FLEX CEUs

Low Back Pain - Clinical Assessment and Treatment

Introduction

Low back pain is a common musculoskeletal complaint, with a high prevalence worldwide. It is estimated that up to 80% of adults experience low back pain at some point in their lives. This condition can vary in severity and duration, ranging from acute episodes to chronic and recurrent pain. Low back pain can be caused by a variety of factors, including muscle strains, ligament sprains, herniated discs, spinal stenosis, poor posture, and even psychosocial factors such as stress and emotional distress. This course will detail strategies of subjective history-taking, objective physical examination, and relevant diagnostic tests. Physical therapists and assistants will learn to differentiate between different types of low back pain and recognize serious red flags that may indicate underlying health conditions. The course will overview evidence-based treatment approaches for low back pain, focusing on physical therapy interventions. This includes therapeutic exercise techniques, manual therapy approaches, and neuromuscular retraining strategies to address pain, improve functional outcomes, and strategies to enhance the overall well-being of patients.

Section 1: Background and Relevance to Physical Therapy

Back pain is one of the most prevalent musculoskeletal conditions in the world. Physical therapists should understand the prevalence and demographics surrounding back pain. In addition to this, clinical anatomy is imperative to understand in reference to pain generators and the cause of symptoms. This section will explore the background and relevance of low back pain causes and provide a foundation for understanding clinical assessment, evaluation, and treatment strategies.

Prevalence [1,2]

It is estimated that approximately 80 percent of adults experience low back pain at some point in their lives, making it a prevalent condition across diverse populations. Out of the 80 percent of people that experience low back pain, 90 percent of those will experience it multiple times in separate occurrences. Low back pain can vary across different cultures, age groups, and ethnicities. Different cultural factors can influence the prevalence of low back pain due to variations in lifestyle, work environments, healthcare-seeking behaviors, and beliefs surrounding pain. However, specific prevalence rates related to culture may be limited due to the scarcity of comprehensive cross-cultural studies. Some cultural factors that may impact low back pain prevalence include work, lifestyle, and behavioral factors. Cultures that involve physically demanding occupations, such as agriculture or construction, may have higher prevalence rates of low back pain due to the nature of their work activities. Meanwhile in terms of lifestyle and behavior, cultural practices, such as sedentary lifestyles, lack of physical activity, and specific dietary habits, can contribute to the prevalence of low back pain.

Demographics [1]

Several factors may increase one's likelihood of developing low back pain, based on available low back pain statistics. Such factors include age, ethnicity, socioeconomic status, education level, and sex at birth. This section will explore the demographics of low back pain to give physical therapists and assistants a better idea of which patients experience it at higher rates.

Age

Age is another large factor in predicting the prevalence of low back pain. Low back pain tends to increase with age due to age-related changes in the spine and cumulative wear and tear. However, many young people sustain back injuries that

lead to acute and chronic problems. Low back pain is increasingly recognized as a common condition in adolescents and young adults, potentially related to factors such as poor posture, increased sedentary behavior, obesity and participation in sports and physical activities. As for middle-aged and older adults, the prevalence of low back pain generally rises during middle age and continues to increase in older adults, primarily due to degenerative changes, such as disc degeneration, spinal osteoarthritis, and spinal stenosis. Low back pain in older adults is a leading cause of debility, functional decline, and dependence on caregivers. It often occurs with comorbidities of other systems. This can make older adults seek treatment less often as they are prioritizing treatment for things like heart disease and diabetes mellitus. Most cases of low back pain are chronic in older adults, meaning it has lasted six weeks or more.

Ethnicity

Studies exploring the prevalence of low back pain among different ethnic groups have shown variations, although the underlying reasons for these differences are not fully understood. Some studies show that African Americans have a higher prevalence of low back pain compared to other ethnic groups. Studies also show a higher prevalence of low back pain in Hispanic/Latino populations compared to non-Hispanic populations. Certain studies suggest lower prevalence rates of low back pain in Asian populations compared to other ethnic groups. However, variations can exist among different Asian subgroups.

Other Factors [3]

Socioeconomic status also affects rates of low back pain. As household income increases, low back pain decreases. In a survey in 2019 by the CDC, the number of adults with back pain was 45 percent in adults below the federal poverty level and decreased to 38 percent in adults with double the federal poverty level. Generally, people with lower education status will experience back pain at higher rates as

well. People with lower income and education generally seek healthcare less often due to financial and time constraints, leading to delays in care and higher rates of back pain.

Women experience back pain at a slightly higher rate than men, usually at a 3 to 5 percent higher rate. This is due to differences in hormones and the possibility that women seek healthcare at higher rates than men. In addition, eight in ten pregnant women will experience low back pain during pregnancy or after.

It is important to note that the demographics of low back pain are generalizations. PTs and PTAs should treat every patient based on their subjective history and clinical examination and not generalize low back pain based on common demographics.

Clinical Anatomy of the Lumbopelvic Region [4–7]

Understanding the clinical anatomy of the low back is essential for physical therapists in effectively assessing and treating individuals with low back pain. Though taught in both physical therapy and assistant programs, review of anatomy is essential in effectively treating low back pain. This knowledge allows for a comprehensive understanding of the structures involved, their functions, and their potential contributions to pain and dysfunction. This section will detail both the clinical anatomy of the lumbopelvic region and the potential causes of symptoms.

The deepest structures of the lumbopelvic region are the bones, joints, and ligaments that create a foundation for the region. The lumbar spine and pelvis work simultaneously to create functional movement, starting with their connections at the bone, joint, and ligaments of the area.

The Pelvis

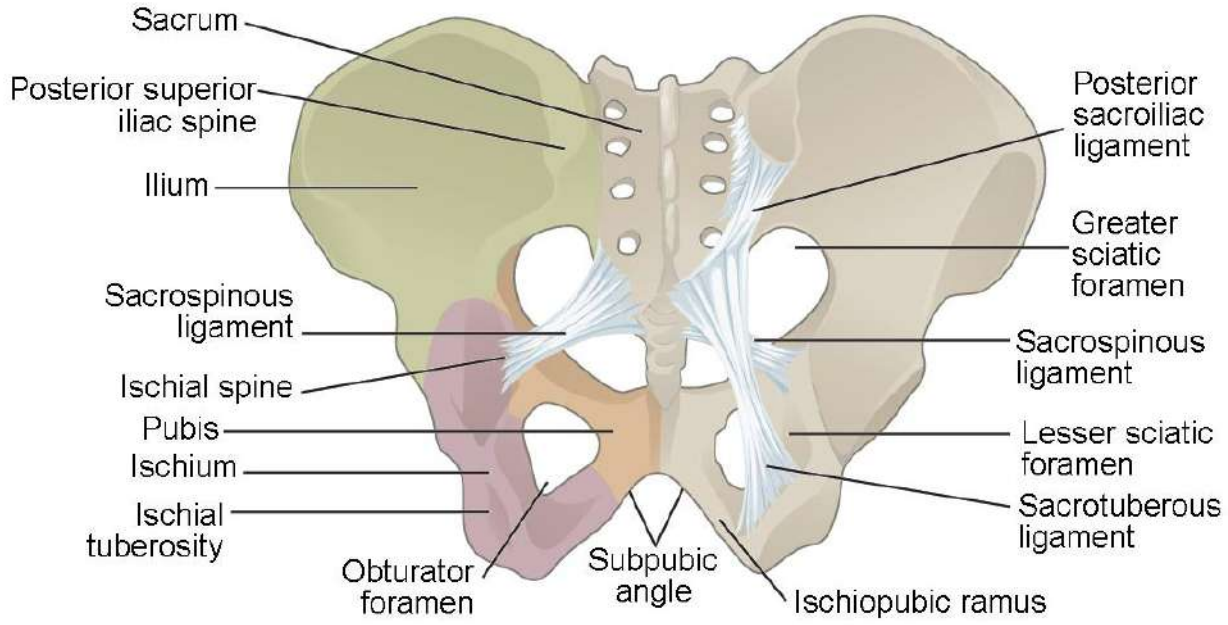
The pelvis is comprised of several bones that work together to form a sturdy and protective structure. It is crucial for PTs and PTAs to have foundational knowledge of the bone, joint, and ligament anatomy of the pelvis in treating conditions like low back pain, pelvic pain, and pelvic floor dysfunction.

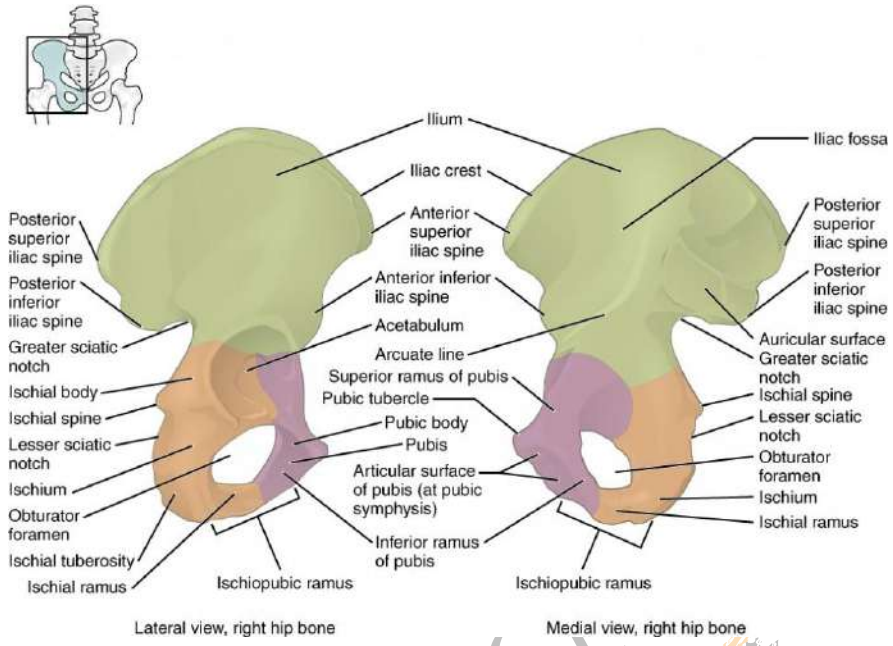
Bones

The *sacrum* is a triangular-shaped bone located at the distal spine. It forms the posterior part of the pelvis and connects the spine to the ilium bilaterally. The *coccyx* is a small bone located at the distal sacrum. It provides attachment sites for ligaments and muscles. Bilaterally, the innominate bones are large, irregularly shaped bones that form the lateral and anterior portions of the pelvis. Each bone consists of three fused bones: the ilium, ischium, and pubis. The ilium is the largest of the three and is the most superiorly positioned bone in the hip. It contributes to the formation of the acetabulum. The most superior ridge is called the iliac crest. The bony prominence anteriorly and posteriorly are the anterior superior iliac spine (ASIS) and the posterior superior iliac spine (PSIS) respectively. The ASIS and PSIS are crucial anatomical markers to determine pelvis height and posture in a physical therapy examination. The iliac fossa is the large internal surface of the ilium with a concave area to provide a base and attachment point for internal organs. The ischium is the lowest and most posteriorly positioned bone of the hip. The *ischium* plays a vital role in providing support, stability, and attachment sites for muscles and ligaments within the pelvis. The ischial tuberosity is a prominent bony prominence located at the posterior and inferior aspect of the ischium. The ischial tuberosity serves as an attachment site for several muscles, including the hamstrings and some fibers of the adductor magnus. The ischium forms the posterior boundary of the lesser sciatic notch, a smaller concave space below the ischial spine. This notch serves as a passageway

for several structures, including the pudendal nerve and the internal pudendal vessels. The ischial spine is a small bony projection located on the posterior border of the ischium, superior to the ischial tuberosity. It serves as a landmark for anatomical and clinical references, particularly in relation to the pelvic cavity and pelvic floor structures. The *pubis* is located in the front of the pelvis and plays a crucial role in providing support, stability, and attachment sites for muscles and ligaments. The pubic symphysis is a cartilaginous joint located at the midline where the left and right pubic bones meet. It is a slightly flexible joint that allows for limited movement and acts as a shock absorber during weight-bearing activities. The pubic symphysis is reinforced by ligaments and fibrocartilage. The pubis, along with the ischium, contributes to the formation of the obturator foramen. The obturator foramen is a large opening in the pelvis that is covered by the obturator membrane, except for a small area called the obturator canal. The obturator foramen allows for the passage of blood vessels and nerves.

https://courses.lumenlearning.com/suny-ap1/chapter/the-pelvic-girdle-and-pelvis/





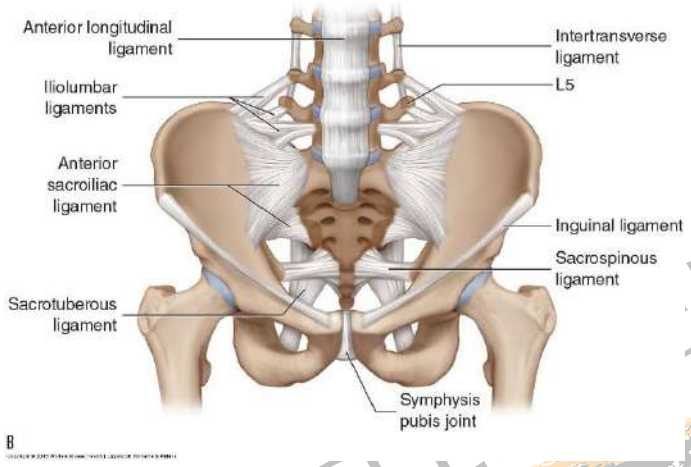
Pelvic Joints

The pelvis contains several joints that allow for movement, stability, and shock absorption. The *sacroiliac joints* are located between the sacrum and the ilium on each side. These joints are essential for transferring forces between the spine and the lower extremities and play a significant role in weight-bearing and movement. The *pubic symphysis* is a cartilaginous joint located at the midline between the pubic bones. It provides stability to the pelvis and allows for limited movement during activities such as walking and childbirth.

Pelvic Ligaments

Ligaments in the pelvis play a critical role in connecting and stabilizing the bones and joints. The sacroiliac ligaments are several strong ligaments that surround and stabilize the sacroiliac joints. These include the anterior sacroiliac ligament, posterior sacroiliac ligament, interosseous ligament, and sacrotuberous ligament.

The pubic symphysis is reinforced by various ligaments, including the superior and inferior pubic ligaments and the anterior and posterior pubic ligaments. The sacrotuberous ligament extends from the sacrum to the ischial tuberosity, providing stability to the sacroiliac joint and assisting in weight transmission. The sacrospinous ligament runs from the sacrum to the ischial spine and contributes to pelvic stability.



https://learnmuscles.com/blog/2017/08/30/ligaments-of-the-lumbar-spine-and-pelvis/

Pelvic Muscles

Understanding the attachment and function of pelvic muscles is essential for physical therapists in assessing and treating various conditions related to the pelvic and low back region. These muscles play a crucial role in providing stability, supporting organ function, controlling bladder and bowel movements, and maintaining proper posture. This section will give an overview of important pelvic muscles, attachment sites, and function.

The *pelvic floor muscles* are a group of muscles located at the bottom of the pelvis, forming a supportive sling-like structure. These muscles attach to the pubic

bone anteriorly, ischial tuberosities laterally, and the coccyx posteriorly. They play a vital role in supporting the pelvic organs, including the bladder, uterus (in females), and rectum. The pelvic floor muscles also contribute to urinary and fecal continence and are involved in sexual function.

