PARTNERS HUMAN RESEARCH COMMITTEE
PROTOCOL SUMMARY

Answer all questions accurately and completely in order to provide the PHRC with the relevant information to assess the risk-benefit ratio for the study. Do not leave sections blank.

PRINCIPAL/OVERALL INVESTIGATOR

Paolo Bonato, PhD

PROTOCOL TITLE

Muscle synergies during the gait in children with cerebral palsy undergoing robot-assisted gait therapy.

FUNDING

VERSION DATE

Protocol closed on September 8, 2020
Last approval on May 3, 2019
Original approval on October 8, 2015

SPECIFIC AIMS

Concisely state the objectives of the study and the hypothesis being tested.

Aim 1. To study the characteristics of muscle synergies in children with cerebral palsy during gait.

Aim 2. To study the relationship between muscle synergies and the outcomes of robot-assisted gait training.

BACKGROUND AND SIGNIFICANCE

Provide a brief paragraph summarizing prior experience important for understanding the proposed study and procedures.

Cerebral Palsy (CP) is a group of disorders affecting movement, development and posture that cause functional limitation, attributed to non progressive alterations occurring in the brain during fetal and newborn development[1]. CP is one of the most common causes of disability in childhood. The prevalence rate of CP is approximately 2/1,000 [2,3]. Clinical features of children with CP usually includes weakness, spasticity, and loss of selective motor control (SMC)[4]. Selective motor control has been defined as 'the ability to isolate the activation of muscles in a selected pattern in response to demands of a voluntary movement or posture'[4] and the knowledge regarding the etiology of selective motor deficits in children with spastic CP is not well studied yet[5].
The scientific community widely accepts that the Central Nervous System (CNS) adopts several strategies to reduce the complexity of the control of movement [6-10]. Many authors have shown that one of these strategies consists in using a limited number of primitive signals undergoing the activation of muscles which, when combined, generate a full collection of movements [9].
Previous studies have shown the sensitive nature of EMG to represent an aberrant motor control in CP[11]. Children with CP utilize fewer synergies during gait than typically developing children. The complexity of control, as measured by synergies, is reduced during gait in individuals with CP compared with unimpaired individuals and is related to functional ability and clinical measures.

The similarity of synergies in CP, stroke, and infant rhythmic-stepping indicates that there are common changes in control after brain injury that may reflect control in early development[12].

Training interventions to improve gait outcomes in CP usually include strength training, balance control and weight bearing activities[13]. Some studies have demonstrated beneficial effects of intensive task-specific gait training on motor recovery in children with CP[14,15].

Figure 1. The driven gait orthosis (Lokomat, by Hocoma AG) that we propose to use in the study.

Robotics has been looked upon as a means to achieve intensity and specificity of gait training, which are known to be key "ingredients" needed to maximize motor gains[16,17]. The most prominent device used to deliver gait training is the Lokomat system (Hocoma AG, Switzerland) shown in *Figure 1*. The system is a driven (i.e., motorized) gait orthosis (DGO), namely a computer-controlled exoskeleton that is secured to a person's lower limbs while he/she walks on a motorized treadmill supported by an unloading system. The DGO is meant to replace the assistance provided by therapists during manually-assisted treadmill-based gait training. The DGO records parameters such as the joint torques, the range of motion at different joints and the level of assistance provided by the robot. These parameters allow therapists to monitor the subject's response to gait training. The Pediatric Lokomat is a DGO for gait training in children. Its safety and benefits on speed, gait endurance, gross motor skills (assessed using the Gross Motor Function Measure Scale) [16,18], postural control [19], hip extension, step length [20] and spasticity have already been demonstrated in many studies. Some of these intervention outcomes have been shown to be retained 6 months post-therapy [20]. In comparison to conventional therapy and manually assisted body weight-supported treadmill training, robot-assisted gait training allows for significantly increasing the number of steps performed during a single session. Besides, the system can assure the performance of a physiological pattern of motion during training. Given its benefits, DGOs like the Lokomat system are becoming more and more common in clinical practice.

