MASSAGE THERAPY FOUNDATION

Massage Therapy Foundation Ergonomics Project: Phase One Report

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Finally, our deep appreciation goes to all Massage Therapy Foundation donors, sponsors, and volunteers. **Your ongoing support enables the Foundation to continue serving the highest needs of the profession through scientific research, education, and community service initiatives that make a difference in the lives of others.**

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1. INTRODUCTION

Most massage therapists agree their work is satisfying, fulfilling, and meaningful. Yet over time, this moderately intense physical labor can take a toll on their bodies. Many professionals working in the field have short-lived careers, often because of injury. For example, consider a December 2017 article in the *Journal of Interdisciplinary Health Sciences* titled, “The Prevalence of Osteoarthritic Symptoms of the Hands Amongst Female Massage Therapists.” The article reported that more than half of the total sample of 133 people experienced the pain and stiffness associated with arthritis. “It also seemed evident that the symptoms experienced were also responsible for placing strain on their ability to perform daily tasks.”[1] Aches and pains often kicked in around age 43.

The Massage Therapy Foundation (MTF) wants to bring about positive change in the health and well-being of practitioners. With that idea front and center, this report addresses the specific challenges that regular massage therapy work involves through the lens of ergonomics. It recommends controls to improve massage therapists’ career longevity by supporting musculoskeletal health, safety, and overall wellness.

To obtain optimal results with significance to a wide range of therapists, MTF selected a vendor at the top of its game, Briotix Health. Based in the US, they are highly experienced in providing specialized solutions for ergonomic health across a variety of workplaces. Briotix Health serves Fortune 500 clients in more than 60 countries. They provide consultations and solutions — including ergonomic assessments — that help in the prevention and reduction of workplace injuries. Their main mission is to enhance the well-being of individuals whose work requires continuous physical effort, repetitive movements, and/or other physical strains.

An understanding of “ergonomics” is a good starting point. Simply put, it is the science and art of designing or arranging workflow processes, workplace environments, and operational work systems so that they are safe and optimally fit the people who use them. When a work area or process is ergonomically healthy, you can bet it did not happen by accident. The application of ergonomics helps create a viable solution that targets workplace safety and optimization, in addition to the improvement of human interactions with products, systems, services, and environments. It strives to enhance work environments and approaches to minimize the risk of injury or harm. As technologies change, so does the need to ensure that the tools we access for work, rest, and play are designed for the functional abilities of the body without potential for injury from overuse.

1. Heinmari Kruger, Valencia Khumalo and Nicolette Nadene Houreld. The prevalence of osteoarthritic symptoms of the hands amongst female massage therapists. *Journal of Interdisciplinary Health Sciences*, Gale Academic Onefile. Dec. 17, 2017.

2. PROJECT BACKGROUND AND OBJECTIVES

In undertaking this research project, the MTF sought to identify the risk profile of massage therapy in terms of its standard tasks. We wanted to use relevant data to make practical recommendations and define guidelines to help massage therapists incorporate simple methods and adaptations that minimize their health risks in daily practice. We also believed that in order to adequately analyze this work, using professional ergonomists to guide us was advantageous in achieving intended outcomes. It also removed the bias from the data collection process.

Our overall goal was to create a formal job task analysis of massage therapy work that could be utilized by educators, employers, and practitioners to create an optimal work environment from an ergonomic perspective to support career longevity. All these elements of the project aligned with the core pillars of the MTF research and education objectives, which is why the MTF chose to champion and fund this valuable project.

3. PRELIMINARY DATA THROUGH SURVEY

Prior to beginning our on-site research, the MTF electronically surveyed 775 massage therapists. Their input helped guide the framework for data collection. In preparing for the survey, we sought to pinpoint specific demographic information in the participants.