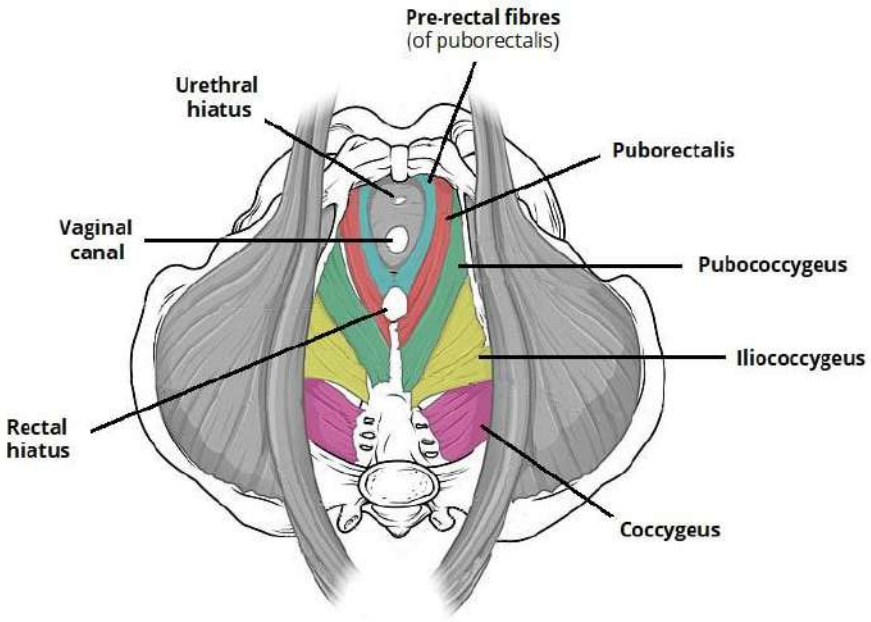
The *levator ani muscles* are the main muscles comprising the pelvic floor. They consist of three parts: the *pubococcygeus*, *iliococcygeus*, and *puborectalis* muscles. These muscles attach to the pubic bone, ischial spine, and coccyx. The levator ani muscles help support the pelvic organs, maintain urinary and fecal continence, and contribute to sexual function. They also function to stabilize the pelvic girdle and assist in maintaining proper posture.

The *obturator internus* muscle is a deep muscle located within the pelvis. It attaches to the inner surface of the obturator membrane and the surrounding bones, including the ischium and pubic bone. The muscle passes through the lesser sciatic notch and attaches to the greater trochanter of the femur. The obturator internus muscle aids in external rotation and stabilization of the hip joint.

The *piriformis* muscle is a deep muscle located in the gluteal region. It originates from the anterior surface of the sacrum and attaches to the greater trochanter of the femur. The piriformis muscle plays a role in external rotation and stabilization of the hip joint. It also contributes to the support and stability of the pelvic region.

The *coccygeus*, also known as the *ischiococcygeus* muscle, is a small triangular muscle located at the posterior aspect of the pelvic floor. It attaches to the ischial spine and the lower sacrum, extending to the coccyx. The coccygeus muscle provides support to the pelvic organs and contributes to pelvic floor function and stability.

Understanding the attachment and function of pelvic muscles is crucial for physical therapists when assessing and treating various conditions such as pelvic pain, pelvic floor dysfunction, and urinary incontinence. It enables therapists to develop targeted interventions to improve muscle strength, coordination, and endurance. Additionally, knowledge of these muscles enhances the ability to educate patients on proper pelvic muscle activation and relaxation techniques, promoting optimal pelvic health and function.



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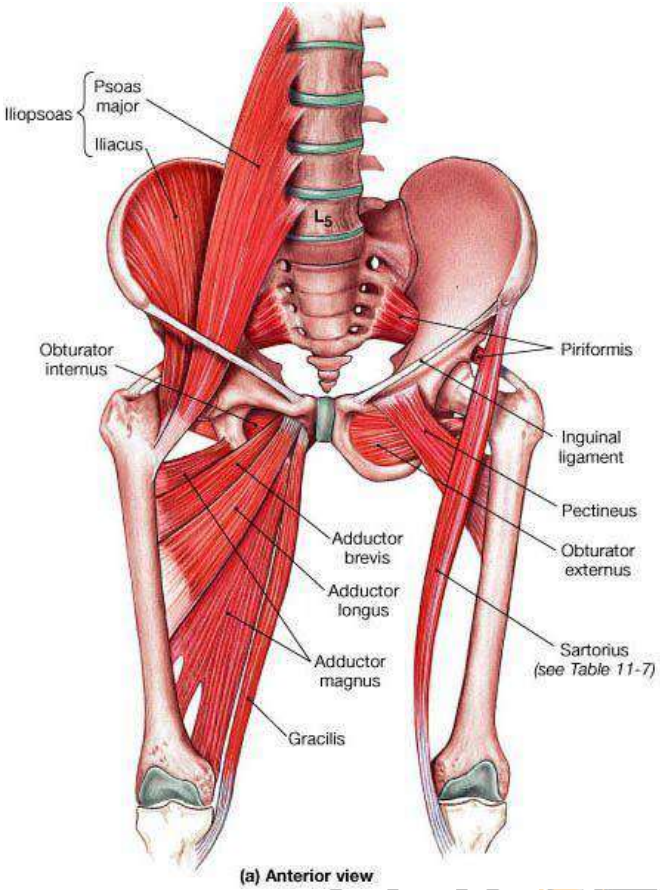

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Nerves

The pelvic region is a complex area of the body that houses various nerves responsible for sensory and motor innervation of the pelvis, genitalia, and lower extremities. Understanding the nerves of the pelvic region is crucial for physical therapists as they assess and treat conditions related to the pelvis, hips, and surrounding structures.

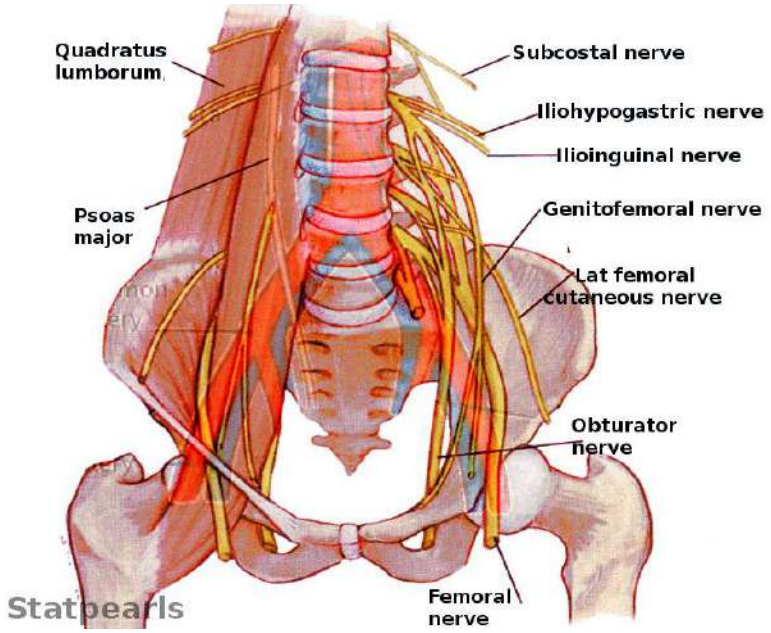
The *obturator nerve* provides sensory innervation to the medial (inner) thigh and provides motor innervation to the muscles that adduct (bring together) the thigh, such as the adductor muscles. The obturator nerve arises from the lumbar spinal nerves L2 to L4. After exiting the pelvis through the obturator foramen, it divides into anterior and posterior branches that pass through the obturator canal.

The *femoral nerve* provides sensory innervation to the anterior thigh, the lower leg, and the foot. It also supplies motor innervation to the quadriceps muscles, which are important for knee extension. It arises from the lumbar spinal nerves L2 to L4. It emerges from the pelvis through the anterior aspect of the psoas muscle and descends in the pelvis along the iliacus muscle before passing beneath the inguinal ligament to enter the thigh.

The *sciatic nerve* is the largest nerve in the body and provides both sensory and motor innervation to the posterior thigh, the entire leg, and the foot. It supplies various muscles, including the hamstrings, calf muscles, and foot muscles. It is formed by the merging of the ventral rami of the fourth and fifth lumbar spinal nerves and the first to fourth sacral spinal nerves (L4-S4). It exits the pelvis through the greater sciatic foramen and travels down the back of the thigh, giving rise to the tibial and common fibular (peroneal) nerves.

The *pudendal nerve* provides sensory innervation to the perineum, including the external genitalia and anal region. It also supplies motor innervation to the pelvic floor muscles, including the muscles involved in urination, defecation, and sexual function. The pudendal nerve arises from the sacral spinal nerves S2 to S4. It exits the pelvis through the greater sciatic foramen and re-enters through the lesser sciatic foramen, eventually reaching the perineum.

The *sacral plexus* is a network of nerves formed by the ventral rami of the fourth and fifth lumbar spinal nerves and the first to fourth sacral spinal nerves (L4-S4). It gives rise to several nerves that supply the pelvic region, hips, and lower extremities, including the sciatic nerve, pudendal nerve, and various branches that innervate the gluteal muscles, hip muscles, and lower limb muscles.



https://www.ncbi.nlm.nih.gov/books/NBK542245/figure/article-26868.image.f1/?report=objectonly

Understanding the pathways and functions of these nerves in the pelvic region is crucial for physical therapists when evaluating and treating conditions such as pelvic pain, hip disorders, nerve impingements, and pelvic floor dysfunction.

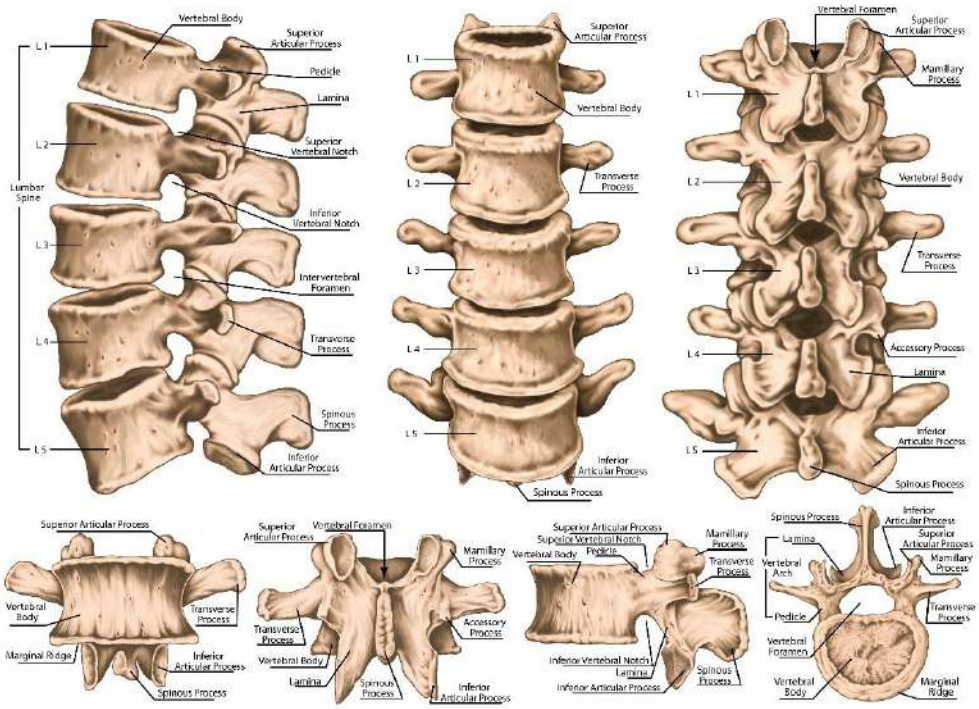
Vertebral Column

The vertebral column in the low back consists of five lumbar vertebrae (L1 to L5). These vertebrae provide structural support, protect the spinal cord, and allow for movement. The intervertebral discs, located between each vertebra, provide shock absorption and facilitate movement. The lumbar vertebrae, like other vertebrae, contribute to the formation of the spinal canal. The spinal canal houses and protects the spinal cord, nerve roots, and other structures of the central nervous system. This section will detail the anatomy and function of the bones, joints, muscles, and nerves of the low back.

Bones

The lumbar vertebrae are the largest bones in the vertebral column, providing support, stability, and flexibility to the lower back region. Understanding the

anatomy of the lumbar vertebrae is crucial for physical therapists in assessing and treating conditions related to the lower back. There are five lumbar vertebrae in the human spine, labeled as L1 to L5. These vertebrae are located in the lower back between the thoracic vertebrae and the sacrum. Compared to other regions of the spine, the lumbar vertebrae are larger and have a more robust structure to bear weight and provide stability.



https://www.healthcentral.com/condition/back-pain/lumbar-spine

The *spinous processes* are bony projections that extend posteriorly from the back of each lumbar vertebra. They can be palpated along the midline of the lower back. The spinous processes provide attachment points for ligaments and muscles, contributing to the stability and movement of the spine. The *transverse processes* are bony projections that extend laterally from the sides of each lumbar vertebra. These processes serve as attachment sites for muscles, ligaments, and other soft tissues. The transverse processes play a role in providing stability to the spine and assist in the movement and control of spinal motion. The *vertebral body* is the large, thick, and weight-bearing portion of each lumbar vertebra. It is located

anteriorly and serves as a support structure. The vertebral bodies are wider and thicker than those in the thoracic and cervical regions to withstand the forces exerted on the lower back.

Joints

The *facet joints*, also known as zygapophyseal joints, are paired joints located on the posterior aspect of the vertebrae. These synovial joints enable movement and stability in the spine. Facet joint dysfunction or degeneration can contribute to low back pain and restricted mobility. The *lumbosacral joint* refers to the articulation between the last lumbar vertebra (L5) and the sacrum. This joint acts as a transitional area between the lumbar spine and the pelvis. It provides stability and support to the lower back and helps to transfer forces between the lumbar spine and the pelvis.

Ligaments and Discs

Several ligaments in the low back provide stability and support to the vertebral column. The *anterior* and *posterior longitudinal ligaments* run along the anterior and posterior aspects of the vertebral bodies, respectively, providing stability and limiting excessive movement. The *ligamentum flavum* connects the laminae of adjacent vertebrae and assists in maintaining the normal curvature of the spine. The *interspinous* and *supraspinous ligaments* connect the spinous processes of adjacent vertebrae, providing support and limiting excessive flexion and extension.

The *intervertebral discs* are fibrocartilaginous structures located between adjacent vertebral bodies. They consist of a tough outer layer called the annulus fibrosus and a gel-like central portion called the nucleus pulposus. The discs help maintain spinal stability, absorb shock, and facilitate movement.

Muscles and Nerves

Numerous muscles in the low back region play a crucial role in providing stability, generating movement, and supporting the spine. This section will include key muscles, attachment sites, and function to provide an overview for physical therapist examination and treatment and physical therapist assistant treatment of low back pain.

The *erector spinae* group of muscles includes the iliocostalis, longissimus, and spinalis muscles. They extend the spine, maintain posture, and provide stability. The *iliocostalis* muscle has three parts, the iliocostalis lumborum, the iliocostalis thoracic, and the iliocostalis cervicis. The iliocostalis lumborum originates from the posterior iliac crest and the posterior sacrum, the iliocostalis thoracis originates from the angles of the lower six ribs, and the iliocostalis cervicis originates from the angles of the upper four or five ribs. The iliocostalis muscles insert into the angles of the ribs and the transverse processes of the cervical vertebrae. The *longissimus* muscle also has three sections: longissimus thoracis, longissimus cervicis, and longissimus capitis. The longissimus muscles contribute to spinal extension, lateral flexion, and rotation. The longissimus thoracic originates at the posterior sacrum, the iliac crest, and the transverse processes of the lumbar and lower thoracic vertebrae. It inserts into the angles of the lower nine or ten ribs and the transverse processes of the thoracic vertebrae. The longissimus cervicis originates from the transverse processes of the upper thoracic and lower cervical vertebrae and inserts at the transverse processes of the upper cervical vertebrae and the mastoid process of the temporal bone. The longissimus capitus originates at the transverse processes of the upper cervical vertebrae and inserts into the mastoid process of the temporal bone. The spinalis muscle runs closest to the midline of the back and is divided into three sections: spinalis thoracis, spinalis cervicis, and spinalis capitis. The spinalis muscles aid in extending and rotating the spine. The spinalis thoracis originates from the spinous processes of the upper lumbar and lower thoracic vertebrae and inserts at the spinous processes of the

upper thoracic vertebrae. The spinalis cervicis originates from the spinous processes of the upper thoracic and lower cervical vertebrae and inserts into the spinous processes of the upper thoracic vertebrae. The spinalis capitus originates from the spinous processes of the upper cervical vertebrae and inserts at the spinous processes of the upper thoracic vertebrae.