We have observed a significant variability in the clinical outcomes of robot-assisted gait training in children with CP using the Lokomat robotic system. We hypothesize that the severity of impairment in Selective Motor Control (SMC)[21] is responsible in large part for the variability in responsiveness to robot-assisted gait training observed across children with CP. In the proposed project, we intend to explore the use of a recently developed technique designed to analyze the activity of muscles. This technique is referred to as the "analysis of muscle synergies". We observe that the study of muscle synergies would allow us to capture the severity of impairments in SMC in a way that is more mechanistic (and therefore more informative) than traditional clinical scales to assess SMC. Furthermore, we hypothesize that abnormalities in muscle synergies would account for the above-mentioned variability in responsiveness to robot-assisted gait training. If this hypothesis was found to be true, the proposed approach would allow us to design patient-specific rehabilitation interventions that would target abnormalities in muscle synergies that could be used prior to the administration of robot-assisted gait training as a way to re-enable motor learning strategies that would allow children with CP who are currently not responsive to robot-assisted gait training to fully benefit from robot-assisted gait training. If successful, the proposed approach would be expected to significantly improve clinical outcomes of robot-assisted gait training in children with CP.

RESEARCH DESIGN AND METHODS

Briefly describe study design and anticipated enrollment, i.e., number of subjects to be enrolled by researchers study-wide and by Partners researchers. Provide a brief summary of the eligibility criteria (for example, age range, gender, medical condition). Include any local site restrictions, for example, "Enrollment at Partners will be limited to adults although the sponsor's protocol is open to both children and adults."

A convenience sample of 30 children with CP with no major orthopedic or neurological complications that could interfere with the gait-training program will be recruited in the study. A study clinician will screen potential subjects. Screening will include a standard history and physical exam to ensure subjects meet all entry requirements after consideration of inclusion and exclusion criteria.

Inclusion criteria:

- Diagnosis of spastic CP
- 6 to 18 years of age.
- Gross Motor Function (GMFCS) Level I, II, III or IV.
- Body/femoral length < size of Lokomat robotic arm (femur length between 210-350mm)
- Ability to communicate pain or discomfort.

Exclusion Criteria:

- Recent use of Lokomat within the last 3 months.
- Contraindication to robot-assisted gait training such us thromboembolic disease, progressive neurologic disorder, cardiovascular or pulmonary contraindications, aggressive behaviors, severe cognitive deficits, bone instabilities, fractures, osteoporosis).
- Skin ulcers in trunk or lower limbs.
- Hip, knee, ankle arthrodesis.

Briefly describe study procedures. Include any local site restrictions, for example, "Subjects enrolled at Partners will not participate in the pharmacokinetic portion of the study." Describe study endpoints.

All study procedures will take place in the Motion Analysis Laboratory at Spaulding Rehabilitation Hospital, Boston, Massachusetts, USA. Spaulding Rehabilitation Hospital is an affiliated hospital of Harvard Medical School.

Assessments

Assessments will be performed before and after the study participant undergoes robot-assisted gait therapy. Each assessment will require approximately 4 hours. The majority of this time will be spent sitting down, attaching markers and electrodes on the subject, checking the position of the markers and sensors, and measuring lengths of body segments. But we will give the option to the families of dividing the assessments into two different appointments.

Visit 1: Clinical tests

Clinical tests will be conducted by a study staff to assess lower limb function before and after the intervention. Throughout the study visit (notably during the clinical testing) if subjects feel tired, they will be given every opportunity to rest; this, in addition to regular rest breaks between the test trials. Clinical tests will include:

- The *Gross Motor Function Measure* (GMFM): this standardized test was designed specifically for children with CP and was developed to measure changes over time in clinical status. The GMFM is a classification system based on movements initiated by the child. It can be used to classify the severity of CP related to mobility. For the purpose of this study, the standing and walking sections of the GMFM will be used.
- The *10-meter walk test* will be used to assess walking speed. Subjects will be asked to ambulate at their normal, comfortable walking speed during the test. Individuals using an assistive device during baseline examination will be evaluated with a similar device during subsequent tests. To estimate gait speed, time will be recorded during the middle 10m of the 14m walk test. We may ask subjects to do this test 3-5 times. Each subject will be allowed to rest between trials.
- The *6-minute walk test* will be used to measure walking endurance. The test measures the distance ambulated during 6 minutes of a continuous walk on a flat, uncarpeted surface. An observer walks alongside the subject and provides encouragement and contact guarding as needed. Subjects will be asked to do this test once.