Here are some of the relevant data we gathered:

- **Age** of therapists in the study was roughly evenly divided among these groups: 36-45, 46-55, and 55 and older (588 survey responses total). Massage therapists ages 35 and younger were a minority.
- **Weekly hours:** Only 8% of 724 respondents said they worked more than 30 hours per week.
- **Techniques and methods:** Although one single method of massage was not specified among the 645 massage therapists included in this answer, a small majority preferred using "palms of the hand" and "deep tissue" techniques. In the survey that preceded this project, therapists with fewer years of experience showed less diversity in methods and techniques as well as a preference for kneading techniques using the hands, fingers, and thumbs.
- **Preferred pressure level:** Using "medium pressure" was preferred by 50% of respondents, with "deep pressure" coming in second.
- **Musculoskeletal discomfort:** An important consideration for this project was the musculoskeletal discomfort (MSDs) felt by massage therapists from their work and the role of risk factors in that discomfort. The neck was reported to be the greatest source of discomfort (59%), followed by the back at 56%. The cluster of neck, upper back, and shoulders was a frequent, severe problem.
- **How does musculoskeletal discomfort impact massage work?**
  Whether carrying a full schedule or working part-time or even choosing to not work at all, we wanted to discover how MSDs impacted massage therapists' work.

Only one-quarter of 583 respondents to this question said they reduced their workload because of discomfort, but just as many said they have missed work because of pain and discomfort. A majority of survey respondents said they knew of a colleague who quit the profession because of the bodily aches and pains associated with their work.

4. DATA COLLECTION METHODS

Location Selection and Study Design for Therapist Observations

We chose Portland, OR and Baltimore, MD as survey sites because the two cities are alike in some important ways. They require similar hours of education for state licensure and education standards are equally high in both locations.

In both cities where Briotix Health conducted onsite data collection, study participants performed 30-minute massages on volunteers, focusing on: neck supine, neck prone, neck and back prone, back, thigh/leg supine, and thigh/leg prone. Massage therapists were not given additional guidelines, and they were free to adjust table heights to their preferences (as equipment allowed).

In Baltimore, hydraulic height-adjustable tables were available, offering therapists great ease and flexibility to adjust the table height while in session — which they did. In Portland, portable tables were used, which required therapists to adjust their tables prior to the client getting situated for the session; therefore, no in-session adjustments were made.

Sessions were video recorded to capture both whole-body movements as well as individual techniques. At strategic points in technique delivery, volunteer subjects were asked to state the pressure they applied on a 10-point scale. To provide further quantitative analysis and comparison, force matching was performed as appropriate when compression techniques were used, with care taken not to overly interrupt the session's flow. Force matching is a widely-used method in ergonomics that measures quantity of force. It relies on an individual reproducing the force immediately after performing a task and using this reproduction to quantify the amount of force that was used.

Massage Work Environments Comparative

To better compare and contrast outcomes in various settings, we visited a variety of practice settings where massage is performed, including a franchise location, a private practice office, a day spa, and a multi-practitioner location.

We wanted to gather as much relevant data for the job task analysis (JTA) that was developed by Briotix as part of this project as was possible. JTA analyses are used in ergonomic evaluations to specify physical tasks that can potentially be risky when overviewing a job in its entirety, — as well as tasks required to successfully complete the work.

To that end, table heights w ere measured and recorded at each site. Table orientations and sizes were noted, as were room measurements. The positioning of both therapist and client was noted at each session. We also discussed the nature of work tasks performed outside of the massage room. Factors like these were another important component of the data collection process for the JTA.

Physical Demands and Site Visitation Data Collection

Tasks Observed, Per Ergonomic Job Task Analysis:

1. Provide manual massage, manipulation, movement of limbs and soft tissues to deliver a therapeutic benefit addressing client medical conditions, injuries, and overall health and wellness (75%).
2. Consult with clients to assess their medical and health histories to best determine an appropriate massage therapy plan (5%).
3. Assess clients' soft tissue condition, joint quality and function, muscle strength, and range of motion during massage (5%).
4. Maintain documentation for massage therapy services and billing records (10%).

5. Retrieve and dispose of linens; move and adjust treatment height table if necessary; set-up table with pillows, supports bolsters; clean service space.
6. Administrative job functions such as: scheduling appointments; processing payments; performing administrative tasks, such as ordering of equipment and supplies; and supporting general housekeeping tasks to maintain an organized, clean work environment.

