***Clinical Decision Making to Determine Need for Medical Referral* (Vignette Key)**

**Study participants,**

 **The research team guided by Mike Shoemaker, Wendy Ginsberg, and Dan Vaughn would like to offer our sincere thanks for making this survey a success. We greatly appreciate your participation and were pleased with the amount of responses we received. We have provided a vignette key to describe our intended survey response and diagnosis for each vignette included in the survey.**

**Thank you!**

*Crystal Lamb, SPT*

*Brittany Bilger, SPT*

*Danielle Hooker, SPT*

*Michael Shoemaker, DPT, PhD, GCS*

*Dan Vaughn, PT, PhD*

1. A 50 year old male who works as a mechanic and enjoys playing tennis as a leisure activity complains of insidious onset of left shoulder pain. His pain is localized to the anterior shoulder but occasionally travels into the left upper arm. He reports his pain increases with overhead activities and disturbs his sleep when he lies on his left side. Patient is left-handed. Upon examination, right upper extremity, left elbow and left wrist active range of motion (AROM) are within normal limits without pain. Left shoulder AROM is within normal limits and painful. Gross upper extremity strength is 5/5 on the right, 4/5 on the left and painful. Vital signs are normal and patient is in no acute distress. Past Medical History: HTN controlled with medications.

**Correct Survey Response: No Medical Referral Required**

**Intended Diagnosis: Shoulder Pain/ Impingement Syndrome**

**Rationale:** Clinical presentation of impingement: insidious, pain localized to anterior shoulder & radiates into arm, pain exacerbated by lying on shoulder (Koester et al.) Also overhead activities. Left shoulder pain in the context of this patient’s PMH could suggest referred pain from cardiovascular causes, but are unlikely given the patient’s normal vital signs.

Bigliani L and Levine, WN. Current concepts review: Subacromial impingement syndrome. *J Bone Joint Surg*. 1997;79(12):1854-1868.

Koester MC, George MS, Kuhn JE. Shoulder impingement syndrome. *Am J Med*. 2005;118:452-455.

1. A 52 year old male who works on an assembly line at a local factory complains of low back pain which has been treated several times over the past 10 years. He reports his back pain as a 6/10 currently that has recently increased after working longer hours at the factory. In the past couple days, he has experienced numbness and tingling that started in his buttock region and has since progressed to his legs and feet. He has also noticed recent bladder changes, with increased difficulty emptying his bladder, and a feeling of numbness and tingling in his perianal region. Upon examination, strength assessment of lower extremities is grossly 3+/5 to 4/5 bilaterally. Assessment of the lumbar spine shows reduced active range of motion into extension and side bending, both of which are painful. Reflexes in his left lower extremity are a 1+ and a 2+ in his right lower extremity. Past Medical History: 30 year history of smoking, Hypertension.

 **Correct Survey Response: Medical Referral Required – Urgent**

**Intended Diagnosis: Cauda Equina Syndrome**

**Rationale:** This patient demonstrates many classic signs and symptoms of Cauda Equina syndrome including saddle paresthesia, numbness and tingling into the lower extremities, and decreased strength of the lower extremities. The diminished reflexes on the left indicate that the condition is progressing but has not impacted the right lower extremity reflexes yet. A history of low back pain suggests that this individual may have had a disc that had started to herniate and has progressed to a full Cauda Equina syndrome.

Lavy C, James A, Wilson-MacDonald J and Fairbank J. Cauda Equina Syndrome. *BMJ*. 2009; 338 (7699): 881-884.

1. A 56 year old female who is unemployed and enjoys working in her yard reports she experienced a sudden onset of sharp pain while completing heavy lifting activities 5 days ago. Her pain is localized to her left posterior thigh and buttock. Symptoms have been gradually improving, although her pain still makes it difficult to walk and complete her daily activities. Upon examination, she ambulates with a guarded, antalgic gait. Passive range of motion of the left hip and knee are within functional limits. Left knee flexion and hip extension strength are 3-/5 and painful, all other lower extremity strength tests are within functional limits. There are no sensory deficits or changes in deep tendon reflexes. Patient reports marked tenderness and sharp pain upon palpation of the left proximal hamstring. Past Medical History: Unremarkable

**Correct Survey Response: No Medical Referral Required**

**Intended Diagnosis: Muscle strain**

**Rationale:** This is a typical muscle strain presentation; mechanical pain, known mechanism of injury, muscle tests limited by pain, and symptoms that are gradually improving demonstrating natural healing. Hamstring strains can result in difficulty with ambulation due to pain and there is typically tenderness to palpation over the muscle body and insertion site with a hamstring strain (Ropiak and Bosco).