Visit 1: Lab-based study

Gait evaluations will be performed in the Motion Analysis Laboratory before and after robot-assisted gait training. Subjects will be asked to change into shorts and shirt. Measurements of the knee and ankle joint and leg lengths will be taken before testing. Surface electromyographic (SEMG) data will be gathered to study the characteristics of muscle activation patterns in children with cerebral palsy during the gait. Data will be collected using electrodes for the detection of EMG activity from muscles that are involved in the gait. Simultaneous recordings of movement patterns will be performed using a camera-based system for motion analysis. Movements of the upper limbs, trunk and lower limbs, will be tracked using a standard set of reflective markers positioned on anatomical landmarks such as acromioclavicular joint, upper arm, lateral epicondyle, forearm, wrist, 7^{th} cervical vertebrae, 10^{th} thoracic vertebrae, clavicle, sternum, the sacrum, anterior superior iliac spine, lateral thigh, distal lateral epicondyles, lateral shank, lateral malleolus, center of calcaneus and second metatarsal head. We will follow the SENIAM (Surface Electromyography for the Non-Invasive Assessment of Muscles) guidelines to place up to 16 electrodes on several muscles involved in the gait pattern, including the following: Gastrocnemius, Soleus, Tibialis Anterior, Peroneus longus, Rectus Femoris, Vastus Medialis and Lateralis, Sartorius, Biceps Femoris, Semitendinosus, Adductor Longus, Tensor Fascia Latae, Gluteus Maximus and Gluteus Medium, Obliquus and erector spinal muscles. The EMG will be attached using bio-adhesive double sided tape and secured with Coban. Each subject will be asked to do this several times until about 5-10 trials with good foot contacts onto the force plates are collected for each side (leg) of the body. Subjects will be asked to complete 5-10 trials walking barefoot (if possible), and then 5-10 trials walking in their shoes with any brace(s) they may normally wear. Rest breaks will be given during the testing. We will ask permission to study participants to video record them during the performance of the above-described clinical tests and the lab-based study.

Training:

Body-weight support will be provided using a harness-counterweight system over a motorized treadmill. The DGO will be secured to patients at the trunk, pelvis, and lower extremities using adjustable cuffs with velcro straps, with hip and knee joints aligned to those of the DGO. The DGO, which is attached to the support frame of the treadmill with a 4-bar linkage and a spring-loaded counterweight system, will provide vertical support and unloading of the device so that the weight of the DGO does not contribute to the loading experienced by the patient during the training. Actuators at the hip and knee joints will generate a physiological gait pattern timed to the

speed of the treadmill belt. Elastic straps will be fitted around the subject's footwear to ensure clearance during swing.
Each training session will include 30 minutes of walking divided into 3 bouts of 10 minutes. During the walking bouts, subjects will be encouraged to walk continuously and as actively as possible. Between bouts, children will be allowed to rest for 5 minutes (or longer if necessary). As training progresses, we will decrease the amount of body weight support and increase treadmill speed. Adjustments will have to vary according to the subject's ability to maintain upright posture and knee extension during heel strike without compromising loading.

Robot-assisted Gait Therapy Protocol

- Length of training – A total of 18 training sessions will be performed in approximately 6-7 weeks.
- Duration of session – approximately 60 minutes (including about 20 minutes for stretching, setup, and warm-up, three 10 min bouts of walking, and 5 min of rest between each bout if needed).
- Speed of training – as determined by patient tolerance and comfort.
- Body weight support – as small a percentage of body weight as possible to a level that allows maximum lower-extremity loading without evidence of excessive knee extension/flexion during stance or toe drag during swing. Patients will be encouraged to voluntarily generate lower extremity movements that are consistent with the assisted stepping pattern. The system provides visual feedback that will be used to encourage joint torque generation and achievement of kinematic goals.

