

Humans, Horses, and Health

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Application for 2010 C. Peter Magrath

University-Community Engagement Award

North Central Region

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ABSTRACT

Humans, Horses, and Health (HHH) is an ongoing collaborative multi-disciplinary community research project. Our goal is to evaluate the effects of therapeutic riding (TR) on children, the horses they ride, and the instructors and volunteers who participate in the program. Our community partner, Children and Horses United in Movement (CHUM) Therapeutic Riding, Inc., shares our mission to document the effects of therapeutic riding so that individuals will benefit, health care providers will understand the therapeutic power of the horse, and insurance providers will regard therapeutic riding as a mainstream medical technique.

1. Significance

Our ongoing research partnership grew out of our collective desire to better understand the relationship between animals and humans, specifically the interaction between horses and humans. We first chose to examine the role of therapeutic riding (TR) on both the riders and the horses, with the notion that if therapeutic riding was good for the human but a detriment to the welfare of the horse, then industry-wide changes should be implemented to ensure the welfare of the horse. As the partnership progressed we decided to include a population of people rarely considered in TR research—those severely handicapped by cerebral palsy (CP), classified as Gross Motor Function IV and V (with I being the least and V being the most disabled). Parents informally report marked improvement in many aspects of their child's health and well being after TR. To impact the medical, health care, and insurance industries, however, these beneficial effects must be documented in well-designed and scientifically based studies. Our partnership allows us to provide scientific data to the medical, rehabilitation, and social service side of patient care, while at the same time developing information that can be used by the therapeutic riding community to improve programs and enhance the welfare of the horse.

Cerebral palsy (CP), the leading cause of physical disability in children, is a heterogeneous condition of movement and posture. CP is frequently accompanied by sensory, perceptual, cognitive, communicative, and behavior disturbances, seizures, and musculoskeletal issues. To preserve function, individuals with CP require lifelong ongoing therapy. Since normal growth and development require weight bearing and movement, without ongoing therapy children with CP will become increasingly disabled over time. CP influences every aspect of the child's life and predisposes these patients to other medical and psychological complications. For maximum benefit the child must receive early and continuous therapy, which should be both efficacious and enjoyable.

Riding a horse is an inherently therapeutic and enjoyable activity. Both physical and psychological health benefits are attributed to horse riding. Therapeutic riding, which is defined as all mounted activities including traditional riding disciplines and adaptive riding activities that are conducted by a North American

Riding for the Handicapped Association (NARHA) certified instructor, has been advocated as a unique form of therapeutic activity for individuals with CP. TR can be started in childhood and continued throughout the individual child's life. The three dimensional rhythmic movement of the horse provides a sensorimotor experience that improves balance, muscle tone, co-ordination, strength, range of motion, and equilibrium. The therapeutic riding environment can also provide a sense of belonging, social interaction, and family support, as well as enabling the rider to develop a relationship with the horse. **A lifelong therapeutic riding program could be an efficacious and enjoyable therapeutic activity for children with cerebral palsy.**

2. Relationship and Reciprocity

This project has proved that a partnership involving more than 10 major players, dozens of students and volunteers, severely handicapped riders and their families, and 13 horses can function in a productive, collegial, and fun way. There are several keys to our success: our overriding belief that understanding the power of human-animal interactions is an important and good thing; a deep respect for each individual involved in the program, no matter what their role; a belief that the welfare of the horse should not be compromised by a therapeutic riding program; and an understanding that all opinions and ideas are equally valued. Each key player has an area of expertise and a specific role, yet no one is above leading a horse, acting as a side walker, or picking up manure.

What brought the university and community partners together?

Almost a decade ago we were asked by the board of directors of a TR riding facility in western Michigan to develop a research program. However, after funding was received a huge snowfall caused much of the facility to collapse and the TR program was curtailed. Consequently, we had funds but no place to utilize them. Serendipity intervened—an article in the local paper described a TR program in our backyard. Furthermore, the president and certified TR instructor was a woman who had gone back to school to obtain an occupational therapy degree so that she could take a scientific approach to TR. It seemed perfect, so we (Lana Kaiser, MD, DVM and Camie Heleski, PhD) met with Bonnie DePue, a registered occupational therapist (OTR), and the partnership between CHUM, TR, and MSU was born.

As time went by the small group grew into a consortium of individuals with a wide variety of expertise and interests, working toward the common goal of better understanding the interactions of humans and horses. CHUM staff and volunteers as well as students from MSU, Calvin College, Baker College, and Lansing Community College have participated in our projects.

Who are the key players?