The *multifidus* are deep intrinsic muscles that stabilize the vertebral column and assist in controlling segmental movements. The origin of the multifidus is the sacrum, iliac crest, and the transverse processes of the lumbar, thoracic, and cervical vertebrae. It inserts into the spinous processes of the vertebrae, several levels above its origin. The *transversus abdominis* is a deep abdominal muscle that acts as a stabilizer for the spine, contributing to core stability and control. It acts as a corset-like muscle, compressing the abdominal contents and creating intra-abdominal pressure. This pressure helps stabilize the spine during movements such as lifting, bending, and twisting, reducing the risk of low back injuries. The transversus abdominis also contributes to forced expiration by aiding in the compression of the abdominal cavity. Its origin is the internal surface of the 7th to 12th costal cartilages (ribs), the iliac crest, the lateral one-third of the inguinal ligament, and the thoracolumbar fascia. It inserts at the pubic crest and the linea alba, which is a fibrous band that runs vertically along the abdomen. The *rectus abdominis* is responsible for flexing the trunk, which involves bringing the ribcage closer to the pelvis. It also aids in stabilizing the trunk and maintaining proper posture. The rectus abdominis originates from the pubic symphysis and inserts into the xiphoid process. The *external oblique* is involved in several movements of the trunk, including flexion, rotation, and lateral bending. It works in conjunction with the internal oblique muscle to support the abdominal wall, compress the abdominal contents, and assist in forced expiration. The external oblique originates from the lower eight ribs and inserts into the linea alba. The *internal oblique* muscle works in opposition to the external oblique to rotate and laterally

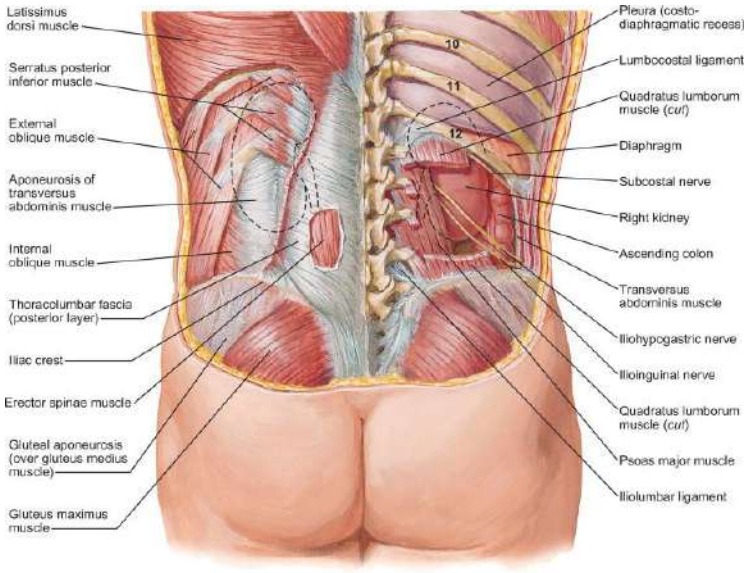
bend the trunk. It also helps with forced expiration and contributes to core stability. It originates from the thoracolumbar fascia and inserts into the linea alba, the pubic crest, and the lower three or four ribs.

The *quadratus lumborum*, located on each side of the low back, helps stabilize and laterally flex the spine. Its origin is the iliac crest and the transverse processes of the lumbar vertebrae. Its insertion is rib 12 and the transverse processes of the upper lumbar vertebrae.

The *psoas major* is a deep muscle that originates from the lumbar vertebrae and extends downward to attach to the femur. It plays a significant role in hip flexion and stabilization of the lumbar spine. The psoas major is often involved in conditions such as hip and low back pain and can be a focus of rehabilitation for restoring normal movement patterns. Its origin is the bodies and transverse processes of the lumbar vertebrae, and its insertion is the lesser trochanter of the femur. The gluteal muscles, including the *gluteus maximus*, *gluteus medius*, and *gluteus minimus*, have attachments to the pelvis and contribute to the stability and movement of the low back. The gluteus maximus is the largest muscle in the body and plays a role in hip extension. The gluteus medius and minimus assist in hip abduction and stabilization of the pelvis. The gluteus maximus originates at the iliac crest, sacrum, coccyx, and the thoracolumbar fascia and inserts into the gluteal tuberosity of the femur and the iliotibial (IT) tract. The gluteus medius originates at the external surface of the ilium and inserts at the greater trochanter. The gluteus minimus originates at the ilium and inserts at the greater trochanter.

Understanding the function and attachments of the muscles in the low back is essential for physical therapists in evaluating and treating conditions such as low back pain, muscle imbalances, postural dysfunction, and movement impairments. It enables therapists to develop targeted interventions to improve muscle

strength, flexibility, and coordination, leading to enhanced stability, function, and pain relief in the low back region.



https://www.sciencedirect.com/topics/neuroscience/lumbar-nerves

Nerves

The low back region is innervated by various nerves, including the lumbar spinal nerves. These nerves emerge from the spinal cord, pass through the intervertebral foramina, and distribute sensory and motor innervation to the lower back, buttocks, hips, and lower extremities. The lumbar spinal nerves are the beginning of each nerve that controls hip and leg movement. Nerve impingements or irritation, such as from herniated discs or spinal stenosis, can result in radiating pain, numbness, or weakness. This section will detail important nerves in the low back region so physical therapists and assistants are able to understand nerves as symptom generators.

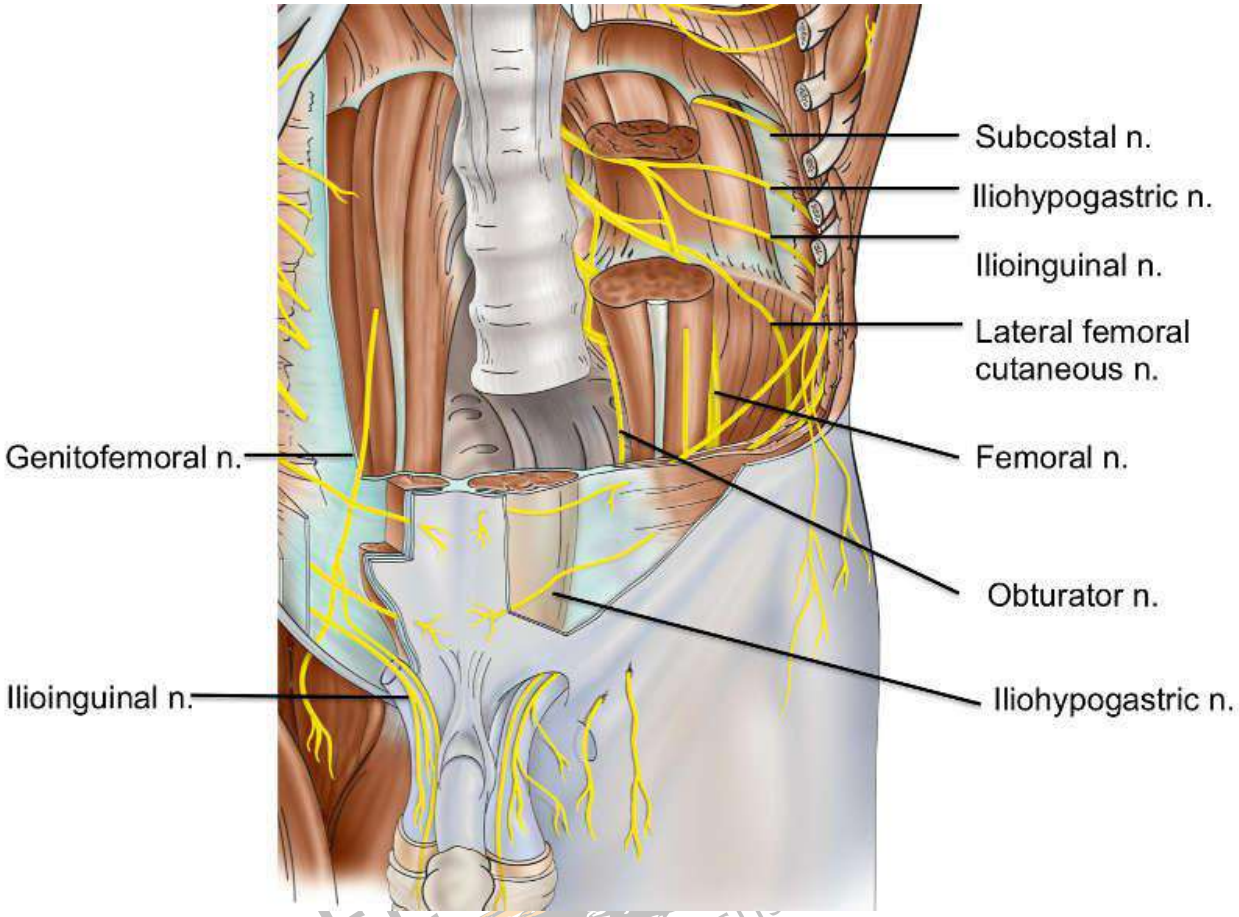
The *lumbar spinal nerves* are five paired nerves that originate from the spinal cord at each level of the lumbar vertebrae from L1 to L5. These spinal nerves exit the spinal column through openings called intervertebral foramina, located between adjacent vertebrae. Each lumbar spinal nerve carries both sensory and motor

fibers, allowing for the transmission of sensory information from the lower back and lower extremities to the spinal cord and brain, as well as the transmission of motor signals from the spinal cord to the muscles of the lower back and lower extremities.

The *sciatic nerve* is the largest and longest nerve in the body, and it originates from the lumbar and sacral spinal nerves (specifically, from the nerve roots L4 to S3). It exits the pelvis through the greater sciatic foramen and travels down the back of the thigh, providing both sensory and motor innervation to the posterior thigh, the entire leg, and the foot. The sciatic nerve is composed of two major branches: the tibial nerve and the common fibular (peroneal) nerve, which further divide into smaller branches to innervate specific muscles and areas of the lower extremity.

The *femoral nerve* arises from the lumbar spinal nerves L2 to L4. It exits the pelvis and passes through the pelvic region, then travels down the front of the thigh. The femoral nerve provides sensory innervation to the front of the thigh, the lower leg, and the foot. It also supplies motor innervation to the quadriceps muscles, which are important for knee extension.

The *obturator nerve* originates from the lumbar spinal nerves L2 to L4. It passes through the pelvis and travels down the inner thigh. The obturator nerve supplies sensory innervation to the medial (inner) thigh and provides motor innervation to the muscles that adduct (bring together) the thigh, such as the adductor muscles.



https://www.wheelessonline.com/issls/lumbar-nerves-anatomy/

Understanding the pathways and functions of these lumbar spinal nerves, as well as the sciatic, femoral, and obturator nerves, is essential for physical therapists when evaluating and treating conditions related to the lower back, hips, and lower extremities. By assessing nerve function, therapists can identify potential nerve impingements, radiculopathies, or other neurological dysfunctions and develop appropriate treatment strategies to alleviate pain, restore function, and promote optimal movement patterns in their patients.

Section 1 Key Words

Facet Joints – synovial joints located on the posterior aspect of the vertebrae that joints enable movement and stability in the spine

Pelvic Floor – a group of muscles, ligaments, and connective tissues that form a supportive hammock-like structure at the bottom of the pelvis; spans the area between the pubic bone anteriorly and the coccyx posteriorly

Vertebral Column – the L1-L5 vertebrae and surrounding structures that surround and protect the spinal cord and create the stability of the lumbar spine

Gluteal Muscles – include the gluteus maximus, medius, and minimis and are responsible for hip extension and stability of the low back

Section 1 Summary

Understanding the demographics, prevalence, and anatomy related to low back pain is of utmost importance for physical therapists treating patients with this condition. By combining insights from demographics, prevalence, and anatomy, physical therapists and physical therapist assistants can develop individualized treatment plans that address the unique needs and circumstances of each patient. This holistic approach ensures that therapists consider relevant factors, such as age-related changes, lifestyle factors, and anatomical variations, to provide effective pain relief, improve function, and enhance the overall well-being of individuals suffering from low back pain.

Section 2: History and Clinical Assessment

Any bout of physical therapy care begins with a thorough subjective history taking and an evidence-based clinical assessment. The subjective history will reveal what to prioritize in the assessment items, so it is important for clinicians to become skilled at deriving valuable information from patients. History taking is also imperative in gaining insight on any comorbidities, health conditions, red flags for serious causes of low back pain that may require prompt emergency care, and

psychosocial factors contributing to low back pain. The clinical assessment will involve gaining a sense of the patient's mobility through observation, strength testing, mobility testing, body mechanics observation, and special tests. Through the history and assessment, a physical therapist will have a foundational understanding of what to prioritize in developing the plan of care and treatment approaches.

Subjective History [8]

Physical therapists should ask for a qualitative description of the symptoms their patient is experiencing. Depending on how much the patient shares, guiding questions should gather a clear picture of the quantity and quality of symptoms. Providers should use open-ended questions, so the patient has to share descriptive details. Close-ended questions, where the patient is welcome to simply answer "yes" or "no" will not elicit the proper detail in a subjective history. The following are guiding questions for the subjective history portion.

What is the primary reason you are seeking physical therapy today?

This question is a great way to begin subjective history taking. Depending on how much the patient shares, the PT can derive information on a chief complaint, what symptoms the patient is experiencing, the acuity or chronicity of symptoms, and how it affects their life.

Can you describe the symptoms you are experiencing?

This question should derive the patient's perception of what their symptoms are, why they are seeking treatment, and how it affects their life. Depending on how much the patient shares this open-ended question, they may describe when the symptoms started, how frequently they have symptoms, and what the symptoms feel like.

When and how did your symptoms start and have you had this pain before?

PTs should gather information on a timeline of symptoms to determine the acuity or chronicity of the symptoms. They should also inquire if the symptoms started from an injury or gradually and if there is a pattern to what makes the symptoms the worst. The mechanism of injury is important in diagnosis, ruling out differential diagnosis, and determining red flags. Asking if this is a recurrent pain is helpful in determining the root cause of the problem as well.

What makes your symptoms better and worse?

Discovering aggravating and relieving factors is crucial to detect how a patient's symptoms respond to certain strategies, like rest, ice, and activity modification. It will give perspective on the patient's ability to self-manage and their coping mechanisms around their symptoms as well.

How have your symptoms influenced your daily routine and occupation?

It is important to get a grasp on how symptoms have affected the lives of patients. PTs should gather information on a patient's daily routine and what skills and pain levels the physical therapy plan will work toward. This information will provide insight into what motivates a patient in the goals they set for treatment. Physical therapists should inquire about occupational duties to understand the body positions their patients are in and whether the workday causes symptoms. This should lead to intervention in body mechanics and postural education.

Do you have other medical conditions you are being treated for and are you dealing with pain anywhere else in your body?

It is critical to investigate a thorough medical history including any systemic conditions, comorbidities, other pain sources, and medication history. Systemic conditions and comorbidities could be the cause of an emergent source of back pain, which will be discussed in the red flags screening section. In addition,

comorbidities could affect one's ability to participate in and prioritize a physical therapy program. Other pain sources, such as ankle or neck pain, are critical to investigate. These pains could contribute to the development of back pain or affect recovery time. A medication review is necessary to perform in every physical therapy evaluation. Patients may be taking pain medications, which will blunt the natural pain experience. Physical therapists should prioritize education on the adverse effects of strong painkillers, like opioids, to prevent dependence.