For studies involving treatment or diagnosis, provide information about standard of care at Partners (e.g., BWH, MGH) and indicate how the study procedures differ from standard care. Provide information on available alternative treatments, procedures, or methods of diagnosis.

Treatments for children with cerebral palsy to improve walking usually include strengthening their muscles and improving their balance. These help to reduce the effects of weakness, contractures and spasticity. Therapeutic options available to decrease spasticity and its impacts on gait are usually staggered, and include physical therapy, oral medications, botulinum neurotoxin injections, phenol or ethyl alcohol perineural injections, intrathecal baclofen, selective dorsal rhizotomy or musculoskeletal surgical procedures. Training by walking on a treadmill is also helpful. The Lokomat robot training is an advanced version of training on a treadmill. It is not the current standard of care.

Describe how risks to subjects are minimized, for example, by using procedures which are consistent with sound research design and which do not unnecessarily expose subjects to risk or by using procedures already being performed on the subject for diagnostic or treatment purposes.

Risks to participants will be minimized by following the Spaulding Rehabilitation Hospital Policy and Procedure: General Safety Precautions and Procedures for the Conduct of Human. All laboratory equipment meets or exceeds hospital standards for electrical safety. The DGO that we propose to use in the study (i.e., the Lokomat system by Hocoma AG) has been demonstrated to be a secure device for pediatric gait training and is equipped with multiple safety tools. Training sessions will be always overseen by a therapist trained in the use of robotic systems for gait training. The risks of using the Lokomat include muscle soreness and fatigue, but no harmful adverse events have been reported with its use in a pediatric population. Subjects will be under

constant observation. Trained staff will be nearby to help in case of loss of balance. Subjects will be asked prior to using sensors to collect data if they recall any past occurrences of fragile skin, or sensitivity to tape or latex. The investigators will use hypo-allergic tapes and bandages that are unlikely to cause skin irritation. The padded harness of the DGO will be used with cushioned linings and foam padding to minimize contact pressures of the harness, straps and device directly on the skin and to prevent abrasions during the bodyweight supported treadmill walking. Subjects will also be asked to wear long cotton pants when training with the robot to minimize the possibility of skin abrasions. A physician will be available to assist should medical complications arise. To minimize fatigue, subjects will be allowed rest periods and will be monitored by study staff at all times during the experiments. Confidential information will be kept in a locked filing cabinet in the laboratory.

Describe explicitly the methods for ensuring the safety of subjects. Provide objective criteria for removing a subject from the study, for example, objective criteria for worsening disease/lack of improvement and/or unacceptable adverse events. The inclusion of objective drop criteria is especially important in studies designed with placebo control groups.

Subjects will be screened prior to and during enrollment for the presence of medical conditions that may contraindicate their participation.

FORESEEABLE RISKS AND DISCOMFORTS

Provide a brief description of any foreseeable risks and discomforts to subjects. Include those related to drugs/devices/procedures being studied and/or administered/performed solely for research purposes. In addition, include psychosocial risks, and risks related to privacy and confidentiality. When applicable, describe risks to a developing fetus or nursing infant.

The DGO to be used in the study (i.e., the Lokomat system by Hocoma AG) has been demonstrated to be a secure device for pediatric gait training and is equipped with multiple safety tools. The risks of using the Lokomat include muscle soreness and fatigue, but no harmful adverse events have been reported with its use in a pediatric population.

Subjects with gait disabilities are at higher than normal risk for falls and injuries from daily activities. Some of the proposed testing procedures will assess the subject's performance of activities of daily living. In general, subjects will be at no greater risk for falls or injury than when walking in the home and community setting. Subjects will be under constant observation. Trained staff will be nearby to help in case of loss of balance.