Lana Kaiser, a physician, veterinarian, and basic science researcher, is a professor in the College of Human Medicine and the “conductor of the orchestra.” She has a longstanding interest in human-animal interaction and the promotion of health and welfare of both humans and animals. **Camie Heleski** is an instructor in Animal Science and coordinator of the MSU horse management program. She received her doctorate in animal welfare, with the goal of scientifically studying equine behavior and welfare as well the development of assessment tools and statistical analyses. **Bonnie DePue**, a licensed and practicing occupational therapist with a 25-year history as a NARHA certified TR instructor, is the president of CHUM. The mission of CHUM, a nonprofit TR program that operates almost entirely on donations and volunteers, includes evaluating and documenting the effects of TR. **Kate Smith** is a practicing registered nurse with a background in psychology. She has been involved in the TR projects since the beginning and has expertise in project management, interview techniques, and data analysis. All of these individuals have a 10-year history of successful collaboration on multiple projects.

Sherman Gorbis is an osteopathic physician and associate professor in the College of Osteopathic Medicine with an interest in the effect of therapeutic riding on muscle symmetry and function. His interest is fueled by a personal involvement through his son who has CP and is involved in TR. **Hilary Clayton**, a veterinarian and researcher, is the Mary Anne McPhail Endowed Chair and director of the McPhail Equine Performance Center in the College of Veterinary Medicine. Her expertise is in movement of the horse and she runs a very active research laboratory examining all aspects of equine and rider performance. **LeeAnn Kaiser**, MS, is a biomechanist and the manager of the McPhail Equine Performance Center. Her expertise is in measuring and analyzing pressure on the horse’s back while the horse is being ridden. Prior to joining

Humans, Horses, and Health (HHH), Dr. Clayton and Ms. Kaiser collaborated in projects with Dr. Kaiser, Dr. Heleski, and Ms. DePue. **Karen Waite**, MS, is the MSU Extension equine specialist and coordinator of the Michigan 4-H Proud Equestrians Program (PEP) for riders with special needs. She is a doctoral candidate in sports psychology and has collaborated with Drs Heleski and Kaiser on a number of projects and mentoring graduate students. **Beth Macauley**, a faculty member at Calvin College in Grand Rapids, has a doctorate in speech-language pathology and neuropsychology. She has a longstanding interest in TR and its effect on speech and lung function and had collaborated on research projects with Ms. DePue before joining HHH. Recent additions to the group include **Millie Horodynski**, PhD, RN, a professor in the College of Nursing with expertise in community projects, theoretical frameworks, and analysis of interview data. She and Dr. Kaiser have collaborated for the past decade. **Joanne Crain** is dean and program director of the Master of Occupational Therapy degree program at Baker College in Flint, Michigan. Dr. Crain has expertise in occupational therapy evaluation and assessment of disabilities.

In addition to the people described above, HHH could not work without countless hours contributed by other individuals—the CHUM volunteers and the high school, college, and professional students involved in various research projects, the program participants and their parents, and the horses. In most instances faculty members and community partners have donated not only their time, but also their mileage and supplies, because they believe in the value of the studies.

What is the role of each partner?

The role each person plays in the HHH project is determined by their individual expertise, but decisions regarding research design, analysis, assessment tools, and publications are made by ongoing and constant interaction via e-mail, cell phone and texting. Dr. Kaiser coordinates the research program and communicates frequently with Bonnie DePue. DePue coordinates the riders, horses, and volunteers. Since most of our current riders require a wheel chair for mobility, the project requires a significant effort and commitment on the part of parents and family to assure that riders are present for each phase of the study. Each study also involves coordination of riders, volunteers, researchers, and horses.

What did the study accomplish?

There are 2 parts to the study. The first part evaluates the effect of TR on horse, rider, and assisting persons using different adaptive devices that enable individuals with CP to ride. The second part is studying the effect of TR on muscle function, the ability to perform activities of daily living over time.

Each study involves both an osteopathic musculoskeletal assessment by Dr. Gorbis and a respiratory and speech evaluation by Dr. Macauley. These tests are performed before and after riding. In some studies, activities of daily living are monitored over time by Ms. DePue and occupational therapy students. The stress and conflict behaviors of the horses are assessed in real time and videotaped by Dr. Heleski and MSU students. Dr. Heleski is also responsible for assessment of the exertion of the assisting persons. Dr. Clayton and Ms. Kaiser evaluate the pressure of the adaptive devices on the horse's back as well as assessing the center of pressure of the rider (which is an indicator of core strength) using the Pliance saddle pad. This is a high-tech pressure sensing device that measures pressure distribution over the horse's back in real time and allows detection of high pressure areas that would be uncomfortable for the horse. See Appendix for photos of riders using the adaptive devices as well as preliminary data results from pilot testing.

3. Impacts

3.1. Impact on Community Partners

The mission of CHUM includes research to document the effects of TR on riders, horses and assisting persons. CHUM not only relishes the opportunity to be involved in research programs, but also provides with an open mind insight into other potential areas of exploration.

In turn, several students involved in the project have become volunteers at CHUM and several of the volunteers were integral players in the project. Involvement of high school and college volunteers and staff to community-based research has the added benefit of exposing students to critical thinking and research design, as well as giving them an opportunity to work with dedicated professionals in a variety of fields.

