and relax your body and mind. It improves both your physical and mental wellness. You should do it while sitting upright.

The science A 2014 study showed that humming bee breath and OM chanting improved the breathing of the people who did them. They had better lung capacity and airflow than those who did not.

Here's how to do it Close your eyes and sit upright. Feel your body and the silence around you. Put your index fingers on your ears. Inhale deeply. As you exhale, press your ears and hum loudly. You can press your ears all the time or on and off while humming. Inhale again. Do this a few more times.

Complete Breath

Complete Breath is a technique to fill your lungs fully and use your whole respiratory system. It is good for your lungs, immune system, and mood. It can also ease your breathing when it is tight.

The Science A 2020 article from Chopra said that doing Complete Breath for 5 minutes, twice a day, can make your lungs healthier and other benefits. Doing this technique regularly will teach your lungs to breathe better and get more air. It can also help you breathe easier when you feel restricted.

Here's how to do it Sit or lie down in a comfortable position. Relax your belly and put a hand on it and one on your chest. Inhale deeply and make your belly push out your hand. Keep inhaling and fill your torso and rib cage with air. Keep inhaling fill your chest with air and feel it lift your hand. Pause for a moment and then exhale in reverse order, from your chest to your torso, to your belly. Squeeze your belly muscles to get all the air out if needed. Do this as often as you want and notice how you feel.

Straw Breathing

Straw breathing is a type of breathing that uses a straw to make your exhale harder. It was made for divers, but it is also good for your lungs and diaphragm. It can make you breathe more oxygen and feel less stressed.

The science article from West London Physiotherapy says that straw breathing can make your lung capacity bigger and your

stress lower. Breathing through a straw makes your diaphragm work more, which makes your lungs stronger and more efficient.

Here's how to do it Use a thin straw. Put the straw in your mouth and face forward. Hold the straw with your fingers so it does not point down. Inhale through your nose normally. Exhale through the straw naturally. Keep your lips and face relaxed. When you are almost done exhaling, take the straw out close your mouth, and finish exhaling through your nose. Take two or three regular breaths without the straw. When you want, put the straw back in your mouth and do it again. Do this for 5 to 10 minutes, as you feel comfortable.

"Our lungs are springy, like the door. But over time, our lungs lose that springiness—especially if we have COPD or asthma. They do not return to the same level as when you start breathing, and the air gets trapped in our lungs," says Lung HelpLine respiratory therapist Mark Courtney. "When your lungs are healthy, breathing is natural and easy. Your diaphragm performs around 80% of the work during inhalation and exhalation to fill your lungs with a mixture of oxygen and other gases and expel waste gases." Breathing exercises can help clear the lungs of accumulated stale air, increase oxygen levels, and allow the diaphragm to perform its function of helping you breathe. Over time, stale air accumulates, leaving less room for the diaphragm to contract and bring in fresh oxygen. When the diaphragm is not functioning at its best, the body begins to breathe through other muscles in the back, neck, and chest. This results in lower oxygen levels and less capacity for exercise and activity [20].

Lifestyle Modifications for Heart and Lung Health

Many factors can influence the development and progression of diseases such as asthma, COPD, lung cancer, and heart disease. Some of these factors are genetic, environmental, or lifestyle-related. Diet and nutrition are important aspects of lifestyle that can have both positive and negative impacts on the health of the heart and lungs.

Impact of Diet and Nutrition on Cardiovascular and Respiratory Function

- A balanced diet with plenty of fruit, vegetables, fish, and whole-grain products can reduce the risk of developing and worsening asthma, COPD, and lung cancer [22-26].
- Foods with antioxidant or anti-inflammatory properties, such as vitamins A, C, E, and D, zinc, and flavonoids, may protect against oxidative stress and inflammation in the airways and blood vessels.
- A high intake of highly processed foods, cured meats, and carbohydrates can accelerate the decline in lung function, increase the production of carbon dioxide, and raise blood pressure and cholesterol levels.
- Being either obese or underweight can have harmful consequences for lung health, as it can affect the breathing mechanics, the immune system, and the response to treatment. Therefore, maintaining a healthy weight is recommended for people with respiratory diseases.
- People with specific conditions, such as cystic fibrosis, pulmonary embolism, or sleep apnea, may require special dietary interventions or supplements to prevent or treat complications.

There is a clear correlation between certain nutrients and dietary patterns; high fruit and vegetable intake, a Mediterranean-style diet, fish consumption, and omega-3 fatty acid intake are dietary patterns associated with benefits in respiratory diseases, while

fast food intake and westernized dietary patterns have negative associations. These findings are supported by mechanistic studies in animal models as well as epidemiological and cross-sectional studies. It is necessary to conduct intervention studies in humans to gather more evidence [22].