Ropiak CR and Bosco JA. Hamstring injuries. *Bulletin of the NYU Hospital for Joint Diseases* 2012; 70(1):41-48.

1. A 75 year old sedentary, Caucasian female of small stature complains of low back and right buttock pain that began 3 weeks ago insidiously. She notes a significant decrease in her daily activity due to difficulty with ambulation. Patient does not report any specific trauma or fall prior to the onset of her back pain. She has 8/10 pain that is elicited with weight bearing and improves with rest or lying down on her back. Patient experiences no change in pain with movements of the lumbar spine. Neurological exam is unremarkable. Past Medical History: Asthma (treated with corticosteriods via inhaler and frequent episodes of oral corticosteroids), Left Colles’ Fracture 4 months ago.

**Correct Survey Response: Medical Referral Required – Non-Urgent**

**Intended Diagnosis: Sacral Insufficiency/Fracture/Osteoporosis**

**Rationale:** The age of this patient, her Caucasian race, low body weight, gender and corticosteroid use contributed to increased risk/suspicion of osteoporosis. The Colles’ fracture she experienced previously is a common occurrence in osteoporosis, so this emphasizes this patient as having a profile for osteoporosis. (Kanis & McCloskey)Sacral insufficiency fractures occur most often in elderly women and it is often insidious. Prominent clinical features: low back, pelvic pain; exacerbated by weight bearing activity and improves with rest. Neurological exam is often unremarkable. (Tsiridis, Upadhyay, & Giannoudis)

Even if a clinician reading this vignette has never heard of or seen a sacral insufficiency fracture, the description of a patient with all the risk factors for osteoporosis (including a past fracture) who had a significant increase in pain without trauma and significant pain with weight bearing would indicate at least the possibility of medical referral to rule out a fracture.

Kanis JA and McCloskey EV. Risk factors in osteoporosis. *The European Menopause Journal.*(1998);229-233.

Tsiridis E., Unadhyay N. Giannoudis PV. Sacral insufficiency fractures: current concepts of management. *Osteoporos Int* (2006);17:1716-1725

Schindler OS, Watura R, Cobby M. Sacral insufficiency fractures. *J Orthop Surg*. (2007);15(3):339-346.

Yoder K, Bartsokas J, Averell K, McBride E, Long C, Cook C. Risk factors associated with sacral stress fractures: a systematic review. *Journal of Manual and Manpulative Therapy*. 2015;23(2): 84-92.

1. A 65 year old retired male who enjoys daily rounds of golf complains of an insidious onset of back pain that is limiting his ability to golf and impacts other daily activities. He reports “many years” of intermittent episodes of low back pain and had a past (2 years ago) radiograph image which showed degenerative changes in his lumbar spine. He describes his current episode as “different” when compared to his previous episodes of back pain, as it seems to be rapidly progressing and is severe. Patient reports his pain has intensified to constant and throbbing. Upon examination, pain increases during general physical exertion but not during lumbar motion testing. His range of motion and muscle strength are within functional limits. Neurological exam is negative. Past Medical History: Significant Family History of Cardiovascular Disease, Hypertension, High Cholesterol, Obesity.

 **Correct Survey Response: Medical Referral Required – Urgent**

 **Intended Diagnosis: Abdominal Aortic Aneurysm**

**Rationale:** The case represents possible method of injury and prolonged history of low back pain. The patient is a male over 50 who is not responding to conservative treatments which are considered red flags. His pattern of pain is consistent with an abdominal aortic aneurysm (AAA) as it has been described as intermittent dull, achy pain to severe constant throbbing pain. Pain is only worsened by physical exertion and not throughout the examination including motion, strength, and neurological testing. Patient has increased risk factors for AAA. This is an urgent referral, throbbing, constant pain representative of a dissecting AAA and has a high mortality rate. (Cates 1997, Van Wyngarden, Ross, & Hando 2014, Goodman & Synder 2007)

Cates JR. Abdominal aortic aneurysms: clinical diagnosis and management. *J Manipulative Physiol Ther*. 1997;20:557-561.