It is estimated that two of every 1,000 live births results in a child with CP and that approximately 10,000 infants annually will develop cerebral palsy. Nearly 800,000 children and adults in the United States

are living with one or more of the symptoms of cerebral palsy. Despite advances in preventing and treating some causes of cerebral palsy, the percentage of infants who develop the condition has remained the same over the past 30 years. The average per person lifetime cost for each individual with CP is \$921,000; when both indirect and direct costs are considered, the lifetime cost rises to \$11.5 billion. Lifelong therapy that is enjoyable, not onerous, and that can maintain or improve function of individuals with CP can both decrease medical costs and enhance the individual's function. For TR to be considered a valid therapy and for insurance to cover the cost there must be scientific documentation of the benefit. Thus documenting the benefits of TR for individuals with cerebral palsy could impact health care, rehabilitation, social services, and education in a variety of ways.

Funding

We have received two different research grants of \$25,000, one from the American Veterinary Medical Foundation (AVMF) and the second an intramural grant from Families and Communities Together (FACT) of MSU. We have also received several smaller grants and donations from NARHA Region 4, the Department of Animal Science, the McPhail Equine Performance Center, and FACT. Most of this money is spent on scholarships for participants and payment for students involved in the project. In the fall of 2009 we responded to a specific NIH call for research into human-animal interactions. If this award is received we will be able to expand our study to include 40 riders with CP over a period of at least two years.

3.2. Impact on University Partners

Our goal is to widely disseminate the result of our studies through peer-reviewed publications as well as regional, national and international presentations. The broad scope of these studies results in a wide potential audience, including those who work in health care and rehabilitation, human and veterinary medicine, animal welfare, the therapeutic riding industry, 4H riding programs, and the insurance industry.

To date we have published two peer-reviewed manuscripts (see Appendix for abstracts); we have a third in press and a fourth in progress. We have presented our work at international scientific and industry conferences and at numerous local, state, regional, and national meetings.

We involve the parents in the research, explaining what we are doing and why, and encouraging them to ask practical questions that we might be able to address. No one understands the challenges and joys of living with a severely handicapped child better than the parents and family, and they have provided us with insight into additional areas to investigate.

3.3. Impact on Engagement Scholarship

Cerebral palsy is the leading cause of physical disability in children. For maximum physical and psychological benefit the child must receive early and continuous therapy. This therapy should be both efficacious and enjoyable. Therapeutic riding has been advocated as a unique therapeutic activity for children with cerebral palsy. It can be started in childhood and continued throughout life. Because of the diverse nature of cerebral palsy, individuals have various abilities and needs, requiring different adaptations to safely ride. Some children with cerebral palsy can ride in a traditional hunt seat saddle, while many of the more severely impaired children require extensive physical support, either in the form of a back rider or a special saddle, for example, the Independence Saddle. While these adaptive devices are routinely used in therapeutic riding programs throughout the country, their impact on the rider, the horse, and the assisting persons have not been evaluated. The goal of therapeutic riding is to provide the maximum benefit to the rider (and family) with minimal negative impact on the horse and the assisting persons.

To be accepted into the mainstream of health care, medicine, therapy, and education, the therapeutic value of therapeutic riding must be examined scientifically and critically. **The purpose of this project is to compare the effects of different adaptive therapeutic riding approaches for individuals with cerebral palsy and the horses they ride.** We will evaluate muscle function, center of pressure, and respiratory function in children with cerebral palsy before and after riding with each adaptive device. We will also evaluate equine stress and the pressure on the horse's back with each adaptive device. Furthermore, we will assess the effectiveness of a two-year therapeutic riding program on muscle function, balance, center of pressure, and respiratory function in children with cerebral palsy, and the impact of this condition on their family. **Therapeutic riding, an activity that can be started at a young age and practiced throughout**

life, has the added benefit of being enjoyable, rather than onerous. Documentation of the benefits of therapeutic riding for children with cerebral palsy will increase acceptance of this novel therapeutic activity.

4. Lessons Learned and Best Practices

HHH is conceptually simple yet remarkably complex in design. We had the notion that we could simultaneously evaluate the effects of TR on rider, horse, and assisting persons—and we can, but it is not easy. To be successful we rely on the willing cooperation of many people, each of whom plays a different, but equally important, role. For example, for one individual with CP classified as GM-V to ride requires one horse; one adaptive device (saddle etc); one person to lead the horse (leader); and two side walkers (assisting persons who provide lateral stability for the rider as needed). Thus, each rider may require three additional assisting persons. This does not include the instructor, the people who prepare the horses, the researchers, the parents, or other family members.

We learned several things from the preliminary HHH studies. We can do all parts of the study, but we need to accept that although they all will not be perfect, the information will be useful. We learned patience and the ability to make changes “on our feet” based on the needs of the rider.

For example, one lesson the researchers learned was the result of a broken wire on the Pliance pressure sensor, a piece of equipment is made in Germany. At the time all the riders and their families, all the volunteers, all the project participants, and all the horses were at CHUM ready for the study. After the first rider finished her ride, the wire broke. Unlike the way it often goes at the university, where everyone is in a hurry, multi-tasking, and annoyed when things don’t go according to plan, everyone involved took the issue in stride. It was a lesson in what is really important that individuals with CP and their families shared with the researchers.