What are your sleeping, eating, and exercise habits?

PTs should determine these health behaviors as they are critical in the healing process from injury and pain. Patients should be getting the recommended seven to nine hours of restful sleep. Sleep hygiene such as limiting light and screen time before bed, avoiding eating for a few hours before bed, and limiting caffeine intake are important educational points. Diet and exercise also play a huge role in healing times, so physical therapists should gain an understanding of their patient's habits. PTs can generally promote good nutrition by educating patients to eat mostly fruits and vegetables, lean proteins, and healthy fats, but should refer to a Registered Dietitian for professional nutrition care. Physical therapists should promote patients getting at least 150 minutes of moderate exercise weekly, including a mix of aerobic and strength-based exercise.

These questions represent a basic knowledge of the history of one's symptoms at PT evaluation. Of course, conversation with a patient may always deliver more or less information depending on how much they share and how comfortable they feel with the patient-therapist rapport. It is the clinician's responsibility to derive information pertinent to the diagnosis of low back pain.

Screening for Red Flags [9,10]

It is important to screen for red flags when evaluating a patient with low back pain because red flags are warning signs that may indicate serious underlying conditions or potential complications. Identifying these red flags helps in many ways, such as in the early detection of serious conditions. Some red flags, such as trauma, unexplained weight loss, or a history of cancer, may be indicative of serious underlying conditions like fractures, tumors, or infections. Early detection of these conditions is crucial for timely intervention and appropriate management. Red flags associated with bladder or bowel dysfunction, weakness or numbness in the legs or feet, or difficulty walking may indicate neurological compromise or spinal cord involvement. Recognizing these signs is essential for ensuring the safety of the patient and preventing further damage or disability. Red flags often require further evaluation and intervention beyond the scope of a physical therapist's practice. By screening for red flags, physical therapists can identify patients who need referral to other healthcare professionals, such as physicians, neurologists, or orthopedic specialists, for a more comprehensive assessment and appropriate management. Red flags can sometimes mimic more common musculoskeletal conditions. Failing to recognize these warning signs may lead to misdiagnosis or delayed diagnosis, resulting in ineffective or inappropriate treatment and potential harm to the patient. By implementing a thorough screening process for red flags, physical therapists can ensure the safety of their patients, facilitate timely and accurate diagnosis, and provide appropriate referrals for further evaluation and management when necessary. Here are questions to screen for red flags, and appropriate actions for physical therapists to take. These questions to screen for the following red flag conditions should be asked in the initial evaluation but can be asked any time in a bout of care.

Fracture

Have you experienced any recent trauma or injury to your back?

This could be indicative of a fracture. A physical therapist should refer directly to an orthopedic specialist and/or urgent care based on the severity of the clinical presentation.

Cauda Equina Syndrome or Nerve Compression

Are you currently experiencing any bladder or bowel dysfunction, such as difficulty controlling urine or stool?

Have you experienced any recent loss of sensation in the genital or rectal area (saddle anesthesia)?

The loss of bladder and/or bowel function is a serious red flag. Cauda Equina Syndrome is a rare but emergent condition where the nerve roots in the lower back, known as the cauda equina, become compressed or damaged. Symptoms may include difficulty controlling bowel or bladder function, urinary or fecal incontinence, or loss of sensation in the genital or rectal area. It can lead to paralysis if left untreated. Other symptoms of Cauda Equina Syndrome are severe low back pain, saddle anesthesia, weakness, numbness, reduced/absent reflexes, and bilateral leg pain. Physical therapists should send patients with this clinical presentation directly to the Emergency Department to prevent permanent nerve damage and paralysis. Nerve compression in the lower back can cause dysfunction in the nerves responsible for bladder and bowel control. Conditions like herniated discs, spinal stenosis, or tumors can potentially compress the nerves and result in these symptoms. In some cases, severe trauma or spinal conditions such as tumors or fractures can lead to compression or injury to the spinal cord. Bladder and bowel dysfunction may be among the signs of spinal cord involvement. For

any loss of bowel and bladder function, physical therapists should refer immediately to a specialist for imaging and treatment.

Cancer

Have you noticed any significant unexplained weight loss recently?

Do you have a personal or family history of cancer?

Do you have pain that wakes you up at night?

Have you been experiencing constant or progressive pain that doesn't improve with rest?

Do you have persistent pain that does not improve with rest?

These questions are crucial in screening for cancer as a potential cause of low back pain. If the patient answers yes to some or all of these questions, especially night pain that awakens them and unexplained weight loss, the patient should be referred urgently to primary care for further investigation.

Abdominal Aortic Aneurysm (AAA)

Do you have a deep, constant pain in the abdomen or back?

Do you feel a throbbing or pulsing sensation in your abdomen?

These questions, and examination items, should make a physical therapist suspicious of an AAA. Pain may radiate to the groin, lower extremities, and buttocks as well. The abdomen may also be tender to palpation, and the physical therapist may be able to see or feel the aneurysm. Patients should be promptly referred to a vascular specialist for surgical and nonsurgical management options. Signs of a ruptured AAA are severe and sudden low back and abdominal pain, elevated heart rate, low blood pressure, dizziness, loss of consciousness, sweaty

skin, and paleness. In this case, an emergency call to 911 and travel by ambulance is necessary to save the patient's life in surgery.

Infection

Do you have a fever or any signs of infection, such as chills or night sweats?

Have you had a recent history of intravenous drug use or a known immunocompromised condition?

A patient with an infection and low back pain may experience progressively worsening pain as an infection spreads. They may have drainage and/or redness over the skin of the low back. They would be fatigued, feeling malaise, and experience chills and/or fever. Patients should be referred to the Emergency Department if the PT suspects an infection. If not, the infection can spread and cause progressively worse problems.

Inflammatory Conditions

Are you experiencing any morning stiffness and pain that worsens with rest?

Ankylosing Spondylitis is a chronic inflammatory condition that primarily affects the spine and sacroiliac joints. Symptoms often include morning stiffness and pain that improve with exercise but worsen with rest. Limited range of motion in the spine and hip joints and fatigue may also be present. It is most common in those from 20 to 40 years old. Physical therapists should refer to a rheumatologist or primary care to treat AS, as it is progressive and responds well to anti-inflammatory medications.

Rheumatoid Arthritis is more commonly associated with peripheral joint involvement, but it can also affect the spine. Inflammatory back pain, joint stiffness, and systemic symptoms may be present. Physical therapists should refer

to a rheumatologist or primary care for management of arthritis to slow the systemic disease process.

These red flag conditions are important to manage appropriately with the correct referrals. Physical therapists may refer, refer and treat, or treat patients based on the subjective history and red flag screening answers.

Psychosocial Screening

Psychosocial factors play an important role in the experience and management of low back pain. Incorporating a psychosocial screening as part of a physical therapy evaluation can help identify any psychosocial factors that may influence the individual's pain experience, recovery, and treatment outcomes. Here are some common psychosocial screening domains and questions to ask in the physical therapy evaluation.

Pain Beliefs and Attitudes

Psychosocial factors can shape how individuals perceive and interpret their pain. Beliefs, attitudes, and expectations about pain can influence pain severity, tolerance, and the degree of disability experienced. For example, fear-avoidance beliefs, catastrophizing (exaggerating the negative aspects of pain), or a belief that pain signifies harm can lead to heightened pain perception and avoidance of activities. Physical therapists may gain insight on their patient’s pain beliefs and attitudes with these questions:

How do you perceive your pain and its impact on your life?

Do you feel that your pain is manageable, or do you believe it is uncontrollable?

How does your pain affect your daily activities, work, or social life?

In addition, the outcome measures The Pain Catastrophizing Scale, and the Fear Avoidance Beliefs Questionnaire are great tools to objectively measure and assess progress of how psychological factors may be impacting the plan of care.

Pain Catastrophizing Scale (PCS)

	Not at all	To a slight degree	To a moderate degree	To a great degree	All the time
I worry all the time about whether the pain will end	0	1	2	3	4
I feel I can't go on	0	1	2	3	4
It's terrible and I feel it's never going to get any better	0	1	2	3	4
It's awful and I feel that it overwhelms me	0	1	2	3	4
I feel I can't stand it any more	0	1	2	3	4
I worry that the pain will get worse	0	1	2	3	4
I keep thinking of other painful events	0	1	2	3	4
I anxiously want the pain to go away	0	1	2	3	4
I can't seem to keep it out of my mind	0	1	2	3	4
I keep thinking about how much it hurts	0	1	2	3	4
I keep thinking about how badly I want the pain to stop	0	1	2	3	4
There's nothing I can do to reduce the intensity of the pain	0	1	2	3	4
I wonder whether something serious may happen	0	1	2	3	4

Rumination: Sum of 8, 9, 10, 11
Magnification: Sum of 6, 7, 13
Helplessness: Sum of 1, 2, 3, 4, 5, 12

A total score of ≥30 indicates a clinically significant level of catastrophizing

https://www.researchgate.net/figure/Pain-Catastrophizing-Scale_fig3_313955534

Fear Avoidance Beliefs Questionnaire (FABQ):

Here are some of the things which other patients have told us about their pain. For each statement please circle any number from 0 to 6 to say how much physical activities such as bending, lifting, walking or driving affect or would affect *your* back pain.

	Completely disagree			Unsure			Completely agree
1. My pain was caused by physical activity	0	1	2	3	4	5	6
2. Physical activity makes my pain worse	0	1	2	3	4	5	6
3. Physical activity might harm my back	0	1	2	3	4	5	6
4. I should not do physical activities which (might) make my pain worse	0	1	2	3	4	5	6
5. I cannot do physical activities which (might) make my pain worse	0	1	2	3	4	5	6

The following statements are about how your normal work affects or would affect your back pain

	Completely disagree			Unsure			Completely agree
6. My pain was caused by my work or by an accident at work	0	1	2	3	4	5	6
7. My work aggravated my pain	0	1	2	3	4	5	6
8. I have a claim for compensation for my pain	0	1	2	3	4	5	6
9. My work is too heavy for me	0	1	2	3	4	5	6
10. My work makes or would make my pain worse	0	1	2	3	4	5	6
11. My work might harm my back	0	1	2	3	4	5	6
12. I should not do my normal work with my present pain	0	1	2	3	4	5	6
13. I cannot do my normal work with my present pain	0	1	2	3	4	5	6
14. I cannot do my normal work till my pain is treated	0	1	2	3	4	5	6
15. I do not think that I will be back to my normal work within 3 months.	0	1	2	3	4	5	6
16. I do not think that I will ever be able to go back to that work	0	1	2	3	4	5	6

Scoring
Scale 1: fear-avoidance beliefs about work – items 6, 7, 9, 10, 11, 12, 15.
Scale 2: fear-avoidance beliefs about physical activity – items 2, 3, 4, 5.

https://www.sralab.org/rehabilitation-measures/fear-avoidance-beliefs-questionnaire

Emotional Well-Being

Psychological factors such as anxiety, depression, stress, and emotional distress can amplify the experience of pain and contribute to its persistence. Emotional states can influence pain thresholds, pain tolerance, and the ability to cope with pain. Conversely, chronic pain can also contribute to the development or exacerbation of psychological distress. Below are questions to assess emotional well-being during the history taking.

Are you experiencing symptoms of anxiety or depression?

Do you feel hopeless or discouraged due to your pain?

Have you noticed any changes in your mood or sleep patterns related to your pain?

The Patient Health Questionnaire (PHQ) is a great outcome measure to assess depression in patients. It comes in four or nine question versions. If patients score in the ranges of recommended psychotherapy, physical therapists should refer them to a mental health professional to practice patient-centered care.

The Patient Health Questionnaire (PHQ-9)

Patient Name _____ Date of Visit _____

Over the past 2 weeks, how often have you been bothered by any of the following problems?	Not At all	Several Days	More Than Half the Days	Nearly Every Day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed or hopeless	0	1	2	3
3. Trouble falling asleep, staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself - or that you're a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed. Or, the opposite - being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3
Column Totals	_____	+ _____	+ _____	
Add Totals Together	_____			

PHQ-9 Score	Provisional Diagnosis	Treatment Recommendation *Patient Preferences should be considered*
5-9	Minimal Symptoms*	Support, educate to call if worse, return in one month
10-14	Minor depression ++ Dysthymia* Major Depression, mild	Support, watchful waiting Antidepressant or psychotherapy Antidepressant or psychotherapy
15-19	Major depression, moderately severe	Antidepressant or psychotherapy
>20	Major Depression, severe	Antidepressant and psychotherapy (especially if not improved on monotherapy)

** If symptoms present ≥ two years, then probable chronic depression which warrants antidepressants or psychotherapy (ask "In the past 2 years have you felt depressed or sad most days, even if you felt okay sometimes?")*

++ If symptoms present ≥ one month or severe functional impairment, consider active treatment

https://www.sralab.org/rehabilitation-measures/patient-health-questionnaire-phq-9

Social Support

Social factors, including social support and the quality of relationships, can impact the experience of low back pain. Adequate social support from family, friends, or healthcare professionals can provide emotional and practical assistance, enhance coping strategies, and improve treatment outcomes. On the other hand, unsupportive or strained relationships can contribute to increased stress and hinder recovery. Below are questions to screen for social support.

Do you have a support system (family, friends) to help you cope with your pain?

Are there any challenges or limitations in your social relationships due to your pain?

Do you feel understood and supported by those around you regarding your pain?

Work and Lifestyle Factors

Occupational and lifestyle factors can play a role in low back pain. Job dissatisfaction, high physical demands, poor ergonomics, and psychosocial stressors at work can contribute to the development or persistence of low back pain. Sedentary lifestyle, lack of physical activity, and unhealthy habits (e.g., smoking, poor sleep) can also impact pain perception and hinder recovery. Below are screening questions to discover one's occupational situation and the impact it may have on outcomes.

How does your pain impact your ability to perform your job or daily activities?

Are there any workplace or ergonomic factors that may contribute to your pain?

Are there any lifestyle factors (e.g., physical activity, sedentary behavior) that may influence your pain?

Coping Strategies

Individuals with low back pain may adopt various coping strategies to manage their pain. Positive coping strategies, such as engaging in physical activity, relaxation techniques, and seeking social support, can promote pain management and functional improvement. However, maladaptive coping strategies, such as avoidance behaviors, excessive rest, or overreliance on medication, can perpetuate pain and disability. Here are subjective history questions that screen for coping methods:

What strategies do you currently use to cope with your pain?

Are there any factors or activities that provide temporary relief or exacerbate your pain?

Have you sought help or support from healthcare professionals, such as therapists or counselors, regarding your pain?

Understanding and addressing psychosocial factors alongside the physical aspects of low back pain is crucial for comprehensive management. Healthcare professionals, including physical therapists, often employ a biopsychosocial approach to address the multidimensional nature of pain, which involves integrating physical interventions with strategies to address psychosocial factors. This may include education, cognitive-behavioral interventions, relaxation techniques, graded activity/exercise programs, and referral to mental health professionals when appropriate. By addressing psychosocial factors, treatment outcomes can be optimized, and individuals can regain control and improve their overall well-being despite living with low back pain.

Physical Examination

The physical examination should be guided by the subjective history taking. It will involve observation, palpation, range of motion testing, joint mobility testing, strength testing, neurological examination, special tests, and functional assessment.

Intake Forms – Outcome Measures [11]

Outcome measures assess functional and pain levels in order to track progress and monitor for discharge readiness. Outcome measures should be given with intake forms and reviewed in the examination session. Examples of effective outcome measures for patients with low back pain are the NPRS, the ODI, and the PSFS.