5. ERGONOMIC TOOLS AND RISK ANALYSIS

List of Ergonomic Assessment Tools Used

The Distal Upper Extremity Tool (DUET) Assessment was one of the tools Briotix used to measure ergonomic risk because of its ability to evaluate risk associated with tasks involving the upper extremities based on *fatigue failure theory*, a system that gauges the cumulative damage of the musculoskeletal system when exposed to repeated stress. There is a great deal of evidence that upper extremity disorders and other MSDs are the result of accumulated damage in musculoskeletal tissue. Repetitive stress was a frequently mentioned problem. (Gallagher and Schall, Jr. 2017).

Another aspect of ergonomic risk exposure, measured as part of our research, is *task duration exposure*. In order to standardize duration exposures per task, the findings are based on a 30-client per week workload, assuming 60 minute massage sessions were given for each client. The results showed the 3 longest-duration tasks were * (1) neck supine, (2) neck prone, and (3) neck and back prone plus back.

Whole-body videos were used to best represent the following defined massage tasks: 30-minute massages on volunteers, focusing on: neck supine, neck prone, neck and back prone, back, thigh/leg supine, and thigh/leg prone, and interval (tasks performed in the intervals between massage application, such as draping, client repositioning, and obtaining lotion). The following instruments and specific elements were used to gather data:

- Task durations for each client and each task were determined, as were average task duration and task duration ranges for each therapist.
- Two Rapid Entire Body Assessments (REBAs) were measured for each task.
  A REBA rates ergonomic risk in terms of posture. Six different body parts are scored, using factors like force, coupling, and activity rate. The REBA is like a snapshot; it measures risk at a moment in time. Five “action levels” of risk are included in the

assessment, with rating scores ranging from 1-11. A score of 2-3, for example, indicates a low level of risk that may indicate needed change, while 8-10 is “high risk,” and 11-plus warns of a very high risk in which change should be implemented.

Summary of Ergonomic Risk Exposures

	Average	Min	Max
Back	0.33	0.05	0.89
Neck Prone	1.17	0.09	2.89
Neck Supine	1.76	0.42	3.73
Neck plus Back	1.13	0.20	3.32
Leg Prone	0.83	0.37	1.73
Leg Supine	0.50	0.04	0.78
Interval	1.20	0.36	2.42
Other	0.33	0.09	0.53

Task duration exposure is a component of the ergonomic risk profile as well as a driver of risk. Metrics regarding task duration exposure are based on an assumed client load of six sessions per day. The majority of survey respondents said they work a maximum of 30 hours per week, which is six appointments of 60-minute massages a day based on a five-day work week. Nonetheless, large ranges of exposure durations are noted among subjects. The most significant factor from an ergonomic risk exposure is the preference of many survey participants to perform massage to the neck/shoulder and low-back regions without changing positions, which may represent a key driver of postural risk, especially to the trunk region.

Briotix Health also noted that the overall physical demand level for the job of massage therapist is rated as “heavy.” The *Revised Handbook for Analyzing Jobs* defines heavy work as exerting 50 to 100 pounds of force occasionally, and or 25-50 pounds of force frequently, and or 10 to 20 pounds of force constantly to move objects.

It’s important to understand that ergonomic risk profiles for the back, shoulder, and neck must be considered only on a “per task” basis. As a result, the profiles do not provide cumulative risk estimates across an entire day or even a workweek. However, the DUET *does* estimate ergonomic risk thresholds for the distal upper extremity over an entire workday.