5. Future and Endorsements

5.1. Future Outreach and Engagement

The future of our collaboration is ensured—what is not clear is the magnitude of the interaction. If we receive our NIH grant we can grow and expand our HHH program, both in number of riders and duration of study. If we do not receive this grant we will continue the program on a smaller scale while seeking other funding.

5.2. Use of Award Dollars

Results from this project will have wide application and will potentially impact not only the therapeutic riding industry, but also health care and rehabilitation. If we can demonstrate that severely handicapped individuals benefit physically and psychologically by riding a horse in a therapeutic atmosphere we will open the door to a lifelong enjoyable, novel and efficacious therapeutic activity. For physicians to prescribe TR for patients and insurance to reimburse the cost of the therapy we must demonstrate scientifically that it works. We also must demonstrate that the welfare of our partners—the horses and the volunteers—is not compromised by TR. Adaptive devices that enable individuals with CP to ride independently, provide respite for volunteers, and do not adversely influence the horse can become mainstream in the TR industry. Our preliminary data suggests that the Independence Saddle, back riding and the hunt seat saddle can be safely and humanely used—the choice of adaptive device should balance which provides the most benefit for all involved.

CHUM Therapeutic Riding, Inc is a not-for-profit organization that operates totally on donations and volunteers. Thus it seems logical that half of the award, if received, should go directly to CHUM and the other half will be used to support the ongoing research project.

MICHIGAN STATE
UNIVERSITY

March 15, 2010

Selection Committee
C. Peter Magrath/W.K. Kellogg Foundation Engagement Award
Association of Public and Land-Grant Universities
1307 New York Avenue, NW, Suite 400
Washington, DC 20005

Dear Selection Committee:

For more than 150 years, Michigan State University has been a transformational force in the lives of our students, faculty, community, and world. We provide academic innovation, research and discovery. MSU leads discussions on significant intellectual issues, and focuses priorities based on societal needs. Our core values are quality, inclusiveness, and connectivity.

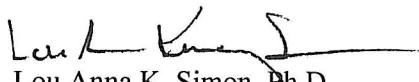
The engagement efforts by our faculty and students include a vast array of projects that demonstrate our university's commitment to collaborative, participatory, empowering, systemic, and transformative work anchored in scholarship. One particular effort is *Humans, Horses, and Health*, led by Dr. Lana Kaiser, Professor Emeritus in the Department of Medicine, and College of Human Medicine.

This project involves working with cerebral palsy patients through therapeutic options on horseback, to maximize physical and psychological benefits. The gentle methods utilized to ensure patient well-being, as well as animal health, while conducting scientific research necessitated broad participation and cooperation with a number of partners and collaborators. This project is an exemplary model of engaged scholarship by our faculty and staff.

It is an honor to endorse this application to represent Michigan State University in the North Central Region for the 2010 W.K. Kellogg Foundation Engagement Award, and C. Peter Magrath University Community Engagement Award. I invite you to review the significance and impact of Dr. Kaiser's work, and her partners' work, with *Horses, Humans, and Health*.

Thank you for your consideration.

Sincerely,


Lou Anna K. Simon, Ph.D.
President

C: Dr. Hiram Fitzgerald
Dr. Lana Kaiser



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March 3, 2010

Selection Committee
C. Peter Magrath/W.K Kellogg Foundation Engagement Award
NASULGC
1307 New York Avenue, NW, Suite 400
Washington, DC 20005

Dear Selection Committee,

We are honored to write this letter on behalf of Michigan State University's *Humans, Horses, and Health* (HHH) collaborative project here at CHUM Therapeutic Riding. In accordance with our mission, CHUM has been steadfastly involved with different colleges within the university for the past 10 years, assessing the impact of equine assisted activities and therapies from the viewpoint of multiple disciplines, such as human medicine and veterinary medicine. These projects were all pilot studies, a history that brought us to the HHH project. The HHH project is making history in our industry. These separate pilot studies, each unique in the scope of research that has traditionally been done in therapeutic riding, have created a very unique and strong foundation between the 'community of CHUM' and the communities of colleges, universities, and professions involved in HHH.

The 'community of CHUM' is how we refer to our program; its riders, volunteers, staff and their respective families, our community families comprised of friends, supporters, referring organizations and professionals from a wide variety of services and occupations. All share our mission. How appropriate then that the ongoing partnership we have been involved in over the past 10 years should be recognized in this much expanded and as yet not done in our industry, multidisciplinary research.

HHH defines the epitome of community involvement with all parts not recruited but eagerly seeking to be a part of this ground breaking opportunity. It serves the community of CHUM well to be adding other agencies to not only serve CHUM but be served by CHUM's community. This is not one college but a community of colleges and even universities that have come together for a common goal, who sincerely support each other's roles and missions for the good of the program and thus the industry of therapeutic riding.