Van Wyngaarden JJ, Ross MD, Hando BR. Abdominal aortic aneurysm in a patient with low back pain. *J Orthop Sports*. 2014;44(7):500-507.

Goodman CC, Snyder TEK.  *Differential diagnosis for physical therapists: screening for referral.*  4th ed. St Louis, MO: Saunders/Elsevier; 2007.

1. A 64 year old male, who is a retired police officer, is self-referred for decreased strength and endurance. He reports no pain but has shortness of breath while working in his vegetable garden and climbing stairs. He attributes shortness of breath partly to his diagnosis of COPD and reports that his COPD symptoms have been stable for the past 6 months. He reports increased difficulty with tasks such as lifting, squatting and walking long distances. Upon examination, gross upper extremity strength is 4/5 bilaterally and gross lower extremity strength is 3+/5 to 4/5 bilaterally. Resting vitals are as follows: Heart Rate 89, Blood Pressure 135/87, SpO2 94% on room air, Respiratory Rate 24, RPE 7/20. Patient ambulates a distance of 367 meters (1,200 feet) during the 6-minute walk test with one standing rest break. Post-test vitals are as follows: Heart Rate 123, Blood Pressure 152/87, SpO2 92% on room air, Respiratory Rate 36, RPE 14/20. He denies exertional chest pain or lower extremity cramping. Past Medical History: COPD, 30 pack-year history of smoking.

 **Correct Survey Response: No Medical Referral Required**

 **Intended Diagnosis: Stable COPD/Deconditioning**

**Rationale:** The patient describes difficulty with daily activities, shortness of breath and strength is decreased overall suggesting the patient is deconditioned. Resting vitals are slightly elevated and initial SpO2 is slightly low, but patient is stable. The patient’s vital sign response to exercise is appropriate given his deconditioned state and COPD and the distance for his 6 minute walk test also suggests deconditioning overall. He has risk factors for cardiovascular disease but does not demonstrate signs suggestive of a symptomatic disease state.

Reid WD, Chung F and Hill K. Stable Chronic Obstructive Pulmonary Disease. *Cardiopulmonary Physical Therapy: Management and Case Studies.* 2nd ed. Thorofare, NJ: SLACK Incorporated; 2014: 354-358.

1. A 59 year old female elementary school teacher complains of intense back pain that began a couple of days ago. The patient does not believe that she has done anything to cause her back to hurt. She rates her pain at a constant 8/10 and describes it as feeling deep. The patient complains that she cannot get into the “right” position to lessen her pain. Upon examination, pain is localized to T7-T9 area and wraps around her right side to her xiphoid process. She experiences mild tenderness with palpation to her right subcostal margin. Her lower rib spring testing is restricted and painful but did not reproduce her chief complaint. Range of motion of the lumbar spine and gross strength is within functional limits. Neurological exam is unremarkable. Past Medical History: Unremarkable.

 **Correct Survey Response: Medical Referral Required – Urgent**

 **Intended Diagnosis: Visceral Referred Pain**

**Rationale:** This case represents a referred pain location for the gallbladder. The pain is described as deep and intense which often a descriptor of visceral pain. Intense pain with insidious onset is reason for concern. She is unable to relieve her pain with movement or positional changes. Restricted and painful rib springing result could be due to muscle guarding. Other examination findings were unremarkable. (Goodman & Synder 2007)

Goodman CC, Snyder TEK.  *Differential diagnosis for physical therapists: screening for referral.*  4th ed. St Louis, MO: Saunders/Elsevier; 2007.

1. An 82 year old female who lives with her husband in a ranch style home complains of decreased balance. She reports several falls since discharge from inpatient rehabilitation 4 months ago following a right middle cerebral artery CVA. In particular, she experiences frequent loss of balance and numerous near falls while dressing and preparing meals. Patient demonstrates moderate right-sided weakness with strength grossly 3/5 to 3+/5. Left-sided strength is within functional limits. Patient ambulates with small based quad cane for 200 feet with decreased gait velocity, decreased right foot clearance and decreased weight bearing on right lower extremity. Berg Balance Test scores are 20/56 indicating a high fall risk. All deficits are similar to those documented during her inpatient rehabilitation stay. Vital signs including orthostatic measurements are normal and patient denies syncope/pre-syncope as a cause of her falls. Past Medical History: Left Middle Cerebral Artery CVA, Left THA 15 years prior, Mild Vascular Dementia.