Numeric Pain Rating Scale (NPRS)

This is a self-report scale where individuals rate their pain intensity on a numerical scale from 0 to 10, with 0 being no pain and 10 being the worst pain imaginable. The NPRS helps to quantify and monitor changes in pain levels over time.

Roland-Morris Disability Questionnaire (RMDQ)

The RMDQ is another self-report questionnaire that evaluates functional disability specifically related to low back pain. It consists of 24 items that assess the impact of pain on various activities and physical functioning. Scores range from 0 to 24, with higher scores indicating higher levels of disability.

Oswestry Disability Index (ODI)

The ODI is a questionnaire that assesses the functional disability related to low back pain. It consists of multiple items covering various activities of daily living. Individuals rate the extent to which their pain interferes with each activity, and the scores are calculated to provide a percentage of disability. The ODI is widely used to evaluate functional limitations and track changes in disability.

Patient-Specific Functional Scale (PSFS)

The PSFS is a patient-centered outcome measure where individuals identify three to five activities that are important to them and rate their ability to perform those activities on a scale from 0 to 10. The scores are averaged to provide an overall functional score and can be used to assess changes in specific functional activities that are meaningful to the individual.

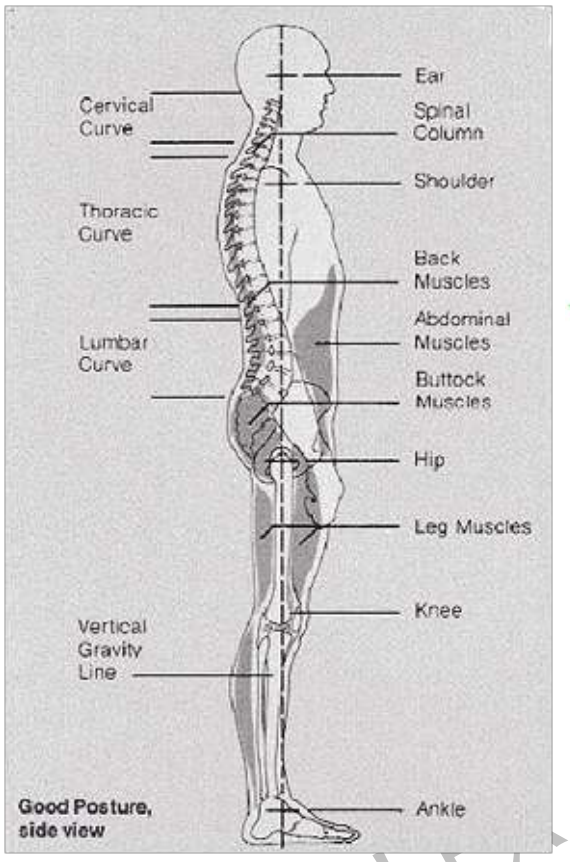
Observation

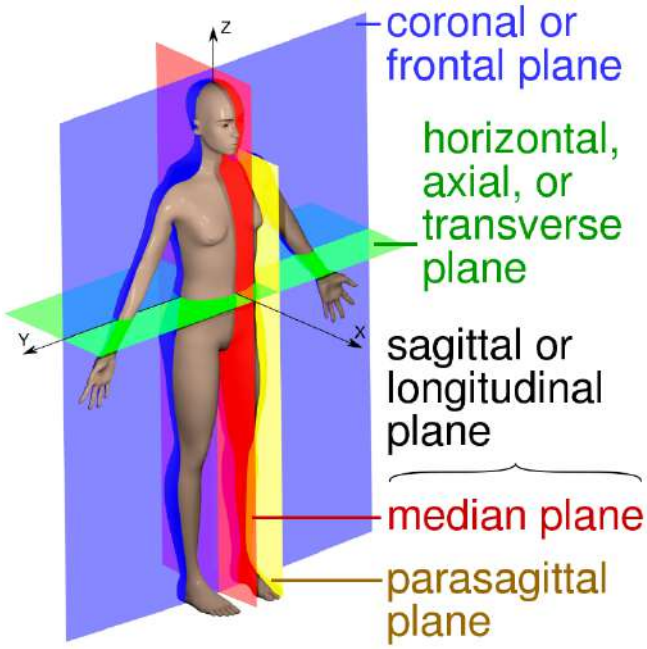
Observation in a physical examination includes postural assessment and gait analysis. It may also include assessing any joint swelling or skin irritation over injury sites. Physical therapists should not overlook making observations of patients during an examination as it can lead to more specific testing later in the examination.

Posture [12,13]

Posture should be assessed in all planes using the plumb line technique. This includes the sagittal, frontal, and transverse plane. In the sagittal plane, optimal head posture involves aligning the external auditory meatus (ear canal) with the midpoint of the shoulder joint. This ensures that the head is balanced and not protruding forward or excessively tilted. Optimal cervical spine alignment includes a slight lordotic curve in the neck region. This curve helps maintain the natural alignment of the vertebrae and facilitates shock absorption during activities. The thoracic spine should exhibit a gentle outward curve, forming the natural kyphotic curve. This curve allows for flexibility, shock absorption, and stability. Optimal alignment of the lumbar spine includes a balanced and moderate lordotic curve. The curve should neither be exaggerated (hyperlordosis) nor flattened (hypolordosis). The pelvis should be in a neutral position, which means the anterior superior iliac spines (ASIS) and pubic symphysis are in a horizontal plane. It should not be tilted excessively forward (anterior pelvic tilt) or backward (posterior pelvic tilt). Optimal posture involves aligning the hip joints vertically over the ankles, with the weight evenly distributed. This alignment optimizes weight-bearing and minimizes stress on the hip joint complex. The knees should be in a slightly flexed position, maintaining a soft and relaxed stance. The ankles should be in a neutral position, with the weight evenly distributed over the feet. The plumb line is an imaginary vertical line that should pass through specific points in optimal posture. These points include the external auditory meatus, the center of the shoulder joint, the center of the hip joint, and slightly anterior to the midline of the knee and ankle joints. In the frontal/coronal plane, optimal alignment for the head involves positioning it in the midline of the body, with equal space on either side of the head. In optimal frontal plane posture, the acromion processes should be aligned horizontally. The distance between the shoulders should be equal on both sides. The spine should be vertically aligned in the frontal plane and there should be no lateral curvature or side bending observed. When viewed from the front, the spinous processes of the vertebrae

should be aligned in a straight line without any deviations to either side. Optimal frontal plane alignment of the hips involves maintaining a level pelvis. The iliac crests should be at the same height on both sides. There should be no noticeable tilting or rotation of the pelvis. The knees and patella should be aligned anteriorly and in line with the hips and feet. Optimal posture in the frontal plane for the feet and ankles involves parallel alignment. The feet should be evenly spaced, with equal weight distribution across both feet. The ankles should be in a neutral position, without excessive pronation or supination. Equal weight distribution between the left and right sides of the body is desirable in optimal frontal plane posture. This ensures balance and prevents excessive loading on one side. In the transverse/horizontal plane, the head and neck should be aligned with the body's central axis. The cervical spine should maintain its natural curvature without excessive rotation or lateral flexion. Optimal alignment in the transverse plane involves symmetrical positioning of the shoulders. When viewed from above or below, the acromion processes (bony prominences on the shoulders) should be level and equidistant from the midline of the body. There should be no significant rotation or tilting of the scapulae or shoulders. The spine should have minimal rotation in the transverse plane. When viewed from superiorly or inferiorly, the spinous processes of the vertebrae should be aligned in a straight line without any noticeable lateral deviation or rotation. Optimal transverse plane posture requires the hip bones to be level and parallel to the floor. There should be no visible rotation or tilting of the pelvis. The arms should hang symmetrically laterally to the body. The palms should face inward or slightly backward, with the thumbs pointing anteriorly. The elbows should be slightly flexed and positioned parallel to the body's central axis. Optimal alignment in the transverse plane involves the knees, ankles, and feet pointing straight ahead without any significant medial or lateral rotation.





Gait Assessment [14,15]

Gait assessment includes observing from stance to swing phase with considerations of ranges of motion and alignment. Physical therapists should look for specific hip, knee, and ankle mobility ranges as well as aberrant movements in all planes.

Stance Phase

Heel Strike (Initial Contact)

At heel strike, the heel makes contact with the ground. The physical therapist should assess the position of the foot at heel strike and any abnormalities in foot alignment, such as excessive supination or pronation. The ankle should achieve approximately 10 degrees of dorsiflexion.

Foot Flat

At foot flat, also called loading response, the entire foot comes into contact with the ground, transitioning from the heel to the forefoot. The therapist observes the distribution of pressure across the foot and pronation versus supination.

Midstance

This is the phase when the body weight is directly over the supporting foot. The physical therapist should examine the alignment of the lower extremity, including the ankle, knee, and hip joints. They assess for proper alignment, stability, and any deviations from the optimal position. The knee should achieve 20 degrees of flexion from heel strike to midstance and the hip should achieve 30 degrees of flexion from heel strike to midstance.

Heel Off

The stance foot begins to lift off the ground as the body moves forward. The therapist observes the timing and smoothness of heel lift and assesses any restrictions or abnormalities in ankle dorsiflexion or toe extension.

Toe Off

The toes of the stance foot push off the ground, propelling the body forward into the swing phase. The therapist observes the range of motion and strength of toe extension and assesses any limitations or abnormalities. The ankle should be plantarflexed about 20 degrees and the hip should extend 10 degrees.

Swing Phase

Initial Swing

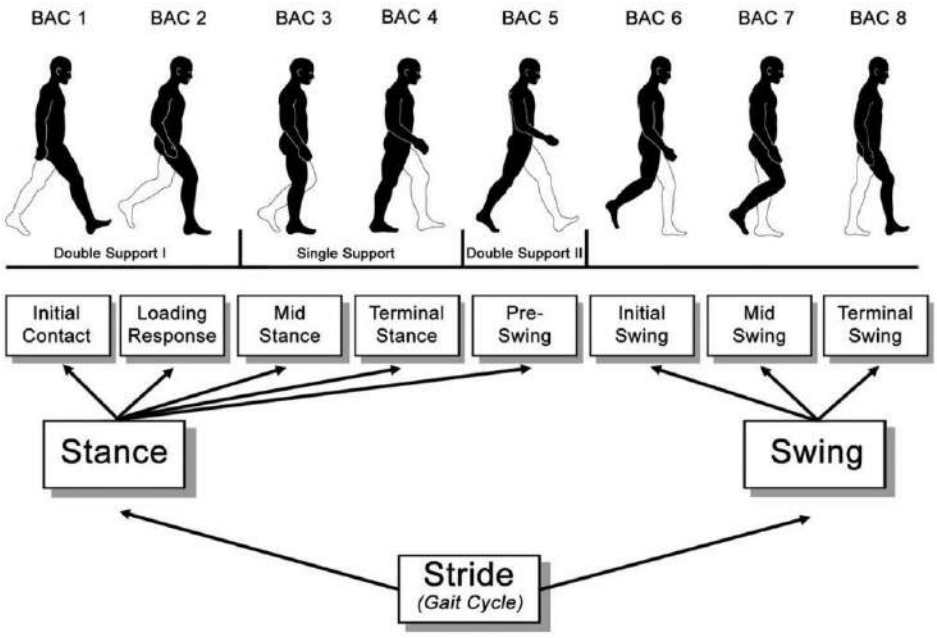
The foot begins to lift off the ground and swing anteriorly. The therapist should observe the clearance of the foot from the ground and assess any restrictions or abnormalities in hip and knee flexion.

Mid Swing

The swing leg continues to move anteriorly, and the knee joint reaches its maximum flexion at 60 degrees. The therapist assesses the smoothness and range of motion of hip and knee flexion during mid-swing. The hip should achieve 20 to 40 degrees of flexion from initial to mid swing. The knee should achieve 40 to 60 degrees of flexion from initial to mid swing. The ankle should achieve 10 to 20 degrees of dorsiflexion from initial to mid swing.

Terminal Swing

The leg prepares for heel strike as it approaches the ground. The therapist observes the positioning of the swing leg and assesses any abnormalities in foot clearance or positioning before heel strike. The hip should achieve 10 degrees of extension by terminal swing. The knee should reach 0 degrees of extension at the end of terminal swing. The ankle should achieve 30 degrees of plantarflexion by the end of terminal swing.



https://www.protokinetics.com/understanding-phases-of-the-gait-cycle/

In addition to these elements, the physical therapist should also assess other factors such as arm swing, trunk rotation, balance, and coordination during the gait cycle. This detailed analysis helps identify any deviations, muscle imbalances, joint restrictions, or movement dysfunctions that may contribute to an individual's gait abnormalities or difficulties.

Palpation [16]

Palpation involves applying pressure to target muscles to determine pain levels, the presence of trigger points, and the presence of muscle tension. Trigger points, pain, and tension often point to muscle reactivity from nearby pain or injury. This section includes muscles to palpate in the low back and what reactivity might signify.

Erector Spinae Muscles

The erector spinae muscles help to extend and stabilize the spine. The erector spinae muscles can be palpated by applying pressure along the sides of the spine, moving from the inferior aspect of the spine superiorly. One may have trigger points, pain, or tension in the erector spinae from a local injury, excess lordosis or thoracic kyphotic posture, a muscle strain, or a chronic pain condition.

Quadratus Lumborum

The quadratus lumborum (QL) helps to stabilize the spine and assists in lateral flexion. To palpate the quadratus lumborum, pressure can should be applied just above the iliac crest bilaterally. Pain, tension, or trigger points within the QL may

be caused by poor lifting form and muscle strain, an injury from twisting during a sport, or a trauma to the area.

Multifidus

The multifidus helps to stabilize the vertebrae and control spinal movement. To palpate the multifidus, gentle pressure can be applied along the sides of the spine, moving from the inferior to superior aspect of the spine. Injury can be caused by muscle strains brought about by poor body mechanics during things like sports, housework, or employment.

Gluteus Muscles

The gluteus muscles, including the gluteus maximus, gluteus medius, and gluteus minimus play a role in hip movement and stability. Palpation of the gluteus muscles can be done by applying pressure to the buttocks region.

Piriformis

The piriformis is found by locating the greater trochanter and the sacrum. Tension or pain over the piriformis may indicate a strain, sciatic nerve irritation, and other factors.

Psoas Major

The psoas major is a deep muscle that connects the lower spine to the hip joint via the lesser trochanter. It plays a role in hip flexion and spinal stability. To palpate the psoas major, pressure can be applied slightly inward and inferiorly, just below the level of the belly button. Pain may indicate a protective muscular response from an injury.

Range of Motion [17,18]

Active Range of Motion (AROM)

Active range of motion testing should always be performed prior to passive range of motion testing to see a patient's natural movement pattern. The clinician should note the quality of the movement pattern and any pain or symptoms experienced by the patient in achieving these ranges of motion. Active and passive range of motion can be measured with a goniometer or an inclinometer.

To assess lumbar flexion, the individual stands upright and bends anteriorly at the waist, trying to touch their toes. The normative value is 40 to 60 degrees of flexion.

For lumbar extension the individual stands upright and arches their back posteriorly as far as possible. The degree of backward arching indicates the range of lumbar extension, which should be 20 to 35 degrees.

To assess lateral lumbar flexion, the patient stands upright with their hands placed on their hips. They then bend laterally to the left and right to their end range. The mobility here should be 20 to 35 degrees.

For lumbar rotation, the patient stands upright with their feet shoulder-width apart and their arms crossed over their chest. They then rotate their torso to the left and right as far as possible without moving their hips. The degree of rotation indicates the range of lumbar rotation, which should be 5 to 15 degrees bilaterally.

Other helpful ranges of motion to gather are within the thoracic spine and the lower extremities (hips, knees, and ankles). Below are normative values for the remainder of the joints for the lower quarter examination.