This project, we hope to be just the beginning here at CHUM, is all about the bigger picture. From the vantage point of the program, the industry, the multiple disciplines who are touched by the services of this industry, but most importantly for the many families and individuals who are positively impacted here daily and what this program means to them. Through their eyes, this program and others like it are life changing for all of the family. The response to this form of

activity is seen well beyond the participants (rider/volunteer/staff) but is reflected in the families of each of those entities. Parents are amazed at the changes in maturity, sincerity, and compassionate response to community of their high school or college volunteer or staff member. Families are impacted on a quality of life level by the response to riding that their family member with a disability brings to the daily life of the family as a whole. The community of families here; with and without disabilities comes together in support, laughter, celebration of life and victories from each participant. Each person holds so much respect and love for the others in their CHUM community and those who participate with us in serving others. The kids feel empowered to be a part of this important research. The parents want so much to bring knowledge of the benefits to other families who struggle in many of the same ways. We as professionals in this field, whose passion for our riders drives us to want so much for the rest of the world to 'get it' are equally embracing this partnership from the academic communities.

Through this project and for the first time several components necessary to the idea of 'quality, safe, and fun programming for all' is being scientifically measured. We were very excited to have Michigan State University recognize the importance of this in our initial pilot data. It is not enough to have anecdotal statements of quality but measurable characteristics of quality and safety for both the human and the horse must be determined to credibly represent this industry.

Combining the world of horses with its inherent risks and the lives of individuals with disabilities has over the years generated research and testimonies to the observed benefits to riders from the viewpoint of families, educators, and medical professionals. Most of this data has not been from the individuals who are considered by diagnostic evaluation to be more complex in their disabilities, or specifically with those who have cerebral palsy of a classification of 4 or 5 on a 1 to 5 scale. We need to know if we are indeed aiding in better health, improving quality of life psychologically, improving their daily living skills, etc.

In doing so and because of the intensity of involvement of the diagnosis, we need to know we are not reaping benefits at the expense of our horses with this group of riders. Since professionals in this industry rely on observation for so much of their decision making, and occasionally upon parameters that may or may not have any basis to them, more information needs to be gathered to help them make the soundest decisions for the good of all involved. In choosing the horse or the adaptive equipment used to assist the rider with a classification of 3 and higher cerebral palsy, decisions based on real data can make the difference between real improvement or real risk.

CHUM Therapeutic Riding is pleased to endorse this collaborative engagement with HHH and Michigan State University and the others within the surrounding communities who have come together to meet this need. This will benefit not one child but many, not just locally but as far reaching as international therapeutic riding programs as shown by our presentation of pilot data at this past year's international congress of 39 countries. The value is far reaching, the passion is heartfelt, and the determination is that of a community reaching for a common goal. I strongly encourage you to consider this application and all it represents for this award and would urge you to contact me if further information is required.

Sincerely,

Bonnie L DePue, OTR/L
Bonnie DePue, OTR/L, President
CHUM Therapeutic Riding Inc

Humans, Horses, and Health
Magrath/Kellogg Award Application

Appendix: A. Adaptive Devices

Hunt Seat Saddle



Figure 1. Child with cerebral palsy riding in a hunt seat saddle. The horse is being led (assisting person on the right of the picture). Two side walkers provide support to the rider as needed. The side walker on the far side is not visible in this picture. Note that the child is wearing a helmet.



Figure 2. Same child as in Figure 1, from the other (left) side of the horse. The horse is being led. Two side walkers provide support to the rider as needed. The side walker on the far side is not visible in this picture.

Back Riding



Figure 3. Child being back ridden by trained individual. The horse is being led by the child. Note that both the child and the back rider are wearing helmets.

Independence Saddle



Figure 4. Independence Saddle. Note the back support, handgrips and neck support. All supports can be adjusted to provide optimum support for the rider.

Independence Saddle



Figure 5. Child with cerebral palsy riding in the Independence Saddle. Note the child is wearing a helmet, the horse is being led and two side walkers are present to provide support.



Figure 6. Rider with cerebral palsy competing in a 4H youth horse show event. The Independence Saddle allows this rider to ride with his peers. Although the rider is holding the reins, a leader is present to guide the horse. Side walkers on either side of the horse provide support to the rider as needed. Note the rider is wearing a helmet.

Pliance Saddle Pad



Figure 7



Figure 8

Pliance saddle pad placed on the back of the horse before (Figure 7) and after (Figure 8) placement of the hunt seat saddle.

Appendix: B. Preliminary Data Report

Child

Osteopathic musculoskeletal examination (OME). This examination evaluates symmetry/asymmetry, range of motion restriction, texture of the skin, and tone of the skeletal muscles in various regions of the spine, pelvis and rib cage. Positive changes in physical findings are believed to correlate with improved function. For example, better symmetry is indicative of a more functional occipital/allanto joint. The specific goal here is to compare the 3 adaptive devices (hunt seat saddle, back-riding, and the Independence saddle) on the rider's musculoskeletal function. Five riders (GMF V) rode with all 3 adaptive devices. The time and pattern for all rides was the same. The OME is performed before and immediately after riding.