 **Correct Survey Response: No Medical Referral Required**

 **Intended Diagnosis: Balance/Stroke**

**Rationale:** Falls and loss of balance are common post stroke, especially in the patient’s home (Batchelor et al). The patient has a high number of falls post discharge often during daily activities and her Berg Balance score suggests she is at a high fall risk. It does not appear that any additional medical conditions are contributing to her condition except for residual effects of her MCA stroke. The falls since discharge and persistently reduced function in her upper extremity are likely due to weaknesses, decreased use, and lack of continued progress since she stopped having regular therapy visits.

Berg Balance Scale. <http://www.aahf.info/pdf/Berg_Balance_Scale.pdf>. Retrieved on May 20,2015.

Batchelor FA, Mackintosh SF, Said CM, Hill KD. Fall after stroke. *International Journal of Stroke*. 2012; 7:482-490.

1. A 58 year old female who is a former competitive runner complains of left knee pain that increases with activities including stair climbing and walking long distances. She reports significant morning stiffness and swelling in her left knee that lasts well over 30 minutes after getting out of bed. Over the past three months, patient has noticed occasional swelling and pain in her wrist and hands that preceded the onset of her knee pain. Upon examination, left knee active range of motion is restricted at end ranges and all ligamentous tests of the knee are negative. The left knee is warm to touch and mildly swollen. Additionally, the patient’s wrist and metacarpophalangeal (MCP) joints are red and mildly swollen. Past Medical History: Unremarkable.

 **Correct Survey Response: Medical Referral Required – Non-Urgent**

 **Intended Diagnosis: Rheumatoid Arthritis/Inflammatory Condition**

**Rationale:** With OA there is typically pain with activity including stair climbing and walking long distances, and associated morning stiffness that lasts less than 30 minutes. (Felson 2006). The former athletic participation could also contribute to the occurrence of OA.

American Rheumatism Association criteria for RA includes morning stiffness, arthritis of 3 or more joints, arthritis of hand joints, and symmetric arthritis for at least 6 weeks which are all potentially represented in this case (Arnett et al, Mooney & Mcgee). Onset of RA is often associated with weight loss and anorexia (Glazier 1996)

Arnett FC, Edworthy SM, Bloch DA, McShane DJ, Fries JF, Cooper NS, Healey LA, Kaplan SR, Liang MH, Luthra HS, et al. The American Rheumatism Association 1987. Revised criteria for the classification of rheumatoid arthritis. Arthritis Rheum. 1988; Mar;31(3):315-24. PubMed PMID: 3358796.

Mooney J and Mcgee M. Early recognition of rheumatoid arthritis. *Nurs Residential Care*. 2012;14(7):344-347.

Glazier R. Managing early presentation of rheumatoid arthritis. *Can Fam Physician*. 1996;42:913-922.

Felson DT. Osteoarthritis of the knee.*N Engl J Med.* 2006;354:841-848.

1. A 38 year old male who works as a construction site manager complains of low back pain that has been present over the past week. He reports no known mechanism of injury but may have “overdone” it at work. He rates his pain as 6/10 that worsens when he stands and walks. He is unable to sleep due to being uncomfortable in his preferred position (lying on his stomach). While resting in his recliner chair his symptoms are relieved. Upon examination, range of motion is restricted in both lumbar flexion and extension. Patient reports pain during range of motion testing and demonstrates increased muscle guarding of bilateral lumbar musculature upon palpation. Neurological exam is without deficits. Past Medical History: Unremarkable.

 **Correct Survey Response: No Medical Referral Required**

 **Intended Diagnosis: Non-Specific Low Back Pain**

**Rationale:** This case represents a male under the age of 50. His pain is mechanical as it worsens with standing, walking, lumbar motion testing. Directional preference is not completely clear as patient reports pain with flexion but could be due to the injury being acute. Although no known mechanism of injury, non-specific mechanical cause is possible. Unable to sleep is due to difficulty finding a comfortable position because of symptoms versus waking due to pain. Typical benign low back pain presentation including worse with movement, improved with rest, and negative neurological findings. (Della-Giustina, Atlas & Deyo)

Atlas SJ, Deyo RA. Evaluating and managing acute low back pain in the primary care setting. *J Gen Intern Med.* 2001;36:120-131.