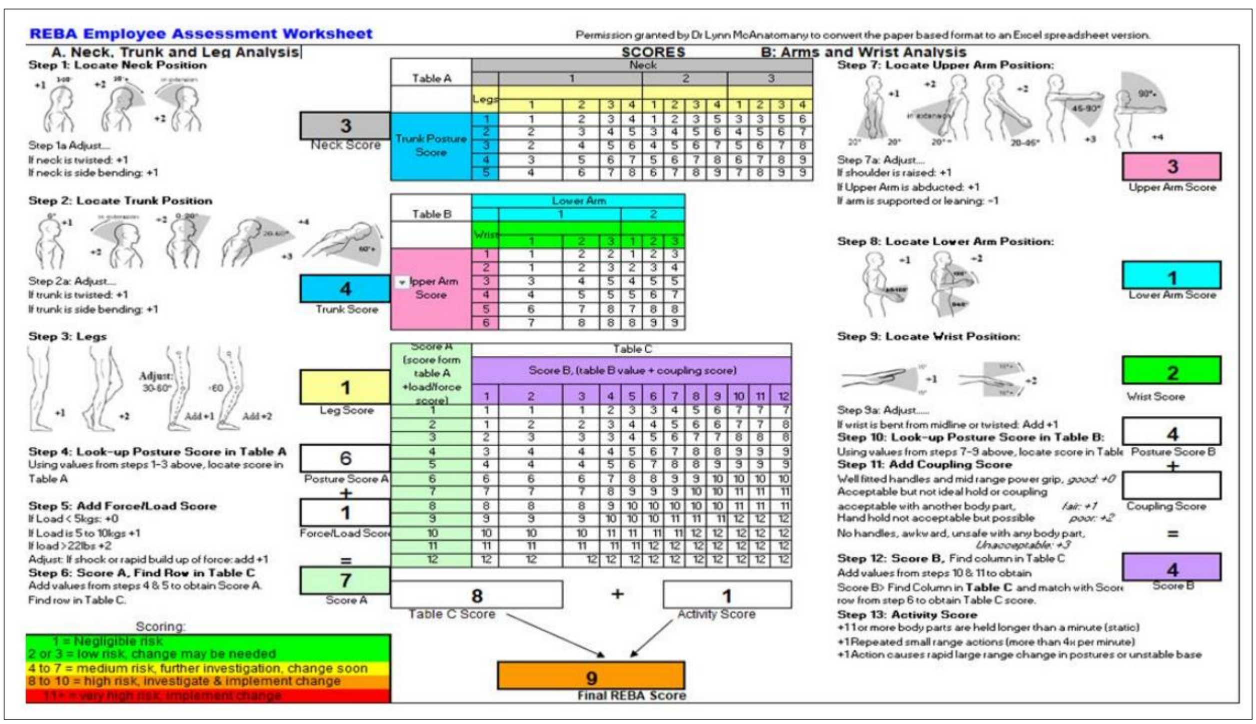
Range of REBA High & Low Scores

Row Labels	REBA High Range
Back	4
Leg Prone	4
Leg Supine	6
Neck Prone	7
Neck Prone + Back	5
Neck Supine	7

Row Labels	REBA Low Range
Back	3
Leg Prone	4
Leg Supine	3
Neck Prone	4
Neck Prone + Back	2
Neck Supine	2

When considering the REBA, it should be viewed as an almost purely posture assessment tool. Both high and low REBA scores were taken per subject and per task to obtain the variability of postural strategies during the same task. The REBA is considered a “snapshot” tool, meaning both high and low REBA scores were obtained per subject and per task.

A high range of variability in scores was noted for “neck prone,” “neck supine, “and “leg prone” tasks. The variability indicates a higher difficulty for massage therapists to maintain low-risk postures during these particular bodywork tasks.



The job of the DUET tool is to determine the cumulative upper extremity load felt during a typical workday. Using the DUET, the likely probability of an upper extremity outcome is calculated. The DUET was used to estimate the cumulative risk for sustaining musculoskeletal disorders in the distal upper extremities. The factors considered were duration exposure, exertion level, and repetition rate of distal upper extremity movement.