- **Hunt seat saddle.** Three riders were unable to complete the ride due to exhaustion (side walker exertion was maximum for these riders). All riders showed improvement, primarily in the occipital and thoracic areas. Four riders showed worsening after riding in the hunt seat saddle, primarily in the hamstring and gleno-humeral joint. These data suggest that the hunt seat saddle may lead to improvement in some core areas; however, some severely disabled individuals may not be able to utilize this adaptive device. Furthermore, side walker exertion is maximal.
- **Back riding.** All 5 riders showed improvement; none showed worsening with this adaptation. Improvement varied with the rider but was primarily seen in the areas of the occipital/atlando joint, cervical and thoracic spine and ribs. These data suggest that back riding may lead to improvement in individuals with various types of musculoskeletal abnormalities without any adverse effects. While side walker exertion with back riding may be negligible, back rider exertion can be significant. Furthermore, this adaptation is not appropriate for full-sized adults and might cause increased pressure on the horse's back.
- **Independence saddle.** All 5 riders showed improvements in some body areas; however, one rider was unable to complete the ride due to exhaustion and 4 showed worsening of some measurements. There was no specific pattern to either the improvement or lack of improvement for the OME. Side walker exertion was intermediate.

Interestingly, the most severely affected individual showed improvement with all 3 adaptive devices and did not show worsening with any adaptation. When improvement is noted with all available devices, and there is no obvious adverse effect of any device, consideration for the horse and assisting persons can play a larger role in the choice of adaptive equipment.

Center of pressure. A major problem for individuals severely affected by CP is lack of core strength, which results in poor balance and the inability to sit straight or right oneself. The Pliance saddle pad was used to assess range of motion of the rider's center of pressure (COP). COP range of motion and COP velocity in the anteroposterior and mediolateral directions can be used as a measure of core stability and balance.

This preliminary study evaluated the usefulness of the Pliance saddle pad to measure COP in riders with severe handicaps. Four riders with CP and 4 able-bodied riders rode in the hunt seat saddle. All riders in a specific pattern for 5 minutes and all riders had previous riding experience.

Results suggest that measurement of COP over time in the same rider can provide insight into the ability of a therapeutic riding program to improve core strength and balance of the rider. Improved core strength and balance would be expected to improve an individual's ability to perform activities of daily living. The ability to measure COP in individuals with CP over time will enable us to quantitatively assess improvement in core strength.

Spirometry data – respiratory measurements. Respiratory measurements were made before and immediately after riding in the hunt seat saddle, back riding, or the Independence saddle. Respiratory measurements (Forced Expiratory Volume in 1 sec [FEV1], Forced Vital Capacity [FVC], and Peak Expiratory Flow [PEP]) and speech data were obtained. Data were obtained from 7 children with CP from different GMF classifications and compared via ANOVA for single factor analyses across the three saddles.

Results indicate that the two respiratory measurements that depended on voluntary motor control, FEV1 and PEF, differed significantly while the respiratory measurement of lung volume did not differ significantly. It also appears that the back riding was the variable that affected the most positive change. The respiratory and speech data both reveal that back riding appears to be the best medium for improvement of muscle control for breathing and speech when compared to a hunt seat saddle and Independence saddle.

Horse

Pliance Saddle Pad – Assessment of saddle pressure. Four riders with CP and 4 able-bodied riders rode in both the Independence Saddle and a hunt seat saddle. The Pliance Saddle pad was used to measure pressure on the horse created by the saddle and the rider.

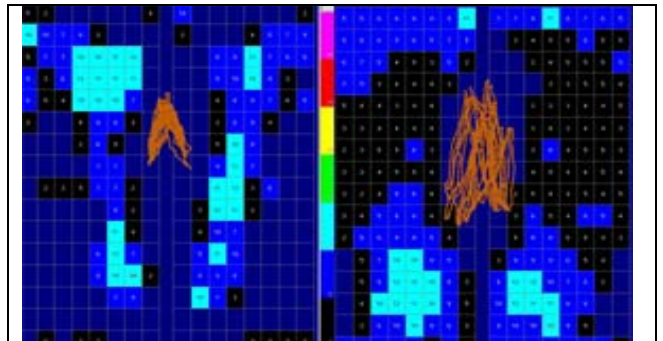


Figure 1 shows the COP from an individual with CP in the hunt seat saddle (left panel) and Independence saddle (right panel). The COP shows movement with every stride of the horse. Note that the design of the Independence saddle creates much more AP movement for both riders with CP (shown right) and those who are able-bodied (not shown).

Pressure was relatively evenly distributed on both sides (left and right) of both the Independence Saddle and hunt seat saddle. Because of its size, the Independence Saddle takes up much more of the Pliance Saddle pad than the hunt seat saddle. These pilot studies suggested that in order to accurately measure the saddle pressure on the horse's back we need to use the larger (Western style) Pliance saddle pad.