For individuals with fragile skin, there is a risk of skin irritation from the adhesive tape that secures the reflective markers and EMG electrodes to the skin. The risk is equivalent to wearing a Band-Aid for a few hours and peeling it off. Alcohol cleansing, shaving, and light sanding needed prior to positioning sensors might also cause mild skin irritation. It is possible that mild bruising may occur from pressure of the sensors against the skin.

Subjects may become fatigued or uncomfortable during any visit. To minimize fatigue, subjects will be allowed rest periods and will be monitored and observed by study staff at all times during the experiments.

EXPECTED BENEFITS

Describe both the expected benefits to individual subjects participating in the research and the importance of the knowledge that may reasonably be expected to result from the study. Provide a brief, realistic summary of potential benefits to subjects, for example, "It is hoped that the treatment will result in a partial reduction in tumor size in at least 25% of the enrolled subjects." Indicate how the results of the study will benefit future patients with the disease/condition being studied and/or society, e.g., through increased knowledge of human physiology or behavior, improved safety, or technological advances.

It is possible that subjects may not benefit from participating in the study. It is possible that gaining a better understanding of the characteristics of muscle activation patterns will eventually lead to earlier diagnostic or the development of new rehabilitation protocols. Hence, the study might benefit patients in the future.

EQUITABLE SELECTION OF SUBJECTS

The risks and benefits of the research must be fairly distributed among the populations that stand to benefit from it. No group of persons, for example, men, women, pregnant women, children, and minorities, should be categorically excluded from the research without a good scientific or ethical reason to do so. Please provide the basis for concluding that the study population is representative of the population that stands to potentially benefit from this research.

No person will be excluded from participation in the study on the basis of gender, ethnicity or race.

When people who do not speak English are excluded from participation in the research, provide the scientific rationale for doing so. Individuals who do not speak English should not be denied participation in research simply because it is inconvenient to translate the consent form in different languages and to have an interpreter present.

Non-English speaking subjects will not be excluded from the study. Interpreter services will be obtained as necessary to facilitate the informed consent process and study participation.

For guidance, refer to the following Partners policy:

Obtaining and Documenting Informed Consent of Subjects who do not Speak English
http://healthcare.partners.org/phsirb/nonengco.htm

RECRUITMENT PROCEDURES

Explain in detail the specific methodology that will be used to recruit subjects. Specifically address how, when, where and by whom subjects will be identified and approached about participation. Include any specific recruitment methods used to enhance recruitment of women and minorities.

All subjects will be recruited by IRB approved study staff for this protocol. Assent will be obtained from subjects who are enrolled by proxy consent. Recruitment strategies will include the use of the following sources:

1. Attending physicians at Spaulding Rehabilitation Hospital may refer their CP patients to the study. We will provide physicians with study information sheets and flyers.
2. Study divulgation through the orthopedic service in the Boston Children's Hospital and Spaulding Rehabilitation Hospital.
3. Flyers posted in the outpatient specialist clinics, in pediatric and orthopedic clinics, therapy gyms and in public spaces inside and outside of the hospital.
4. Phone calls through volunteer registry.
5. Via contact with support groups and conferences.
6. Patients with CP who previously volunteered to be contacted about opportunities to participate in research studies at Spaulding Rehabilitation.
7. Contact with patients who received robot-assisted gait training as part of the clinical program at Spaulding Rehabilitation Hospital via referrals from physical therapists.
8. Via advertisement on clinicaltrials.partners.org and researchmatch.org websites.
9. Via letter to prospective subjects co-signed by their physician and study PI.
10. Via contact to the patients listed for direct contact in the Partners Research Patient Data Registry (RPDR).