Thoracic Spine

The normal range for thoracic flexion is around 20-45 degrees. The normal range for thoracic extension is around 20-45 degrees. The normal range for thoracic lateral flexion is around 20-40 degrees bilaterally. The normal range for thoracic rotation is 20-40 degrees bilaterally.

Hip Joint

The normative degrees for flexion are 120-140 degrees, extension is 10-20 degrees, abduction is 30-50 degrees, adduction is 20-30 degrees, internal rotation is 30-45 degrees, and external rotation is 40-60 degrees.

Knee Joint

Flexion should be 130-150 degrees and extension should be 0 with no hyperextension.

Ankle Joint

Dorsiflexion should be 10-20 degrees, plantarflexion should be 45-60 degrees, inversion should be 20-30 degrees, and eversion should be 10-20 degrees.

Passive Range of Motion (PROM)

PROM testing should be used sequentially after AROM testing. The therapist should apply overpressure to the movements in the AROM testing section to determine gross joint mobility and to assess symptoms. The PT should use a goniometer or an inclinometer in PROM testing, and document whether active range of motion equals passive, or what the discrepancy is. For example, if active and passive are the same but limited from normative values, a joint restriction may be limiting the movement. However, if passive range of motion is more than active, a muscle strain or injury may be limiting the degrees of motion.

Joint Mobility [19]

It is crucial to assess joint mobility to determine where joints have mobility issues. Therapists should assess mobility in each vertebra from at least the thoracic to sacral spine. They should also assess lower quarter mobility if there is an impairment in mobility of any joint from the range of motion assessment.

The segmental mobility assessment involves assessing the mobility of individual spinal segments or vertebrae with the patient lying prone on an examination

table. The examiner should apply gentle pressure or oscillatory movements over each vertebra from the sacral to thoracic spine. The pressure should be gentle at first and if tolerated should be moderate to assess joint play. Each vertebra should travel anteriorly a similar amount although this varies by patient. The therapist should assess for and document uniformity and provocation of symptoms. Palpation of spinous processes and facet joints is also helpful to determine alignment and mobility of the spinal segments. By gently feeling the bony prominences (spinous processes) along the spine and the small facet joints on the sides of the vertebrae, the examiner can identify any tenderness, swelling, or abnormalities that may indicate joint dysfunction.

Resistive Testing [20,21]

Resistive testing is useful for both individual muscles surrounding the low back and within the hips and lower extremities. Myotome testing should be used as well for patients with unilateral or bilateral weaknesses that could suggest nerve root involvement. Myotomes represent the global strength of muscles that share a common nerve root(s).

Manual Muscle Testing

It is often necessary to test the muscle strength of the abdominal muscles, hips, and other lower extremity muscles that are suspected to be weak or involved in symptoms.

Rectus Abdominis

The patient should be positioned hooklying and the therapist asks the patient to perform a partial sit-up, lifting their head and shoulders off the table. The therapist then applies resistance on the patient's chest while the patient tries to maintain the sit-up position. This is graded on the same 0-5 scale that is normal for resistive testing.

Transversus Abdominis (TA)

The patient lies hooklying and the therapist places their hands just medially to the anterior superior iliac spine of the patient's abdomen. The therapist instructs the patient to draw their navel towards the spine, activating the deep core muscles. The therapist provides resistance by gently pressing inward against the patient's abdominal muscles. Another approach to TA muscle testing is the Sahrmann five-level core stability test. All levels require the patient to recruit the TA by hollowing the abdomen or drawing the navel towards the spine while completing a posterior pelvic tilt. The therapist should grade the patient at the highest successful level and use this for documentation of progress throughout the plan of care. The position for Level 1 is hooklying while raising one leg at a time to 100 degrees of flexion. Level 2 has the patient move from 100 degrees of hip flexion to knee extension while sliding the heel away from the body, bilaterally. Level 3 has the patient move from hip flexion to lowering the foot to about six inches from the table. The patient should then extend their knee, and then return to the starting position, bilaterally. Level 4 involves starting from hip flexion to bringing the heels to the table and fully extending the knees bilaterally. Level 5 involves starting from hip flexion to lowering the heels to 6 inches above the table. The patient should extend both knees fully with their heels floating 6 inches above the table.

Myotome Assessment

Myotomes are assessed on a scale of 0 to 5, from weak to strong. Below are the grades and the test results assigned to each grade.

0: No muscle contraction or movement detected

1: Muscle contraction is present, but there is no movement at the joint

2: Movement occurs at the joint, but it is unable to move against gravity

3: The muscle can move against gravity, but not against any resistance applied by the examiner

4: The muscle can move against moderate resistance applied by the examiner

5: Normal muscle strength with the ability to move against strong resistance

Below is the testing technique for each myotome in the lower quarter.

Hip Flexors (L2-L3)

The therapist asks the patient to lie supine and lift one leg off the table, keeping the knee straight. The therapist applies resistance to the leg while the patient tries to lift it against the resistance.

Knee Extensors (L3-L4)

The therapist instructs the patient to sit on the edge of the table with their legs hanging freely. The patient is then asked to extend their knee against resistance applied by the therapist.

Ankle Dorsiflexors (L4-L5)

The patient is seated with their feet hanging freely. The therapist asks the patient to pull their foot and toes superiorly (dorsiflexion) against resistance provided by the therapist.

Great Toe Extensors (L5)

The therapist asks the patient to sit with their feet off the ground and their knees flexed. The patient is instructed to extend their great toe against resistance applied by the therapist.

Ankle Plantar Flexors (S1-S2)

The patient is seated with their feet off the ground and knees flexed. The therapist asks the patient to push their foot and toes downward (plantarflexion) against resistance provided by the therapist.

Therapists should document any differences bilaterally and any provocation of symptoms the patient experienced during resistive testing.

Neurological Examination [22–24]

Physical therapist examination for neurologic involvement is a crucial way to narrow down a diagnosis and to rule out potential red flags. Reflex testing and sensation testing should be completed when symptoms indicate to do so. Reflex testing determines the integrity of nerve pathways from the spinal cord to the extremities. The patellar and Achilles reflex tests are most common to complete during a lower quarter examination.

Reflexes

The patellar reflex (knee jerk) tests the integrity of the L2-L4 nerve roots of the lumbar spine. The therapist taps the patellar tendon just below the patella with a reflex hammer over a relaxed lower extremity and with the patient sitting.

The Achilles reflex tests the integrity of the S1 nerve root and the tibial nerve. The therapist taps the Achilles tendon with a reflex hammer while the patient's foot and ankle are relaxed. This should cause the calf muscles to contract and the foot to plantarflex.

Below is a grading scale that physical therapists should follow while assessing reflexes.

0: Absent reflex - No response is elicited upon stimulation.

1: Diminished reflex - A slight response is present, but it is significantly reduced or only present with reinforcement (additional maneuvers that enhance the reflex response).

2: Normal reflex - A typical, expected response is observed upon stimulation. This is considered the average or normal reflex response.

3: Increased reflex - An exaggerated or hyperactive response is observed, which may involve a more pronounced movement or prolonged duration of the reflex.

4: Hyperactive reflex - A markedly exaggerated response that includes repetitive or clonic movements is observed. This is considered an abnormal response. Clonus is a series of rhythmic, involuntary muscle contractions and relaxations that indicate a neurological lesion or other abnormality.

The Babinski reflex is a test for an abnormal reflex of the foot. The therapist should use a blunt object, such as a key or the handle of a reflex hammer, to stroke the sole of the foot from the heel toward the toes. In a normal response, the toes flex downward. However, in cases of nerve damage or certain neurological conditions, the big toe may extend upward, and the other toes may fan out (Babinski sign). This could be a sign of certain conditions like spinal cord injury, Multiple Sclerosis, brain tumors, a cerebrovascular accident (CVA), or other conditions. Therapists should refer patients urgently to a specialist if they exhibit a positive Babinski response without a known cause.

Sensation Testing

Sensation testing involves determining the integrity of the afferent nerve pathways. If altered, it could be a sign of several conditions such as CVA, peripheral neuropathy, nerve compression, complex regional pain syndrome, infections, autoimmune disorders, and many others. Physical therapists should use the results of sensation testing as part of a larger clinical examination. The

dermatome map in this section pictures which nerve roots represent corresponding areas of sensation over the skin.

Light Touch

Light touch dermatome sensation testing examines the integrity of A-beta nerve fibers which are myelinated nerve fibers that transmit signals quickly. The therapist should use a cotton swab or their fingertips to lightly touch different areas of the skin on the lower extremity. They apply gentle and consistent pressure to avoid causing discomfort or pain. The touch should be brief and not linger in one spot.

Pinprick Sensation/Pain

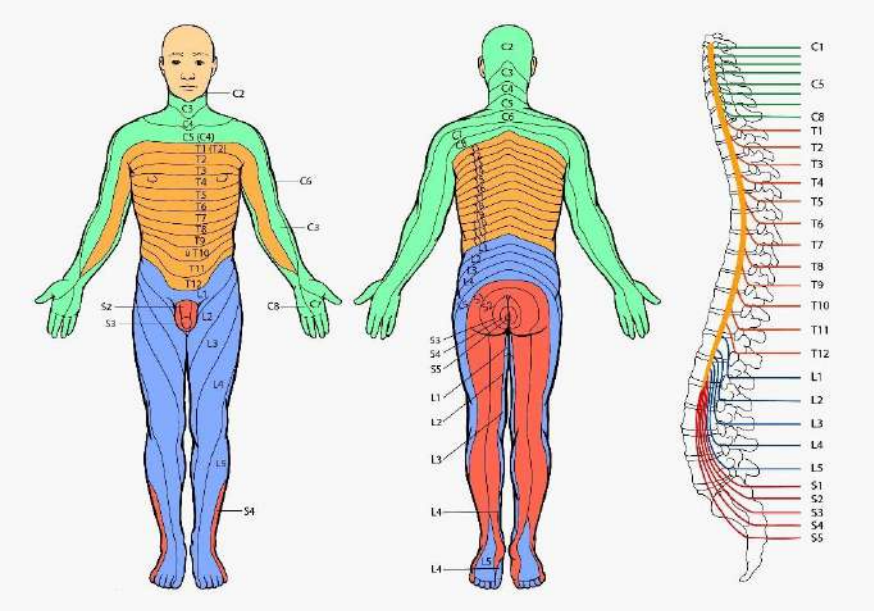
A pin or sharp object is gently pressed against the skin to test pain perception. The patient is asked to distinguish between sharp and dull sensations. This tests A-delta (myelinated and carries intense pain signals) and C nerve fibers (unmyelinated and carry dull chronic pain).

Temperature Sensation

Cold and warm objects should be applied to the skin to assess the patient's ability to perceive temperature changes. This tests the integrity of C fibers and A-delta fibers.

Vibration Sense and Proprioception

A tuning fork is placed over bony prominences (such as the ankle or toes) and activated. The patient is asked to indicate when they no longer feel the vibration. Proprioception is another sensation test that determines a patient’s ability to determine where their joints are in space. The therapist should move the patient's joints passively and ask them to identify the position of their limb or digit without looking.



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Special Tests [25–27]

Special tests for the low back involve ruling certain conditions in or out as part of a comprehensive lower quarter examination. It is imperative for the physical therapist to use the results of the special tests in combination with the results of the rest of the examination. There could be false negatives or false positives with special tests. This section will overview the purpose and technique of common special tests for low back pain and what results mean.

Straight Leg Raise (SLR) Test

This test assesses for the presence of sciatic nerve irritation or lumbar disc herniation. The patient lies supine on the examination table and the examiner raises the patient's straightened leg while keeping the knee extended, until the patient feels a stretch or pain within the hamstring or posterior to the knee. The examiner then extends the hip until the patient does not feel the pain/tightness

and dorsiflexes the ankle passively. If the patient experiences pain radiating down the leg, it may indicate nerve compression or irritation.

Crossed Straight Leg Raise (Femoral Nerve Stretch Test)

Similar to the SLR test, the crossed SLR test helps differentiate between sciatic nerve involvement and femoral nerve involvement. During the CSLR test, the patient lies supine, and the examiner raises the unaffected leg while keeping the knee extended. If raising the unaffected leg causes pain or reproduces symptoms in the affected leg, it suggests compression or irritation of the femoral nerve. If raising the unaffected leg causes pain in the affected leg, it suggests the involvement of the femoral nerve.

Patrick's (FABER) Test

This test evaluates the hip joint and sacroiliac joint. The patient lies on their back with the affected leg flexed, abducted, and externally rotated to place the foot on the opposite knee. The examiner applies downward pressure on the knee, assessing for pain in the hip or sacroiliac joint area.

Lumbar Compression Test

The patient is seated or standing, and the examiner applies downward pressure on the top of the patient's head. This test helps identify pain caused by compression of the intervertebral discs or facet joints in the lumbar spine.

Lumbar Extension Test

The patient is asked to perform a backward bending motion (extension) of the lumbar spine. If this movement reproduces the patient's symptoms, it may indicate facet joint dysfunction or spinal stenosis.

Lumbar Flexion Test

The patient is asked to perform a forward bending motion (flexion) of the lumbar spine. Pain or other symptoms during this movement may suggest disc-related issues or spinal stenosis.

Prone Instability Test

This test evaluates the presence of lumbar instability while the patient is prone. The physical therapist applies a gentle posterior-to-anterior force to the lumbar spine, assessing for excessive motion or pain provocation. The test may reveal increased lumbar hypermobility if the patient demonstrates excessive motion in the lumbar spine in response to the applied force. If the test reproduces or exacerbates pain, the patient may have an underlying instability or an unstable segment contributing to their symptoms.

Kemp's Test

Kemp's test is performed with the patient in a standing or seated position. The physical therapist assists the patient in rotating their trunk and bending laterally towards the affected side. The therapist may provide additional pressure on the shoulders or hips to increase the stress on the lumbar spine. The test is typically performed on both sides to compare the patient's response.

Quadrant Test

The quadrant test involves a combination of lumbar spine extension, lateral bending, and rotation to provoke pain. The patient is typically standing or seated, and the physical therapist assists in guiding the patient through the test. The therapist stabilizes the pelvis while the patient extends, laterally bends, and rotates the trunk to the affected side. The test is performed on both sides for comparison. Positive findings during the quadrant test include the reproduction or exacerbation of pain or symptoms, such as localized pain, radiating pain, or a combination of symptoms. The specific pattern of pain reproduction can help

identify potential sources of pain, such as facet joint dysfunction, discogenic pain, or nerve root irritation.

Repeated Movement Testing and the McKenzie Method (Mechanical Diagnosis and Therapy)

Assessment of Movement Responses

The McKenzie assessment begins with a thorough examination of the patient's pain and movement patterns. The physical therapist guides the patient through a series of movements, such as standing, sitting, lumbar flexion, extension, lateral flexion and rotation. The patient's pain response and any associated changes in symptoms are closely observed and documented. Based on the initial assessment, the physical therapist may identify specific movements that either worsen or alleviate the patient's symptoms. These movements are then systematically repeated to determine the effect on the patient's pain and functional limitations. Repeated movements may include repeated extension, repeated flexion, or lateral shifts. One of the key principles of McKenzie testing is the concept of centralization and peripheralization of symptoms. Centralization refers to the phenomenon where pain is brought closer to the midline of the spine or disappears altogether with specific movements or positions. Peripheralization occurs when pain spreads further away from the spine or into the legs. The therapist carefully observes and records any changes in symptom location during the testing process. Common subgroups for the classification of symptoms by the McKenzie method include derangement syndrome, dysfunction syndrome, and postural syndrome.

Functional Assessment

The physical therapist should assess a patient’s ability to perform certain functional activities, such as walking, squatting, or lifting, to determine how the

low back pain impacts their life. Functional movement assessment should be guided by the subjective history and what activities provoke pain for the patient.