Equine behavior. The welfare of the horse in a therapeutic setting is a primary concern. One way to assess equine stress is to observe and record behavior during different situations using an ethogram (Kaiser et al 2006a). We have developed an equine ethogram for stress behaviors that will be utilized for this study (see Appendix: C. Horse Stress Ethogram). An ethogram is a list of behaviors with precise definitions that are grouped by context, in this case the behaviors that indicate stress or frustration (conflict behaviors). Conflict behaviors indicating stress and/or frustration in the horse include head toss, head shake, head raise, ears pinned, tail swish, side bite threat, foot shift, and yawn.

The entire riding session is videotaped and behaviors are recorded at predetermined duration and frequency (1 minute recording every 5 minutes). Unlike recreational riders, mounting and dismounting for children with CP may cause additional stress on the horse, consequently 3 time periods are evaluated: mounting, riding, and dismounting. Total conflict/stress/ frustration behaviors were tabulated for 10 riders with CP using the 3 adaptive devices (hunt seat saddle, back riding, and the Independence saddle). All riders used all 3 devices.

We noted from the behavior studies that horses exhibited stress and frustration behaviors during mounting and when stopped for readjustment of equipment or rider. We had not originally planned to include non-movement activities in the behavioral assessment, however since we observed conflict behaviors during mounting, stopping, and dismounting we will include this time in the study.

The preliminary data show fewer conflict behaviors when riders with CP use the Independence saddle than either of the other adaptive devices. This suggests that the inability of individuals with CP to maintain balance in the hunt seat saddle could result in more stress and frustration in the horse during riding. In addition, the horses ridden with the Independence saddle appear to exhibit fewer conflict behaviors, suggesting that this saddle may provide respite for side walkers without undue stress on the horse. Modifications of riding schedules and use of adaptive equipment could ensure that horses do not become unduly stressed or frustrated and are given an opportunity for "down time" or recreational riding.

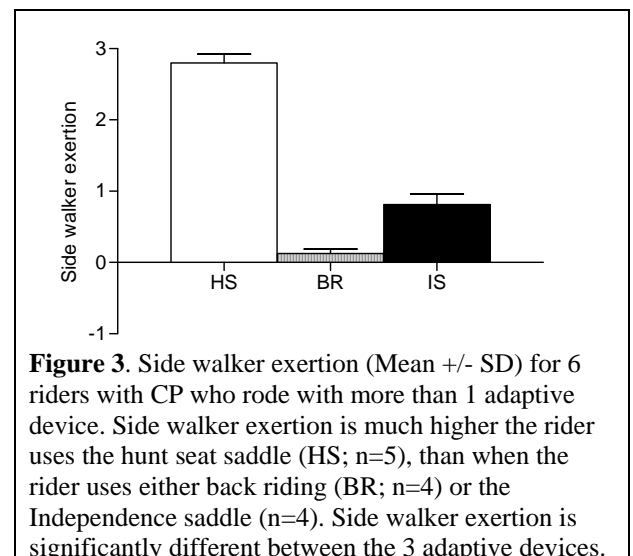
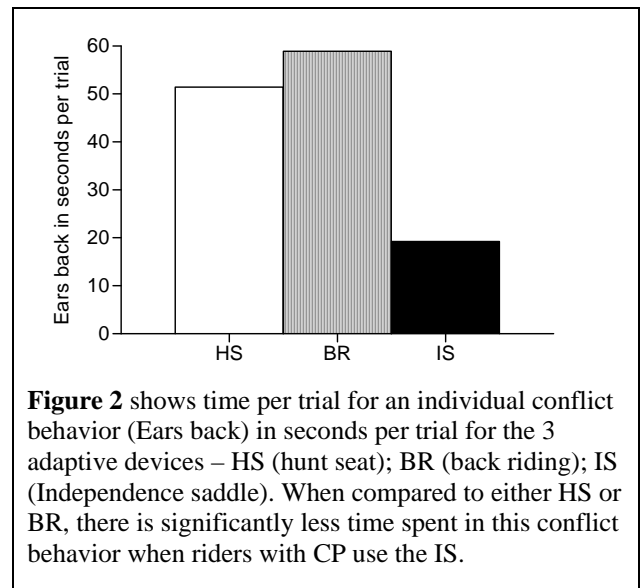
Assisting Persons

Side-walker exertion. Therapeutic riding for individuals with significant handicaps can require a great deal of physical effort on the part of the volunteers, especially the side walkers who provide physical support to the rider. Often the volunteers are parents, or guardians of the individual with CP; thus TR may provide benefits for the child but little respite for the parent. Adaptive devices that not only improve the quality of the ride for the rider, but also enhance the experience for the volunteers, could be very important.