David Della-Giustina. Acute back pain. *Primary Care Reports* 1 Oct. 2008. *Health Reference Center Academic*. Web. 22 Feb. 2015.

Goodman CC, Snyder TEK*.  Differential diagnosis for physical therapists: screening for referral*.  4th ed. St Louis, MO: Saunders/Elsevier; 2007.

1. A 56 year old male commercial driver presents with decreased endurance and 4/10 cramping leg pain bilaterally after walking several minutes. He reports that his symptoms have gradually developed over the past 6 months. Patient’s pain is relieved by rest in sitting or in standing. Upon examination, lumbar range of motion is slightly restricted in flexion and extension but does not reproduce his leg pain, as he claims it “feels good”. Manual muscle testing of lower extremities are within functional limits with the exception of decreased strength in gross bilateral hip musculature, 4-/5. No lower extremity edema is noted. Neurological exam is unremarkable. Past Medical History: Hypertension, Coronary Artery Disease, Diabetes Mellitus.

 **Correct Survey Response: Medical Referral Required – Non-Urgent**

 **Intended Diagnosis: Claudication/Pulmonary Artery Disease**

**Rationale:** This case represents a typical presentation of vascular claudication. Pain is described as “cramping” and induced by exercise/activity. Pain subsides immediately afterwards with rest. Slight lumbar range of motion restriction and decreased hip strength could be due to decreased activity. Past medical history of coronary artery disease is common with peripheral vascular disease. (Schemieder & Comerota)

Schmieder FA, Comerota AJ. Intermittent claudication: magnitude of the problem, patient evaluation, and therapeutic strategies. *Am J Cardiol.* 2001;87:3D-13D.

1. A 75 year old retired business man with a complicated medical history is seeking physical therapy intervention due to his wife’s concern for his decreased balance and endurance. His wife reports a decline in function since hospitalization 3 weeks ago for an exacerbation of heart failure. Patient was ambulating without an assistive device and had no functional limitations prior to his hospital stay. Patient experiences episodes of dizziness and muscle cramping since his discharge. Upon examination, strength tests are within functional limits, with a grade of 4/5 or greater. He demonstrates impaired static and dynamic standing balance. He ambulates with a front wheeled walker and a slowed gait velocity. Throughout the examination the patient is lethargic and appears confused. Vitals signs during examination are stable with the exception of a slightly elevated blood pressure (135/88). Past Medical History: Diabetes Mellitus, Chronic Heart Failure, Coronary Artery Disease, Hypertension, Extensive medication list that includes insulin, Lasix (furosemide), Zestril (lisinopril).

 **Correct Survey Response: Medical Referral Required – Urgent**

**Intended Diagnosis: Medication complication/Stable Chronic Heart Failure**

**Rationale:** Given that patients are living longer and with more medical complications due to medical advancements, physical therapists will encounter more complex patients with many factors contributing to their illness and recovery (Fulton 2005). Issues such as polypharmacy and poor health literacy can lead to medication complications and increase patient risk for falls, subsequently increasing the health care burden and lowering patient health status (Ferrer 2012, Boye 2012). In this vignette we include symptoms that suggest hypokalemia which can be caused by Lasix in hopes that physical therapists would take note of the adverse reaction to this medication and the need for medical referral.

Fulton MM and Allen ER. Polypharmacy in the elderly: A literature review.  [*Journal of the American Academy of Nurse Practitioners*](http://search.proquest.com.ezproxy.gvsu.edu/pubidlinkhandler/sng/pubtitle/Journal%2Bof%2Bthe%2BAmerican%2BAcademy%2Bof%2BNurse%2BPractitioners/%24N/34049/DocView/212886222/fulltextwithgraphics/C7F332F33C6F4E58PQ/1?accountid=39473). 2005; 17(4): 123-132.

Lasix Side Effects Center. <http://www.rxlist.com/lasix-side-effects-drug-center.htm>. Retrieved on May 20, 2015.

Desai, AS, Stevenson, LW. Rehospitalization for heart failure. *Circulation*. 2012;126:501-506.