It appears that vitamin D is important in respiratory diseases and infections, but the temporal role of vitamin D deficiency in disease onset, pathogenesis, and exacerbations, as well as whether supplementation is indicated, are yet to be clarified. The evidence for mechanisms of vitamin D in lung development and immune function is not fully established [22].

The strong connection between diet and CVD. Thus, the goal is to promote healthy eating habits and an active lifestyle in children and young adults as early as possible. The data favors healthy dietary patterns, such as the Mediterranean or DASH diet, over bad dietary patterns, such as the Western diet, which is heavy in salt, added sweets, and saturated and trans fats. Although strong evidence suggests that various foods, nutrients, bioactive compounds, and dietary antioxidants, such as polyphenols, may affect CV risk factors or directly affect CVD development, more interventional studies with a larger number of cases and longer follow-ups are needed [23,24].

Nutrition therapy is a critical component of patient care and a major factor influencing ICU outcomes. There are many ways that nutrition can affect respiratory function; two well-established ways are overfeeding and underfeeding. Other important nutrition-related factors influencing ICU patient outcomes include the diet's carbohydrate composition, the route of feeding, and the method of feeding. New research is also shedding light on the role of immune therapy in patients suffering from acute respiratory distress syndrome. In the ICU, nutrition dogmas, like the need to check gastric residual volumes or to use full-calorie enteric feeds rather than trophic feeds, are continually being questioned by cutting-edge clinical research. Basic research offers the possibility of evaluating novel strategies for patients in intensive care units (ICUs), such as antioxidant use to avoid diaphragm weakness [25,26].

Guidance on Adopting Heart-Healthy Lifestyle Practices

There are many things you can do to improve your cardiovascular and respiratory health, such as eating well, being active, managing stress, quitting smoking, and limiting alcohol [27-29].

- Maintain a healthy body weight by balancing your energy intake and expenditure. You can use a [BMI calculator] to check your weight status and a [calorie calculator] to estimate your daily calorie needs.
- Eat a variety of fruits and vegetables, preferably fresh, frozen, or canned without added salt or sugar. Try to obtain at least five servings a day, and vary the varieties and colors to ensure you are getting a variety of antioxidants and minerals.
- Whole grains, such as brown rice, oats, quinoa, and whole wheat bread, should be preferred over refined grains. Whole grains are rich in fiber, vitamins, minerals, and phytochemicals that can lower blood pressure, cholesterol, and inflammation.
- Choose healthy sources of protein, such as plant-based proteins (beans, lentils, nuts, seeds, soy), fish and seafood, low-fat or fat-free dairy products, and lean meat and poultry. Avoid processed meats, such as bacon, ham, sausage, and salami, as they are high in salt, fat, and nitrates that can harm your heart and lungs.
- Use liquid plant oils, such as olive, canola, sunflower, or corn oil, instead of solid fats, such as butter, margarine, or

lard. Plant oils are rich in unsaturated fats that can lower LDL (bad) cholesterol and increase HDL (good) cholesterol. Avoid tropical oils, such as coconut and palm oil, and partially hydrogenated fats, such as trans fats, as they can raise LDL cholesterol and increase the risk of heart disease.

- Choose minimally processed foods over ultra-processed foods, such as chips, cookies, cakes, candy, soda, and fast food. Ultra-processed foods are high in calories, salt, sugar, and additives that can contribute to weight gain, diabetes, high blood pressure, and heart disease.
- Minimize the intake of beverages and foods with added sugars, such as soft drinks, fruit juices, sports drinks, energy drinks, flavored milk, yogurt, cereals, and desserts. Added sugars can increase blood glucose, triglycerides, and inflammation, and lead to obesity, diabetes, and heart disease.
- Select and cook foods that are low in or free of salt. Too much salt can raise blood pressure and damage the blood vessels and the heart. The recommended daily limit for salt is 2,300 mg, which is about one teaspoon. You can reduce your salt intake by reading nutrition labels, avoiding processed and packaged foods, using herbs and spices instead of salt, and asking for less or no salt when eating out.
- If you do not already drink alcohol, do not start. If you do, keep your consumption to no more than one drink for women and two for men each day. One drink is equivalent to 12 ounces of beer, 5 ounces of wine, or 1.5 ounces of liquor. Excessive alcohol consumption can increase blood pressure, triglycerides, and calories, and damage the heart muscle and the liver.