DUET Assessment

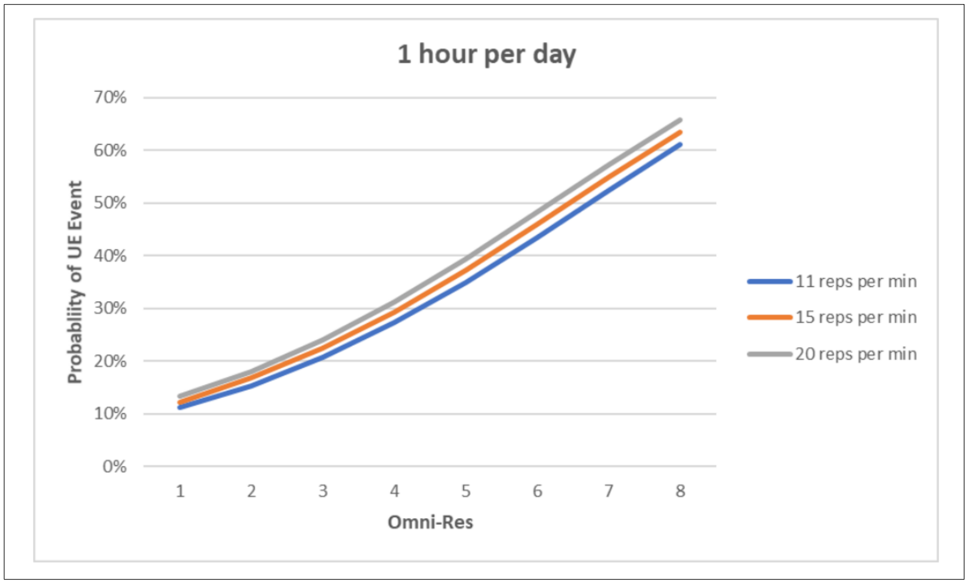
The DUET was used to estimate the cumulative risk for sustaining musculoskeletal disorders in the distal upper extremities based on duration exposure, exertion level, and repetition rate of distal upper extremity movement.

The force matching summary per task is as follows:

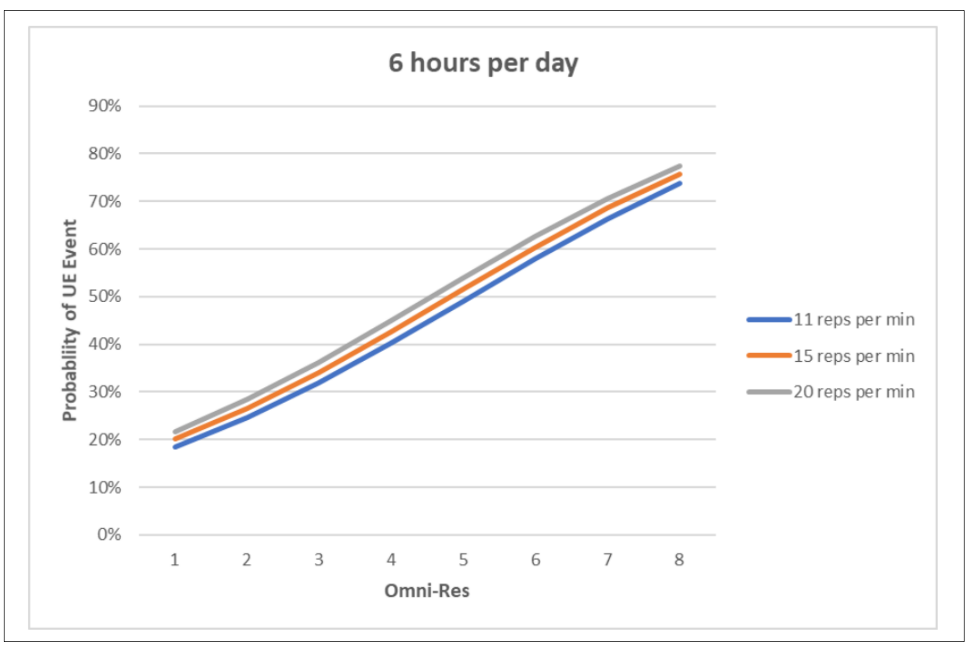
Row Labels	Min of Force Match High	Max of Force Match High	Average of Force Match High
Back	11	77	30.5
Leg Prone	3	64	27.3
Leg Supine	6	64	24.2
Neck Prone	1	20	10.7
Neck Prone + Back	11	77	30.7
Neck Supine	1	27	12.3
Grand Total	**1**	**77**	**22.6**

The most commonly noted frequency range for the distal upper extremity was 11-20 repetitions per minute. Using the DUET, the following scenarios shown below were plotted in graphs against key metrics driving ergonomic risk to establish approximate risk-exposure thresholds.