1. A 22 year old male college student who recreationally plays basketball reports injuring his right ankle 4 weeks ago during a game. He self-treated his ankle sprain with an over-the-counter ankle immobilizer and has been ambulating with the assistance of a knee scooter he received from his sister. He reports having significant calf pain that has increased over the last few days. Upon examination, the patient’s ankle ROM and strength are decreased and there is moderate, unilateral right lower leg swelling. During examination, the patient notes difficulty with breathing that began in the last 24 hours. Past Medical History: Tonsillectomy at 8 years old.

 **Correct Survey Response: Medical Referral Required – Urgent**

**Intended Diagnosis: Pulmonary Embolism**

**Rationale***:* Immobilization and unilateral swelling are associated with a positive test for PE (Courtney et al, Kostantinides) Pain with breathing is a clinical sign of PE. This is a likely presentation to an outpatient physical therapy clinic in a direct access setting.

Courtney DM, Kline JA, Kabrhel C, et al. Clinical features from the history and examination that predict the presence of absence of pulmonary embolism in symptomatic emergency department patients: Results of a prospective, multicenter study. *Ann Intern Med.* 2010;55(4):307-315.

Kostantinides S. Acute pulmonary embolism. *N Engl J Med*. 2008;359:2804-2813.

1. A 46 year old female who works as an accountant complains of neck pain that is making daily activities difficult and is worse at the end of the day. Patient reports being involved in a low-speed car accident seven months prior but was not sent to the hospital for any imaging after the accident. She notes some numbness and tingling in her hands bilaterally but reports this as a recurrent, intermittent symptom for the past few years and is unchanged since the accident. Upon examination, patient’s posture in sitting and standing is significant for moderate forward head and rounded shoulders. Patient demonstrates decreased cervical range of motion with flexion and extension limited to 45 degrees in each direction, rotation to 60 degrees bilaterally, and lateral flexion to 40 degrees bilaterally with increased pain at end ranges. There is tenderness with palpation along bilateral cervical and shoulder musculature. Upper limb nerve tension tests reproduce numbness and tingling to hands during the elbow extension component. Strength and deep tendon reflexes of all extremities are normal. Ligamentous tests of the upper cervical spine are negative for instability. Past Medical History: Unremarkable.

 **Correct Survey Response: No Medical Referral Required**

 **Intended Diagnosis: Neck Pain**

**Rationale:** This case incorporated a few of the Canadian C-Spine Rules but the patient was outside of the parameters indicated by those predictors. The described patient is at a high risk for an overuse injury due to employment and poor posturing.

Stiell IG et al. The Candian C-Spine Rule versus the NEXUS Low-Risk Criteria in patients with trauma. N Engl J Med 2003;349:2510-8.

<http://www.nlm.nih.gov/medlineplus/ency/article/003025.htm>

Canadian C-spine Rules. [http://www.health.vic.gov.au/vscc/downloads/canadianc-spinerule.pdf. Accessed May 20,2015](http://www.health.vic.gov.au/vscc/downloads/canadianc-spinerule.pdf.%20Accessed%20May%2020%2C2015).

1. A 16 year old high school athlete, who is in the middle of his basketball season, complains of right knee pain that has been increasing during the last week of practices. He reports that his pain started over the summer months but that it has increased substantially since school started and with basketball practice. He does not remember any specific injury to his knee. His parents believe the pain is due to a growth spurt but are concerned now that the symptoms are worsening and not improving with rest. Upon examination of his knee, mild range of motion deficits are found in flexion and extension. Mild swelling and warmth is noted above the knee. Patient reports pain with deep palpation to the distal femur. Manual muscle testing of the knee is limited by pain. Tests of ligamentous and meniscal integrity are negative. Past Medical History: Unremarkable.

 **Correct Survey Response: Medical Referral Required – Urgent**

 **Intended Diagnosis: Osteosarcoma**

**Rationale:** Cancer in children is a time-sensitive and imperative diagnosis to make in order to treatment to be initiated. 1 in 285 children will be diagnosed with cancer each year; as part of the medical team, physical therapists need to be detailed and accurate with referrals for suspicious clinical presentations in children. The patients presents with a swollen distal femur and restricted ROM which is a typical presentation with an osteosarcoma. He has no mechanism of injury and fits a typical profile for osteosarcoma (teenage, male). (Tebbi & Gaeta)

Tebbi CK and Gaeta J. Osteosarcoma. *Pediatric Annals* (1988). 17(4):285-300.