Squatting is a key functional movement to examine. Normally, weight should be distributed equally across both lower extremities, the hips should hinge, and the spine should be neutral. Common compensations may include excessive anterior trunk lean, genu valgus, spinal flexion, or excessive lumbar extension. Anterior trunk lean would indicate weakness in the posterior chain, such as the gluteals and hamstrings. Genu valgus could indicate weakness in the hip abductors. Spinal flexion during a squat could indicate poor core stability, poor spinal or hip mobility, and weakness in the spinal extensors. Excess lumbar extension could indicate limited core stability, postural lumbar lordosis, and/or poor hip mobility.

Body mechanics during lifting are an important component of a clinical picture, especially if a patient has a physically demanding job or they report pain during lifting. At first, the physical therapist should have the patient simulate lifting without any weight and progress to simulating what a work task or a painful activity looks like. The PT should monitor the joint positions in the low back, hips, knees, and ankles. They should see a neutral spine to suggest proper core engagement. There should be no rotation or excess spinal flexion or extension while the patient is lifting.

Body mechanics or ergonomics for more sedentary work tasks or daily tasks, like desk work, are also important to examine for patients with low back pain. Sitting and standing posture should be examined by simulating work or daily tasks and the physical therapist should inquire at what points a patient has pain or other symptoms throughout the workday.

Section 2 Key Words

Babinski Reflex - a test for an abnormal reflex of the foot where the toes splay rather than curl down in response to dull pain and is indicative of a neurological condition

Centralization - pain is brought closer to the midline of the spine or disappears altogether with specific movements or positions

Peripheralization - pain spreads further away from the spine or into the legs upon certain movements

Section 2 Summary

A thorough subjective history and examination are key to a successful evaluation and plan of care for any type of low back pain. Clinicians should ask open-ended questions and search for motivating factors, such as getting back to work or hobbies, to help patients continue to engage in the physical therapy recommendations. Physical therapists should be skilled in screening for and referring out cases of red flag conditions, especially with the traction that physical therapy direct access care is gaining. Psychosocial factors, medical history, and current medications are also important to understand in a comprehensive patient-centered plan of care. Physical therapists should not only obtain this information, but should document comprehensively, so other physical therapists and physical therapist assistants who join on the plan of care are prepared to provide excellent care as well.

Section 3: Evaluation

During a physical therapy evaluation for low back pain, the specific diagnosis may not be immediately known or accurate upon the first patient visit. The evaluation

focuses on identifying contributing factors to symptoms, assessing movement patterns, evaluating objective findings from the examination, and ruling out differential diagnoses and red flags. The findings from the evaluation help guide the development of an individualized treatment plan to address the underlying causes of the low back pain and improve function and quality of life.

Common Diagnoses and Evaluation Considerations [25,28]

The examination and evaluation for low back pain may not need to result in a specific diagnosis. Sometimes, patients, especially with fear avoidance beliefs, may focus too much on a diagnosis and not follow active recovery recommendations. There are a few clinical pictures that do point to specific conditions and diagnoses. The physical therapist may identify the condition to help the healthcare team and the patient understand their evaluation better.

Lumbar Strain or Sprain

This diagnosis may be considered if the examination reveals tenderness in the lumbar region, muscle spasm, limited range of motion, and pain with movement or palpation without any other concerning findings.

Herniated Disc

If the examination findings include radicular symptoms (such as pain, numbness, or weakness radiating down the leg), positive nerve tension tests (such as straight leg raise or slump test), and possibly neurological deficits, a herniated disc or nerve root compression may be considered.

Facet Joint Dysfunction

If the examination reveals localized tenderness over the facet joints, pain with extension or rotation movements, and relief of symptoms with manual traction or specific spinal mobilization, facet joint dysfunction may be a possible diagnosis.

Lumbar Spinal Stenosis

If the patient's examination findings include pain, numbness, or weakness in the lower extremities with walking or standing, relieved symptoms with forward flexion or sitting, and possibly decreased pulses or signs of vascular insufficiency, lumbar spinal stenosis may be considered.

Spondylolisthesis

If the examination reveals palpable step-off or abnormal movement of the vertebrae, pain with extension and backward bending movements, and possible neurological symptoms, spondylolisthesis (anterior slippage of one vertebra relative to the adjacent one) may be suspected.

Sciatica

The hallmark symptom of sciatica is pain that starts in the lower back or buttock and radiates down the back of the thigh, calf, and occasionally into the foot and toes. The sharp, shooting pain typically follows the path of the sciatic nerve. It is accompanied by paresthesia at times. Patients will have a positive straight leg test and possible weakness in their affected lower extremity.

Common ICD 10 Codes for Low Back Pain Diagnosis (as of 2023) [29]

M54.5 - Low back pain. This is the primary code used to describe general low back pain without specifying a specific cause or diagnosis.

M54.16 - Radiculopathy, lumbar region. This code is used when low back pain is accompanied by radiating pain, numbness, or weakness in the leg(s) due to nerve root compression or irritation.

M54.17 - Radiculopathy, lumbosacral region. Similar to M54.16, this code is used when the radiculopathy involves the lumbosacral region.

M51.26 - Other intervertebral disc displacement, lumbar region. This code is used when there is a specific diagnosis of intervertebral disc displacement or herniation in the lumbar region causing low back pain.

M47.816 - Other spondylosis, lumbar region. This code is used for spondylosis or degenerative changes in the lumbar spine that may contribute to low back pain.

Differential Diagnosis

Physical therapists should take a multifaceted approach to determining a diagnosis and cause of symptoms. Low back pain could arise from the musculoskeletal system, the nervous system, arthritic conditions, systemic causes, and referral pain. Common musculoskeletal causes include the conditions mentioned in this course like lumbar muscle strains, spondylolisthesis, weakness, and more. Nerve-related causes include lumbar radiculopathy, piriformis syndrome, peripheral nerve entrapment like sciatica. Inflammatory and arthritic conditions include ankylosing spondylitis, Rheumatoid Arthritis, osteoarthritis, and psoriatic arthritis. Systemic causes include kidney stones, infection, tumors, and AAA. Referred pain to the low back may stem from a hip pathology such as a labral tear or osteoarthritis, a pelvic pathology, gastrointestinal disorders, or urinary tract infection.

Musculoskeletal causes of pain and symptoms have a different clinical presentation than systemic causes of pain. Musculoskeletal pain typically is better with rest and worse with movement whereas systemic causes of pain usually do not vary with movement. Systemic pain may be worse after eating, through the night, and may be accompanied by symptoms like unintentional weight loss.

Acute, Subacute, and Chronic Low Back Pain

Acute low back pain is pain that lasts up to four weeks that typically starts from an injury. Physical therapists should focus on pain management, education, gentle

exercise, postural education, and manual therapy at this stage in their plans of care. This is the ideal stage of low back pain to start treatment as it can resolve more quickly without causing compensatory problems in nearby regions (hips, knees, thoracic spine).

Subacute low back pain occurs between one and three months from the original injury or the beginning of pain. In their plans of care, physical therapists should focus on continued pain management, progressive exercise, manual therapy, and education for self-management.

Chronic low back pain is pain that has been present for three months or more. Physical therapists need to understand the biopsychosocial model of assessment, which includes understanding psychological and social factors that may exacerbate chronic pain. Chronic pain treatment should take a multidisciplinary approach, with mental health professionals, possible medication management, pain specialists, and more. Physical therapists should help to desensitize their patient to the cycle of chronic pain through an individualized exercise program to improve strength, flexibility, endurance, and functional capacity. This may include aerobic exercise, resistance training, and specific therapeutic exercises. Manual therapy should be used more sparingly to reduce the tendency for dependence on the treatment. Pain education, stress management, relaxation strategies, and education on pacing activities throughout the day are highly successful strategies for chronic low back pain.

Progression of Neuropathic and Radiating Pain [30]

Neuropathic pain is a result of pathology or insult to the nervous system. Its onset involves things like trauma, infection, nerve compression, or a disease process that attacks the nervous system, like diabetes mellitus. In the acute phase, the pain may be intense, sharp, shooting, burning, or electric shock-like. It may be accompanied by other sensory abnormalities such as tingling, numbness, or

hypersensitivity in the affected area. The pain may be intermittent or continuous, and it can worsen with certain triggers or activities. It may progress to chronicity if the nerves do not heal properly. Chronic neuropathic pain can persist for months or even years. During this phase, the pain may become more persistent, but its intensity may vary. Some individuals may experience periods of relative relief, while others may have continuous pain. Over time, the nervous system can undergo changes that lead to central sensitization. This means that the central nervous system becomes hypersensitive to pain signals, amplifying the pain experience. Even non-painful stimuli can be perceived as painful (allodynia), and the pain may spread to larger areas beyond the initial site of injury (secondary hyperalgesia). Prolonged neuropathic pain can have significant physical, psychological, and social effects on individuals. It can lead to decreased functional abilities, sleep disturbances, mood changes (such as depression and anxiety), and overall reduced quality of life.

Referral Necessity and Medical Imaging [31]

Referrals take many forms, including referring straight to the emergency department, referring to primary care, to an orthopedic specialist, or to medical imaging.

Emergency Department

Referrals to the ED should happen for the discovery of suspected red flag conditions. These were discussed earlier in the course and include Cauda Equina Syndrome, suspected fracture, suspected Spinal Cord Injury, infection, Abdominal Aortic Aneurysm, and any condition presenting with progressive neurological deficits or intractable pain.

Primary Care

Referrals should be made to primary care when a patient brings up symptoms or a clinical presentation that a physical therapist does not treat. Examples are symptoms of systemic conditions, like diabetes mellitus, mild cardiac symptoms, and for medication management. Physical therapists may also refer to primary care if patients are not making progress in the PT treatment plan and need medical management.

Specialist

Physical therapists may refer to a neurological specialist or an orthopedist for specific patients who present with deficits that fit this need. Insurance plans may require that the patient is sent to primary care first, but if not, saving time and referring right to a specialist is a better option. For example, a patient with a Multiple Sclerosis flare up should be referred to their neurologist. A physical therapist may refer to an orthopedist in cases where the patient would benefit from surgery, medication management, or other pain control options. An example of this is a patient not progressing with physical therapy after eight weeks working on improving symptoms of severe hip osteoarthritis.

Medical Imaging

There are a few cases where imaging may be necessary to safely carry out a plan of physical therapy care. One case is suspected fracture or a structural abnormality. If the physical therapist suspects a fracture, spinal deformity, or other structural abnormality as the cause of the patient's symptoms, they should recommend immediate imaging to confirm the diagnosis and guide further treatment. Another case may be a suspected disc herniation or nerve compression. If the patient's symptoms, such as severe radiating pain, muscle weakness, or sensory deficits, suggest the possibility of a disc herniation or nerve compression, the physical therapist should recommend imaging, such as an MRI, to assess the condition of the spinal discs and nerve roots. Another case is a lack

of improvement with conservative treatment. If the patient's symptoms persist or worsen despite an appropriate course of conservative treatment, including physical therapy interventions, the physical therapist may suggest imaging and referral to help identify any underlying factors that may be contributing to the lack of progress. If the patient has a suspected infection or tumor, they will present with signs or symptoms that raise suspicion of an infection or tumor in the spine, such as persistent fever, unexplained weight loss, night sweats, or localized tenderness. This would result in a referral and imaging studies to rule infection and cancer out.

Documentation [32]

Documentation of a physical therapist examination and evaluation should be inclusive of every impairment, activity limitation, and participation restriction the patient has. It is not necessary to document every normal finding, but anything deviating from normal should be recorded. This is the basis of how visits are deemed medically necessary and to document progress from the beginning to the end of treatment.

To summarize what should be included in an examination/evaluation note, guidelines are below. This is based on the SOAP (Subjective, Objective, Assessment, and Plan) format of documentation.

Subjective Assessment: “S” of SOAP Note

This should include a detailed history of the patient's low back pain, including the onset, duration, aggravating and alleviating factors, and any associated symptoms. It should also include past medical history, including previous injuries, surgeries, or relevant medical conditions. The therapist should record the impact of low back pain on the patient's functional activities, work, and quality of life. They should

also document patient-reported pain levels, using standardized pain scales if available.

Objective Assessment: “O” of SOAP Note

This section of documentation should include physical examination findings, such as range of motion (ROM) of the lumbar spine, hip, and lower extremities. It should include any muscle strength assessment, including manual muscle testing of the lower back, hip, and lower extremity muscles. It should include the neurological examination, evaluating sensory perception, reflexes, and presence of any radicular symptoms. In addition, special tests specific to the lumbar spine should be documented, such as straight leg raise, crossed straight leg raise, or lumbar compression test, if performed and relevant. It may also include an assessment of posture, gait, and functional movements related to the low back.

Diagnosis and Assessment: “A” of SOAP Note

The physical therapist should document a clear and specific diagnosis or clinical impression, based on the findings from the subjective and objective assessments. This should involve the identification of any contributing factors or underlying causes, such as muscle imbalances, joint dysfunction, or movement impairments. It should also include an assessment of the patient's functional limitations and impairments related to their low back pain.

Treatment Plan: “P” of SOAP Note

The treatment plan section of documentation should include goals of the physical therapy intervention, which may include pain reduction, improving functional mobility, increasing strength and flexibility, and enhancing the patient's overall quality of life. It should outline specific treatment techniques or interventions planned, such as manual therapy, therapeutic exercises, modalities, and/or patient education. The note should also include the expected frequency and

duration of the treatment sessions. It is imperative to list any precautions or contraindications considered during the treatment planning.

Progress and Discharge Notes:

The physical therapist should be recording regular documentation of the patient's progress and response to the interventions provided. This is typically completed every ten sessions, depending on insurance requirements and if there is a significant change in symptoms or patient status. Progress notes should include objective measurements and outcomes, such as improvements in range of motion, strength, functional abilities, or reduction in pain levels. They should also include any modifications or adjustments made to the treatment plan based on the patient's response and progress. Discharge notes should address all goals and document the patient's status and plan for independent management of symptoms.

Section 3 Key Words

1. Spondylolisthesis – a spinal condition characterized by the forward displacement or slippage of one vertebra over another
2. Central Sensitization – a condition in which the central nervous system becomes hypersensitive to pain signals

Section 3 Summary

The physical therapy evaluation should focus on determining the most plausible diagnosis, ruling out red flag conditions, referring if necessary, and developing the basis of a treatment plan based on findings. It is critical to produce quality documentation that records each patient encounter accurately.

Section 4: Treatment [33]

Physical therapy treatment for low back pain should be patient-centered and based on examination and evaluation findings. This section will review current best evidence for low back pain treatment through the use of manual therapy, lumbar traction, specific exercise progression, the effects of non-pharmaceutical and pharmaceutical interventions, and patient education interventions.

The Treatment-Based Classification System (TBC) for Low Back Pain [34]

The TBC is an approach used by physical therapists to classify and guide treatment interventions based on the patient's specific presentation and response to initial interventions. The TBC system helps clinicians tailor treatment plans to individual patients and has been supported by various studies. Each classification has a Clinical Prediction Rule and treatment approaches associated.

Classification Categories

The TBC system classifies patients into four main categories based on their clinical presentation and response to initial interventions: Manipulation, Stabilization, Specific Exercise, and Traction.

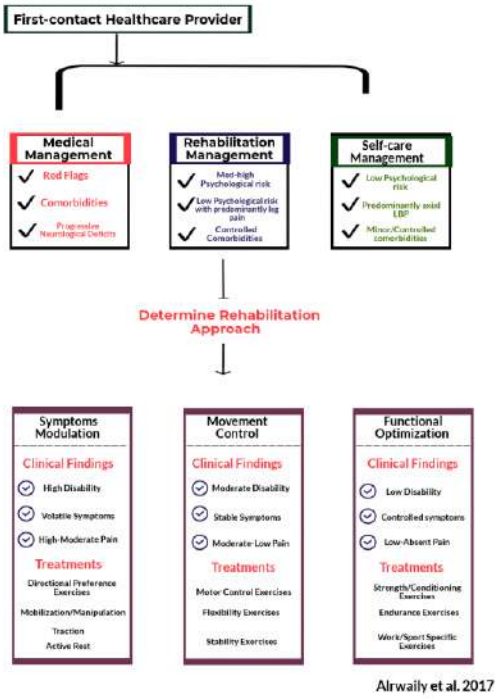
Manipulation: Patients who show a rapid and significant improvement in response to spinal manipulation techniques.