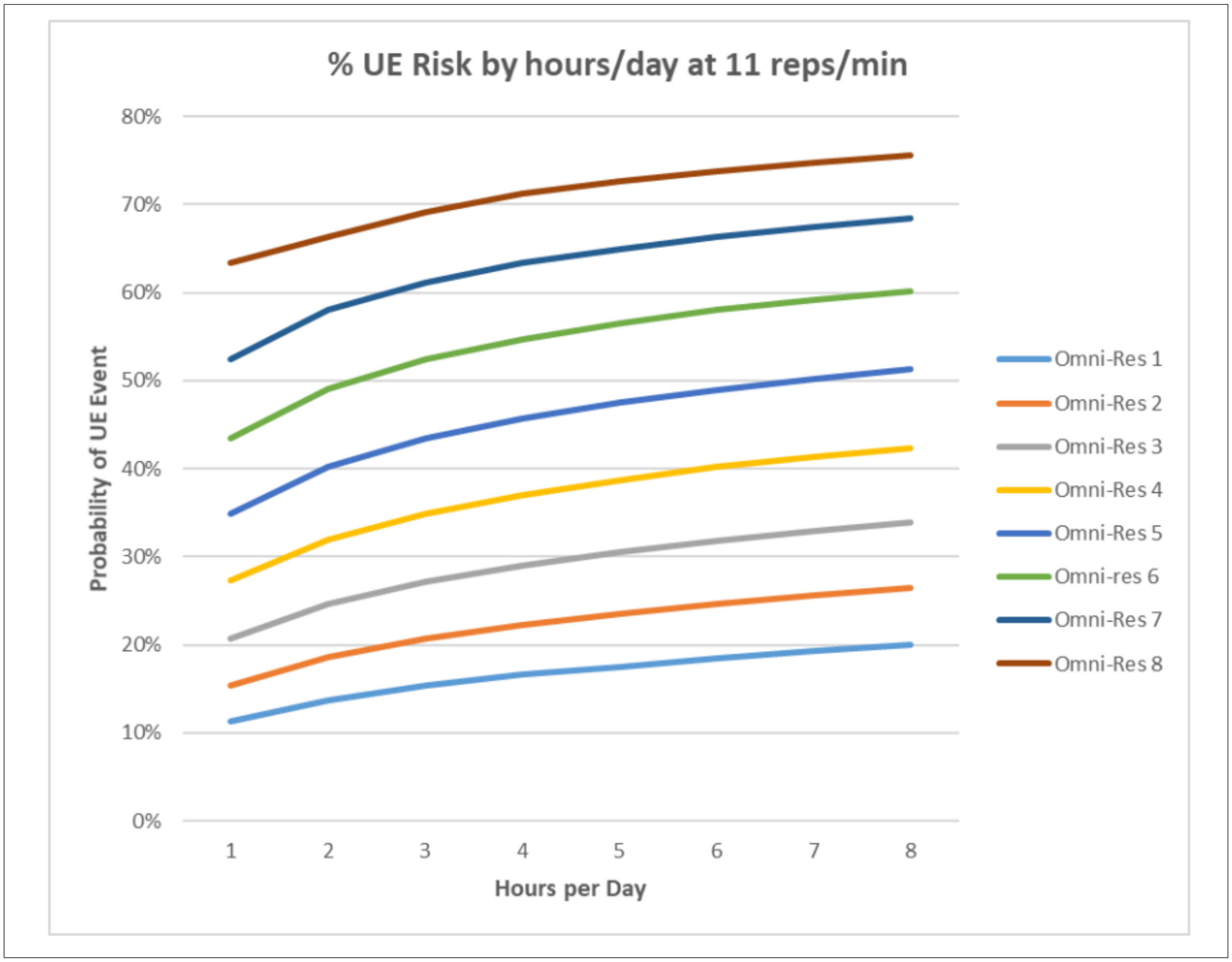
- The chart below indicates the probability of an Upper Extremity Musculoskeletal Event, with increasing force exposures, when using typical repetition rates (11 to 20 reps per minute) over the course of a 1-hour massage.



- The next chart shows the likelihood of an Upper Extremity Musculoskeletal Event, with increasing force exposures, when using typical repetition rates of 11 to 20 reps per minute over the course of a full workday, based on six full-hour massages.



- The probability of an Upper Musculoskeletal Event, with increasing duration exposures, when using the lower end of typical repetition rates (reps per minute) at different exertion levels is shown below.