Provide details of remuneration, when applicable. Even when subjects may derive medical benefit from participation, it is often the case that extra hospital visits, meals at the hospital, parking fees or other inconveniences will result in additional out-of-pocket expenses related to study participation. Investigators may wish to consider providing reimbursement for such expenses when funding is available

Subjects will be compensated based on the procedures undertaken. The compensation amount will be as follows:

- $35 for evaluation sessions
- $15 for intervention sessions

For guidance, refer to the following Partners policies:

Recruitment of Research Subjects
http://healthcare.partners.org/phsirb/recruit.htm

Guidelines for Advertisements for Recruiting Subjects
http://healthcare.partners.org/phsirb/advert.htm

Remuneration for Research Subjects
http://healthcare.partners.org/phsirb/remun.htm

CONSENT PROCEDURES

Explain in detail how, when, where, and by whom consent is obtained, and the timing of consent (i.e., how long subjects will be given to consider participation). For most studies involving more than minimal risk and all studies involving investigational drugs/devices, a licensed physician investigator must obtain informed consent. When subjects are to be enrolled from among the investigators' own patients, describe how the potential for coercion will be avoided.

Subjects who are interested and willing to participate in the study will undergo an initial phone screening to determine their eligibility. Subjects who qualify will be sent study information and will be scheduled to visit the lab and undergo a final screening in person. At the time of the scheduled test, the subject will be met by one of the study staff in the Motion Analysis Lab. Informed consent will be obtained by the investigators who have completed the Partners Healthcare System's human subject protection educational requirements (i.e. HIPAA), and the CITI Program in Protection of Human Subjects, in compliance with all Federal regulations regarding such training. Study staff will clearly explain to the subject the nature of the informed consent process, study purpose and procedures, time commitments, risks, potential benefits, treatment alternatives, rights as research participants, study staff contact information, confidentiality procedures, and arrangements for medical care provided in case of injury during the study. The subject and his/her parents/guardians will be given adequate time to consider their decision and encouraged to ask questions, both during the initial interview and throughout the study. A member of the study staff will answer any questions regarding the study at the time consent is given. Enrollment will begin when the parents/guardians thoroughly understand and signs the informed consent form, and the child thoroughly understands and signs the assent form. The subject and parents/guardians will be provided with a signed copy of the completed consent and assent form. The subject may pause or terminate his/her enrollment at any time during the study.

NOTE: When subjects are unable to give consent due to age (minors) or impaired decision-making capacity, complete the forms for Research Involving Children as Subjects of Research and/or Research Involving Individuals with Impaired Decision-making Capacity, available on the New Submissions page on the PHRC website:
http://healthcare.partners.org/phsirb/newapp.htm#Newapp

For guidance, refer to the following Partners policy:
Informed Consent of Research Subjects
http://healthcare.partners.org/phsirb/infcons.htm

DATA AND SAFETY MONITORING

Describe the plan for monitoring the data to ensure the safety of subjects. The plan should include a brief description of (1) the safety and/or efficacy data that will be reviewed; (2) the planned frequency of review; and (3) who will be responsible for this review and for determining whether the research should be altered or stopped. Include a brief description of any stopping rules for the study, when appropriate. Depending upon the risk, size and complexity of the study, the investigator, an expert group, an independent Data and Safety Monitoring Board (DSMB) or others might be assigned primary responsibility for this monitoring activity.

NOTE: Regardless of data and safety monitoring plans by the sponsor or others, the principal investigator is ultimately responsible for protecting the rights, safety, and welfare of subjects under his/her care.

Approval of protocol, informed consent procedures, and recruitment will be obtained from the IRB during annual reviews. Monthly data and procedural reviews by the PI in consultation with study staff will be done to identify and ameliorate any potential safety issues. Any safety concerns about the equipment or protocol will be brought to the immediate attention of Dr. Bonato. Study staff will conduct bimonthly audits to ensure compliance with regulatory standards for study documentation.

Describe the plan to be followed by the Principal Investigator/study staff for review of adverse events experienced by subjects under his/her care, and when applicable, for review of sponsor safety reports and DSMB reports. Describe the plan for reporting adverse events to the sponsor and the Partners' IRB and, when applicable, for submitting sponsor safety reports and DSMB reports to the Partners' IRBs. When the investigator is also the sponsor of the IND/IDE, include the plan for reporting of adverse events to the FDA and, when applicable, to investigators at other sites.