Adhere to these guidelines regardless of where food is prepared or consumed. You can follow a heart-healthy diet at home, at work, at school, or when eating out. You can also adapt a heart-healthy diet to your personal preferences, lifestyles, and cultural customs. For example, you can follow a Mediterranean diet, a DASH diet, a vegetarian diet, or an Asian diet, as long as they meet the general principles of a heart-healthy diet.

Empowering Patients: The Role of Pts in Patient Self-Management

Cardiopulmonary rehabilitation is a program that helps patients with heart and lung problems improve their health and quality of life. It involves exercise, education, counseling, and support to reduce the risk of future complications and promote healthy behaviors. However, many patients do not participate in cardiopulmonary rehabilitation or do not complete the program, which can limit its benefits. Therefore, it is important to encourage active patient participation in the preventive care of cardiopulmonary rehabilitation.

Some of the Strategies that can Increase Patient Participation are

- Educating patients and their families about the benefits and safety of cardiopulmonary rehabilitation, and addressing any misconceptions or barriers they may have [30-32].
- Providing personalized and tailored exercise prescriptions and goals, and monitoring and adjusting them as needed.
- Offering flexible and convenient options for cardiopulmonary rehabilitation, such as home-based, web-based, or self-managed programs, that suit the patient's preferences, needs, and abilities.
- Establishing a supportive and multidisciplinary team that includes cardiologists, nurses, exercise specialists, dietitians, psychologists, and pharmacists, and ensuring regular

communication and feedback between the team and the patient.

- Engaging the patient in shared decision-making and self-management, and empowering them to take responsibility and control of their health.
- Providing positive reinforcement, motivation, and incentives for the patient to adhere to the program and achieve their goals.
- Creating a sense of community and social support among the patients and their families, and facilitating peer-to-peer interactions and group activities.

The reasons for the low use of cardiac rehabilitation include the lack of awareness of its benefits by the doctors and the patients, and the barriers that the patients face, such as cost, distance, or time. The way that cardiac rehabilitation is organized may also need to change to better suit the patient's needs. Cardiac rehabilitation is a chance for patients to learn about their risk factors, how to improve their health, and how to start or continue a physical exercise program. The patients should keep doing these things for a long time to get the most benefits [31].

Cardiac rehabilitation can be done in different ways, such as in a center or at home, with or without supervision. The European standards for cardiac rehabilitation require a team of professionals, such as doctors, nurses, exercise specialists, dietitians, psychologists, and others, to help the patients. A study of more than 2172 patients showed that both center-based and home-based cardiac rehabilitation are equally good for improving the health and quality of life of low-risk patients after a heart attack, heart surgery, or heart failure [32,33].

Another study of more than 80,000 patients showed that both supervised and self-managed cardiac rehabilitation are equally good for reducing the risk factors of heart disease, such as obesity, smoking, and high blood pressure. However, supervised cardiac rehabilitation may be slightly better for increasing physical activity. The study also showed that both types of cardiac rehabilitation can improve the exercise capacity of the patients [34].

Self-managed cardiac rehabilitation may be more suitable for older patients, women, and patients with low incomes, as it may be more convenient, faster, and cheaper for them. It may also help them to adopt healthy habits in their daily life. However, the study mainly included patients with stable heart disease, and the two types of cardiac rehabilitation were not the same, as they followed the British model of care [31].

Fostering a Sense of Ownership in Maintaining Cardiovascular and Respiratory Well-Being

Cardiovascular and respiratory well-being are important aspects of health that can affect your quality of life, happiness, and productivity. However, many factors can threaten your heart and lung health, such as air pollution, smoking, stress, obesity, and a sedentary lifestyle. Therefore, it is essential to take care of your cardiovascular and respiratory systems by adopting healthy habits and behaviors that can prevent or reduce the risk of diseases and complications.

One way to do this is to foster a sense of ownership in maintaining your cardiovascular and respiratory well-being. This means that you recognize that you are responsible for your health and that you have the power and the motivation to make positive changes in your life. A sense of ownership can help you to [35,36].

- Be more aware of your health status and risk factors, and seek professional advice when needed.
- Set realistic and specific goals for improving your health, and monitor your progress and achievements.
- Choose and follow a balanced diet that is rich in fruits, vegetables, whole grains, fish, and healthy fats, and low in salt, sugar, and processed foods.
- Engage in regular physical activity that suits your preferences, needs, and abilities, and that can improve your cardiovascular and respiratory fitness, strength, and endurance.
- Avoid or quit smoking, and limit your exposure to secondhand smoke and other air pollutants that can harm your heart and lungs.
- Manage your stress levels and emotions, and practice relaxation techniques, such as meditation, yoga, or breathing exercises.
- Seek and provide social support from your family, friends, and peers, and join a community or a group that shares your health goals and values.