Stabilization: Patients who exhibit signs of lumbar instability benefit from stabilization exercises aimed at enhancing core muscle control. They may have excess lumbar motion or difficulty maintaining stability during functional movement. Treatment should include stability exercises and working on improving control of lumbar movements during functional activities.

Specific Exercise: Patients who have specific movement impairments and benefit from specific exercises targeting those impairments.

Traction: Patients who show signs of nerve root compression or mechanical blockage and respond well to traction techniques to improve nerve compression.

There is also an approach that splits cases of low back pain down three possible avenues – Symptom Modulation, Movement Control, and Functional Optimization. There is overlap between the TBC model in that the Symptom Modulation approach represents manual therapy and often acute pain strategies, Movement Control category represents Specific Exercise and Stabilization, and Functional Optimization represents any approach from the TBC once the patient is progressing to self-management.



Alrwaily et al. 2017

Manual Therapy and Manipulation [35–37]

Manual therapy includes joint and soft tissue mobilizations and manipulations. Manual therapy, especially manipulation, has strong evidence for the improvement of acute low back pain.

Clinical Prediction Rule for Spinal Manipulation [38]

1. The patient's symptoms should be present for less than 16 days
2. There should be no symptoms distal to the knee such as radiating pain or neurologic deficit
3. FABQ score of less than 19
4. Internal rotation of one hip must be greater than 35 degrees
5. There should be hypomobility of one or more lumbar spine levels

Manual Therapy Techniques and Purpose

Joint Mobilization

Joint mobilization involves skilled passive movements of the joints performed by the physical therapist. It aims to restore normal joint mobility, reduce pain, and improve overall joint function. The effect of mobilization is to promote relaxation of tight tissues, increase joint lubrication, and restore optimal movement. The grades of mobilizations are as follows, and it is typical to complete 2-3 sets of 30 seconds of the mobilization in a session:

Grade I (Mild) is a small-amplitude, oscillatory movement performed at the beginning of treatment with minimal force applied to the joint, producing a gentle rocking motion.

Grade II (Moderate) is a larger-amplitude oscillation or sustained stretch performed within the joint's available range. It targets joint capsules, ligaments, and other soft tissues to promote joint mobility.

Grade III (Moderate to Strong) is a high-velocity, low-amplitude thrust applied to the joint, taking it to the end range. It is designed to stretch restricted tissues, restore joint play, and improve joint mobility.

Grade IV (Strong) is similar to Grade III, but with sustained pressure or stretch at the end range. It is used to address significant joint stiffness, adhesions, or limitations in mobility.

Grade V (Manipulation) is a high-velocity, low-amplitude thrust performed near the end range of joint motion. Therapists should be trained and legally able to perform manipulations in their state of practice. There is a moderate amount of evidence supporting its use in the reduction of low back pain, and typically more than with mobilizations.

Soft Tissue Mobilization

Soft tissue mobilization techniques target the muscles, tendons, ligaments, and other soft tissues surrounding a joint. These techniques may include massage, myofascial release, trigger point therapy, and instrument-assisted soft tissue mobilization (IASTM). Soft tissue mobilization aims to reduce muscle tension, improve tissue extensibility, promote blood flow, and alleviate pain or discomfort.

Muscle Energy Techniques (MET)

Muscle energy techniques involve active contractions of the patient's muscles against a resistive force applied by the therapist. This technique is used to improve joint mobility, lengthen tight muscles, and restore balance between opposing muscle groups. It is often utilized to address musculoskeletal imbalances and joint dysfunctions.

Neural Mobilization

Neural mobilization techniques focus on mobilizing and optimizing the movement of nerves. By gently tensioning and gliding the nerves, the therapist can improve neural mobility, reduce nerve-related symptoms (such as radiating pain or tingling), and enhance overall neural function.

Strain-Counterstrain

Strain-counterstrain, also known as positional release technique, involves placing the affected muscle or joint in a position of comfort, reducing tension and facilitating relaxation. This technique is particularly useful for treating tender or sensitive areas and can help alleviate pain and muscle spasms.

Mulligan Concept

The Mulligan Concept is a manual therapy approach that combines mobilization with movement. It involves applying specific manual techniques while the patient performs active movements. This technique aims to improve joint alignment, increase pain-free range of motion, and restore functional movement patterns.

Stabilization [39]

The stabilization approach focuses on enhancing the stability and control of the lumbar spine and pelvis to improve function and reduce low back pain. The stabilization component of TBC involves specific exercises and strategies aimed at activating and strengthening the deep stabilizing muscles of the core, including the transversus abdominis, multifidus, pelvic floor muscles, and diaphragm.

Clinical Prediction Rule for Lumbar Stabilization

1. Age less than 40 years old
2. SLR greater than 91 degrees
3. Aberrant motion present
4. Positive prone instability test

Specific Exercise [27]

Patients who respond well to a specific exercise approach are typically of younger age, have a positive prone instability test, aberrant movement patterns, lumbar hypermobility, and past episodes of back pain.

Clinical Criteria for Specific Exercise Approach

1. Centralization with two or more movements
2. Centralize with movement in one direction and peripheralize in other direction

Specific Centralization Exercises

Physical therapists need to find a patient's directional preference which centralizes symptoms first. From there, the goal is to complete repeated movements in that direction to continue to centralize. As tolerated, the therapist should instruct the patient in all movement directions, gradually moving into flexion, extension, side glides, and lateral flexion as long as there is no peripheralization. This will alleviate the symptoms of radiculopathy and nerve compression, which will prevent long term lower extremity weakness and altered sensation. Exercises can be completed sitting, standing, or prone, and should progress to functional positions. If a patient's original directional preference is extension, the therapist would prescribe exercises to tolerance (standing, sitting, or prone) to extend the spine repeatedly up to 20 times a few times per day. Once the patient is able to perform flexion with only centralizing symptoms, the therapist would progress to prescribing in this direction.

Traction [40]

Mechanical and manual traction have mixed evidence for effectiveness. Several systematic reviews and meta-analyses have been conducted to evaluate the

effectiveness of traction for low back pain. The findings from these reviews have been inconclusive, with some studies showing a modest benefit of traction in reducing pain and improving function, while others have shown no significant difference compared to placebo treatments. Some studies have suggested that traction may be more beneficial for individuals with specific conditions, such as lumbar disc herniation or spinal stenosis, compared to non-specific low back pain. However, further research is needed to clarify the subgroups of patients who may benefit the most from traction. The effectiveness of traction may vary by type used, whether it is mechanical traction, manual traction, and/or intermittent traction. The effectiveness of traction may also vary with the duration and frequency of treatment and the individual patient's characteristics.

According to the TBC model, traction may be used as an adjunct treatment when patients have signs of nerve root compression and when no movements centralize symptoms. Mechanical traction should be set to at least 26% of body weight to overcome friction. Evidence best supports mechanical traction for disc pathologies and nerve compression because it can be standardized and consistent across patient interactions.

Strengthening and Flexibility Training [33,41]

Once mobility, stabilization, directional preferences, and lower extremity symptoms are under control, physical therapists need to focus on restoring normal strength and flexibility in the low back, core, and lower extremities.

Acute Phase

The acute phase or hyperirritable phase of injury or symptoms necessitates a gradual approach to movement. PTs and PTAs should begin with range of motion, stability exercises, and light resistance if tolerated. After mobilizations, manipulations, or centralization exercises are finished, physical therapists need to

instruct patients on light core activation and gentle spinal mobility. Examples of this are below.

1. Supine or Sitting Pelvic Tilts
   Contracting the deep core (transversus abdominis) and gently mobilizing the lumbar vertebrae are key to initiating a successful low back pain treatment program. This can be completed for 3 sets of 15 per day to tolerance.

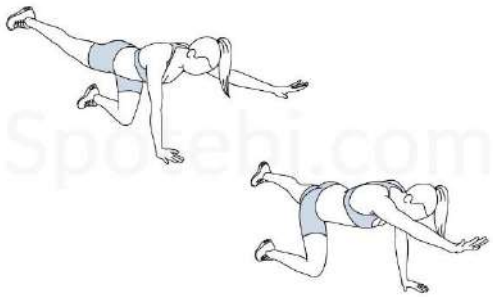
2. Bridge
   Hooklying bridges with cues for deep core activation and dosed at 2-3 sets of 15 per day is a good place to start. This targets the gluteals and core. It is a stability exercise and a strengthening exercise when weight is added. Progression ideas include adding a bar of weight and holding the position longer with a slower eccentric phase. If patients experience an exacerbation of pain, they should be instructed only to move in a pain-free range.

3. Cat-Cow/Camel
   The purpose of the cat-camel exercise is to improve pain free range of motion. It should be prescribed at 2-3 sets of 15 per day in a pain free range of motion.

https://equilibriumsas.com.au/cat-camel-articulation/

4. Bird Dog

   The bird dog should be instructed in quadruped, targets the glutes, core, and paraspinals, and patients should be cued to engage the transversus abdominis. It may be prescribed at 2-3 sets of 15 per day, within a pain free range of motion.



https://www.spotebi.com/exercise-guide/bird-dogs/

5. Squats/Sit to Stands

   Squats target the gluteals and core and demand a neutral spine for a

stability approach of the lumbar vertebrae as well (when cued correctly). It is easily progressed and can be adapted to older adults by completing sit to stands for safety if need be. Squats for strengthening should be dosed at 3 sets of 8-12 and there should be form failure at the last couple repetitions. Physical therapists should add weight or vary the surface to progress. Squats for muscle activity and stability may be dosed at 3 sets of 15.

6. Stretches of Lower Extremities
   Hip flexor, piriformis, hamstring, and gastrocnemius tautness is often part of a clinical examination for low back pain and may be addressed with stretches prescribed at 3 times per day for 30 second holds. This flexibility will bring new ranges of motion, which should be utilized for strengthening across a larger motion.

Chronic Pain and Exercise Progression

Exercises should be progressed per patient tolerance. Physical therapists should progress exercises towards normal muscular strength and flexibility, targeting impairments and reassessing throughout the plan of care. However, with chronic pain, progress may not be linear as patients can have exacerbations. PTs and PTAs should empower patients with chronic low back pain to engage in regular aerobic exercises as well as progress into a strengthening program developed within therapy. Pain neuroscience education and concepts like active recovery are crucial to inform patients of the best recovery strategies.

Variations for Certain Populations

Elderly populations may need different versions of exercises to promote safety. Exercises should be completed with a gait belt, if necessary, in standing. Physical therapists should think about preventing fall out in the community with older adults and any patient presenting with balance impairments.

Athletes will need a specific return-to-sport approach. This will likely involve progressing to advanced exercises of lower extremity strengthening with proper core engagement. Examples are back squats, lunges, plyometrics, and other exercises with added weight for challenge. Physical therapists should ensure to treat the underlying low back injury, but to also simulate the sport tasks and demands as the athlete progresses. Exercises should be dosed at 3 sets of 8 to 12 repetitions to form failure for strength training.

Benefits and Adverse Impact of Pharmaceuticals [25]

Medication has its purpose in the plans of care of many patients with low back pain. Common medications prescribed are NSAIDs, muscle relaxants, opioids, and certain antidepressants. This section will overview each and its benefits and/or adverse effects.

Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)

NSAIDs, such as ibuprofen and naproxen, are commonly used to reduce pain and inflammation associated with low back pain. A systematic review of randomized controlled trials (RCTs) found that NSAIDs can provide short-term pain relief and improve functional outcomes compared to a placebo. However, the long-term effectiveness of NSAIDs for low back pain is uncertain, and potential side effects should be considered, especially in older adults or those with underlying health conditions. It can cause organ damage if used too frequently.

Muscle Relaxants

Muscle relaxants, such as cyclobenzaprine and baclofen, are sometimes prescribed to reduce muscle spasms and associated pain. Evidence supporting the use of muscle relaxants for low back pain is limited and inconsistent. Some studies suggest short-term pain relief, but overall benefits are modest. Muscle relaxants are associated with sedation and other side effects.

Opioids

Opioids are typically prescribed after surgeries and acute pain. The current evidence for the long-term use of opioids for chronic pain, including low back pain, is limited and raises concerns about potential risks, including addiction, tolerance, and adverse effects. Patients should be educated that opioids do not improve or cure chronic pain.

Other Medications

Other medications, such as antidepressants and anticonvulsants, may be prescribed for chronic low back pain with neuropathic components. Antidepressants, specifically tricyclic antidepressants and selective serotonin-norepinephrine reuptake inhibitors (SNRIs) have shown some effectiveness in reducing neuropathic pain associated with low back pain. Anticonvulsants, such as gabapentin and pregabalin, have also demonstrated efficacy in managing neuropathic pain.

Section 4 Key Words

Treatment Based Classification of Low Back Pain - an approach used to categorize and guide the treatment of patients with low back pain

Mulligan Concept – a manual therapy approach used by physical therapists to assess and treat musculoskeletal conditions

Section 4 Summary

Physical therapy treatment strategies such as manual therapy, traction, exercise, and modalities are effective for specific patient presentations. It is the responsibility of the physical therapist and assistant to practice evidence-based care based on the examination findings and plan of care.

Case Study 1

John, a 45-year-old office worker, presents to the physical therapy clinic with complaints of low back pain that radiates down his left leg. The pain started two weeks ago and has progressively worsened. He describes the pain as sharp and shooting, extending from his lower back through the buttock and into the back of the thigh. He reports that sitting exacerbates the pain, while walking provides some relief. He denies any history of trauma.

Reflection Questions

1. What are additional subjective history questions to ask prior to moving into the examination?
2. What are important examination items to perform?
3. What classification group may this patient fall into for treatment?
4. How should a physical therapist approach treating this patient if they score a 20 on the FABQ?

Responses

1. The physical therapist should inquire about medical history, red flags, and understand what John's daily routine and functional activities look like. The PT should know if John has had low back pain before and where he has had any surgeries.
2. The PT should complete a myotome assessment of strength, test reflexes, test sensation, examine range of motion, complete a SLR test, perform repeated movement testing to determine a directional preference, and examine posture and body mechanics.

3. This patient fits mostly into the manipulation group but would benefit from centralization exercises from the specific exercise group as well. Treatment might include manual therapy, strengthening, body mechanics training, and centralization principles.

4. The patient will need education on the fact that pain does not equal harm in individuals with low back pain. This would be especially necessary if John's pain progressed to chronic stages.

Conclusion

In conclusion, this course on low back pain assessment and treatment has provided valuable insights and practical knowledge for physical therapists and assistants. It overviewed the prevalence and demographics of low back pain, understanding the impact it has on individuals worldwide. By recognizing the diverse factors contributing to low back pain, including musculoskeletal and psychosocial factors, PTs and PTAs should feel prepared to best evaluate and treat their patients with low back pain. The course has emphasized evidence-based treatment strategies, focusing on physical therapy interventions, including therapeutic exercise techniques, manual therapy approaches, and neuromuscular retraining strategies that can be applied to address pain, improve functional outcomes, and enhance the overall well-being of patients. By incorporating the latest research findings and individualizing treatment plans, providers are equipped to provide optimal care for individuals with low back pain. The course has also stressed the importance of a comprehensive and patient-centered approach. By considering the unique needs and circumstances of each individual, participants have developed the skills to deliver personalized care and achieve meaningful outcomes for their patients. By continually applying and expanding upon the principles learned in this course, physical therapists and physical

therapist assistants can contribute to improving the quality of care provided to patients with low back pain and contribute to better overall health outcomes.

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