For this pilot study, 8 riders with CP and 3 recreational riders without disability were evaluated. Side walker exertion was rated on a scale of 0 to 3, with 0 representing no assistance given to the rider and 3 representing a high level of assistance. Side walker exertion was assessed for 30 seconds every 5 minutes and exertion for both side walkers for the ride was averaged. Recreational riders rode both in the hunt seat and Independence saddle and required no side walker assistance. For riders with CP, side walker exertion was compared between the hunt seat saddle (HS), back riding (BR), and the Independence saddle (IS).

These preliminary studies suggest that the adaptive devices used for therapeutic riding are not a welfare concern because they do not cause undue stress or irritation to the horse. However, the Independence saddle may cause increased pressure at the withers.

Understanding the effect of the adaptive devices on the rider, horse, and assisting persons, will allow therapeutic riding programs to balance the needs of the rider, horse and the assisting persons.



Appendix: C. Horse Stress Ethogram

Ethogram of stress/frustration/conflict behaviors observed in horses while being ridden in a therapeutic riding program (modified from ethogram in Kaiser et al., 2006, *JAVMA*, 228(21), p. 45, and ethogram in Heleski et al., 2009, *Vet J*, 181, Table 1, pp. 60-62).

<i>Behavior</i>	<i>Description</i>
Head toss	Horse moves head quickly out of “neutral” position (i.e. where it is positioned the majority of the ride); oscillation; will contain some movement in medial-lateral plane
Head raised	Head held higher than the normal carriage with nose extended upward and with slight extension of the neck
Head down	Head held lower than the normal carriage, neck may be stretched out with nose pushed forward
Head shake/head toss	Movement in vertical plane dorsally or ventrally; might be only nose
Head turn	Lateral cervical flexion not in line with rest of horse’s body; horse may appear to be making a threat display toward one of handlers
Head tilt	Nasal midline not perpendicular to ground; deviation of angle of nasal midline to left or right
Ears pinned back	Ears pressed caudally against the poll area of the neck
Tail lash/tail swish	Dorsa-ventral movement of caudal vertebrae; movement of tail beyond that of simple rhythmic swaying of the tail; and/or circular (or medial-lateral) movement of caudal vertebrae

Note: Other behaviors representing stress/frustration/conflict such as frequent defecation, baring of teeth, kicking, striking, rearing or bucking were never observed in this population of horses. We did not record chomping of the bit because most horses were not ridden with bits.

Appendix: D. Exploring the Bond (abstracts of journal articles)

Stress-related behaviors among horses used in a therapeutic riding program

Lana Kaiser, MD, DVM; Camie R. Heleski, PhD; Janice Siegford, PhD; Katharine Ann Smith, BSN

Objective—To determine whether therapeutic riding resulted in higher levels of stress or frustration for horses than did recreational riding and whether therapeutic riding with at-risk individuals was more stressful for the horses than was therapeutic riding with individuals with physical or emotional handicaps.

Design—Observational study.

Animals—14 horses in a therapeutic riding program.

Procedure—An ethogram of equine behaviors was created, and horses were observed while ridden by 5 groups of riders (recreational riders, physically handicapped riders, psychologically handicapped riders, at-risk children, and special education children). Number of stress-related behaviors (ears pinned back, head raised, head turned, head tossed, head shaken, head down, and defecation) was compared among groups.

Results—No significant differences in mean number of stress-related behaviors were found when horses were ridden by recreational riders, physically handicapped riders, psychologically handicapped riders, or special education children. However, mean number of stress-related behaviors was significantly higher when horses were ridden by the at-risk children.

Conclusions and Clinical Relevance—Results suggest that for horses in a therapeutic riding program, being ridden by physically or psychologically handicapped individuals is no more stressful for the horses than is being ridden in the same setting by recreational riders. However, at-risk children caused more stress to the horses, suggesting that the time horses are ridden by at-risk children should be limited both daily and weekly.

J Am Vet Med Assoc 2006; 228:39–45

Effects of a therapeutic riding program on at-risk and special education children

Lana Kaiser, MD, DVM; Katharine Ann Smith, BSN; Camie R. Heleski, PhD; Linda J. Spence, PhD, RN

Objective—To determine the effects of a therapeutic riding program on psychosocial measurements among children considered at risk for poor performance or failure in school or life and among children in special education programs.

Design—Observational study.

Population—17 at-risk children (6 boys and 11 girls) and 14 special education children (7 boys and 7 girls).

Procedure—For the at-risk children, anger, anxiety, perceived self-competence, and physical coordination were assessed. For the special education children, anger and cheerfulness were measured, and the children's and their mothers' perceptions of the children's behavior were assessed. Measurements were made before and after an 8-session therapeutic riding program.

Results—For boys enrolled in the special education program, anger was significantly decreased after completion of the riding program. The boys' mothers also perceived significant improvements in their children's behavior after completion of the program.

Conclusions and Clinical Relevance—Results suggest that an 8-session therapeutic riding program can significantly decrease anger in adolescent boys in a special education program and positively affect their mothers' perception of the boys' behavior.

J Am Vet Med Assoc 2006;228:46–52