Overcoming Barriers to Patient Education

This is a very important topic for improving the quality and safety of health care. Patient education is the process of providing information, skills, and support to patients and their families to help them manage their health conditions, prevent complications, and improve outcomes. However, patient education can be challenging when there are language, cultural, and literacy barriers that affect the communication and understanding between healthcare providers and patients.

Some of the Common Barriers to Patient Education are

Health literacy: This is the ability to obtain, process, and understand basic health information and services needed to make appropriate health decisions [37,38]. Many people have low health literacy, which means they may have difficulty reading, comprehending, and applying health information. Low health literacy can affect people of all ages, races, ethnicities, and education levels, but it is more prevalent among older adults, immigrants, refugees, and people with low socioeconomic status.

Language: This is the system of communication used by a particular community or country. Language barriers occur when healthcare providers and patients do not share a common language, or when the language used is too complex, technical, or unfamiliar for the patient. Language barriers can affect the patient's ability to express their symptoms, concerns, and preferences, as well as the provider's ability to explain the diagnosis, treatment, and follow-up instructions. Language barriers can also lead to misunderstandings, errors, and mistrust.

Culture: This is the set of beliefs, values, norms, and practices that influence the way people think, feel, and behave. Culture affects how people perceive health, illness, and healing, as well as their expectations and preferences for health care. Cultural barriers occur when healthcare providers and patients have different cultural backgrounds, assumptions, or perspectives that affect their communication and understanding. Cultural barriers can also affect the patient's willingness to seek, accept, or adhere to health care recommendations.

To overcome these barriers, healthcare providers and organizations need to adopt strategies that are patient-centered, culturally competent, and linguistically appropriate.

Some of the Strategies are

Assessing the Patient's Health Literacy, Language, and Culture: This involves asking the patient about their preferred language, level of education, reading ability, and cultural background, as well as observing their verbal and nonverbal cues, such as eye contact, gestures, and body language [39,40]. This can help the provider tailor the patient's education to the patient's needs, preferences, and learning style.

Using Plain Language and Clear Communication: This involves using simple, common, and familiar words, avoiding jargon, acronyms, and technical terms, and explaining any medical terms or concepts that are necessary. This also involves using active voice, short sentences, and positive statements, and organizing the information logically and coherently. The provider should also use visual aids, such as pictures, diagrams, charts, or models, to supplement the verbal information, and check for the patient's understanding by asking open-ended questions, such as "What questions do you have?" or "Can you tell me what you will do when you go home?".

Providing Language Assistance Services: This involves using qualified interpreters, translators, or bilingual staff to facilitate communication between the provider and the patient who does not share a common language. The provider should avoid using family members, friends, or untrained staff as interpreters, as they may not be able to convey the information accurately, completely, or impartially. The provider should also use written materials, such as brochures, handouts, or videos, that are translated into the patient's language and are culturally appropriate.

Respecting and Accommodating the Patient's Culture: This involves being aware of and sensitive to the patient's cultural beliefs, values, norms, and practices that may affect their health, illness, and healing. The provider should also acknowledge and address any potential conflicts or misunderstandings that may arise from cultural differences, and seek to find common ground and mutual respect. The provider should also involve the patient's family, community, or religious leaders, if appropriate, in the patient education process, and support the patient's use of complementary or alternative therapies, as long as they do not interfere with the conventional treatment.

By addressing the language, cultural, and literacy barriers in patient education, healthcare providers and organizations can improve the quality and safety of healthcare, as well as the patient's satisfaction, engagement, and outcomes. Patient education is not only a professional responsibility, but also a human right.

Conclusion

Patient education is vital for preventing heart and lung dysfunction, a major cause of morbidity and mortality worldwide. This white paper demonstrates how patient education can play a vital role in reducing the risk of heart and lung problems. By using their toolkit, physical therapists can not only treat existing conditions but also educate patients on how to prevent future complications. This way, physical therapists can contribute to the promotion of cardiovascular and respiratory health in society. Physical therapists have a unique toolkit that enables them to educate patients on how to optimize their cardiovascular and respiratory health. This white paper highlights the evidence-based strategies that PTs can use to inform and motivate patients, such as assessing risk factors, providing individualized feedback, and facilitating behavior change. By doing so, physical therapists can help patients take

charge of their health and prevent the onset or progression of heart and lung dysfunction [41-46].

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