NOTE: In addition to the adverse event reporting requirements of the sponsor, the principal investigator must follow the Partners Human Research Committee guidelines for Adverse Event Reporting

Study staff will report any adverse event promptly to Dr. Bonato. A written report will be submitted to the IRB within 48 hours, and appropriate changes in procedure and protocol will be implemented to prevent reoccurrence. Remedial action to prevent reoccurrence of the event will be instituted prior to resumption of the study treatment.

MONITORING AND QUALITY ASSURANCE

Describe the plan to be followed by the principal investigator/study staff to monitor and assure the validity and integrity of the data and adherence to the IRB-approved protocol. Specify who will be responsible for monitoring, and the planned frequency of monitoring. For example, specify who will review the accuracy and completeness of case report form entries, source documents, and informed consent.

NOTE: Regardless of monitoring plans by the sponsor or others, the principal investigator is ultimately responsible for ensuring that the study is conducted at his/her investigative site in accordance with the IRB-approved protocol, and applicable regulations and requirements of the IRB.

The study coordinator will be responsible for monitoring the completeness of all data and source documents. The Principal Investigator will monitor the informed consent procedures in accordance with the Informed Consent Compliance Checklist of Partners HealthCare.

For guidance, refer to the following Partners policies:

Data and Safety Monitoring Plans and Quality Assurance
http://healthcare.partners.org/phsirb/datasafe.htm

Adverse Event Reporting Guidelines
http://healthcare.partners.org/phsirb/adverse_events.htm

PRIVACY AND CONFIDENTIALITY

Describe methods used to protect the privacy of subjects and maintain confidentiality of data collected. This typically includes such practices as substituting codes for names and/or medical record numbers; removing face sheets or other identifiers from completed surveys/questionnaires; proper disposal of printed computer data; limited access to study data; use of password-protected computer databases; training for research staff on the importance of confidentiality of data, and storing research records in a secure location.

NOTE: Additional measures, such as obtaining a Certificate of Confidentiality, should be considered and are strongly encouraged when the research involves the collection of sensitive data, such as sexual, criminal or illegal behaviors.

Patients will be assigned a study number, which will be used for all documentation except for a master list matching subjects names and study numbers, and forms for which subjects' names must be recorded (e.g. intake interview forms, copies of reimbursement receipts etc). The master list and interview forms will be kept in a secure location in locked offices. No non-study staff will have access to any identifiable patient study data or demographic information. All subjects' parents will be informed of their privacy rights and sign a HIPAA-compliant authorization form previously approved by the Spaulding IRB. Study staff in the Motion Analysis Laboratory will conduct quarterly audits to ensure compliance with regulatory standards for study documentation.

SENDING SPECIMENS/DATA TO RESEARCH COLLABORATORS OUTSIDE PARTNERS

Specimens or data collected by Partners investigators will be sent to research collaborators outside Partners, indicate to whom specimens/data will be sent, what information will be sent, and whether the specimens/data will contain identifiers that could be used by the outside collaborators to link the specimens/data to individual subjects.

No personally identifiable data will be sent to or viewed by collaborators outside of SRH.

Specifically address whether specimens/data will be stored at collaborating sites outside Partners for future use not described in the protocol. Include whether subjects can withdraw their specimens/data, and how they would do so. When appropriate, submit documentation of IRB approval from the recipient institution.

Data will not be stored for future use not described in the protocol.

RECEIVING SPECIMENS/DATA FROM RESEARCH COLLABORATORS OUTSIDE PARTNERS

When specimens or data collected by research collaborators outside Partners will be sent to Partners investigators, indicate from where the specimens/data will be obtained and whether the specimens/data will contain identifiers that could be used by Partners investigators to link the specimens/data to individual subjects. When appropriate, submit documentation of IRB approval and a copy of the IRB-approved consent form from the institution where the specimens/data were collected.

This study does not involve receiving data or specimens from outside collaborators.