In combination, these estimates indicate when using a 30% threshold for increased risk of sustaining a distal upper extremity event that upper extremity risk is more sensitive to force exposures than repetition rates, using the typical rates observed across all subjects.

Risk to the upper extremity crosses the 30% threshold when working at approximately 30% of MVC after working at 5 hours at this exertion level. The OMNI-RES scale measures perceived exertion levels, including numerical categories from 0 to 10. The numbers on the scale represent a range of exertion levels from 0, 'extremely easy,' to 10, 'extremely hard.

6. RECOMMENDATIONS BY TASK: BIOMECHANICS

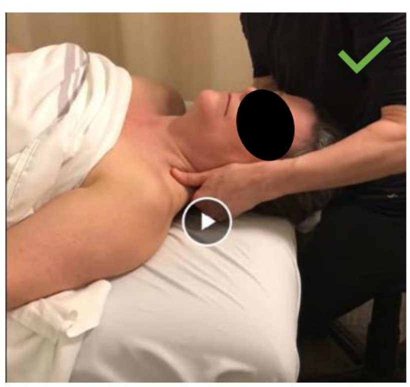
A. Neck Supine (Therapist Seated)

Keeping the trunk vertical (at 90 degrees to the floor) minimizes the ergonomic risk associated with sustained trunk flexion. Demands on the back extensor muscles are reduced when the trunk is vertical, leading to reduced muscular fatigue over time. Also, the neck extensor moment is also lessened with the trunk in a n upright position, resulting in a reduction of neck extensor activity. The most successful strategies to maintain a vertical trunk posture during this task are as follows:

1. Keep the hands visible.

By limiting the reach of the hands to the more accessible portions of the neck, therapists can avoid overreaching to treat the client's mid-thoracic and scapular region while in supine.

Ensure that the hands are visible, as this strategy moderates overreaching and the tendency to engage in trunk-forward flexion.



2. Avoid using the elbows.

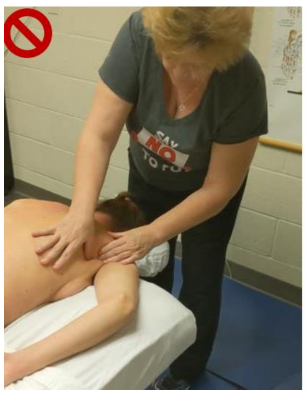
B. Neck Prone

The trunk should remain vertical, at 90 degrees, to minimize risk associated with extended trunk flexion. When the trunk is used to enhance force production, it should be aligned with the direction of force application to lessen force exposures across joints that are awkwardly positioned. Here are the most successful strategies to lessen ergonomic risk exposures:

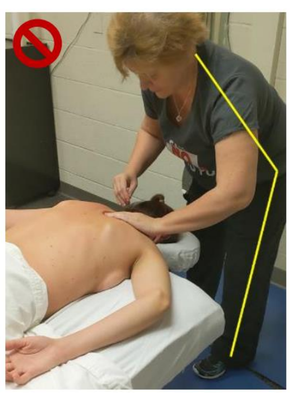
1. Avoid reaching over the head of the client.

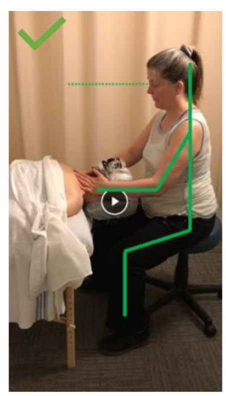
One key strategy to minimize awkward postures of the back and shoulder:

Get as close to the client's tissues as you can. It's easier to do so when a therapist is positioned next to — not above — the client's head.



2. Use lighter-pressure techniques in a seated position.





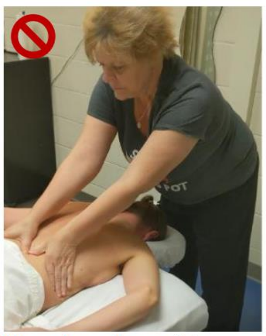
Lighter force applications are associated with more upright trunk postures when sitting (right), rather than in a standing position. When seated, therapists can move closer to the target tissues with their leg position beneath the head cradle.

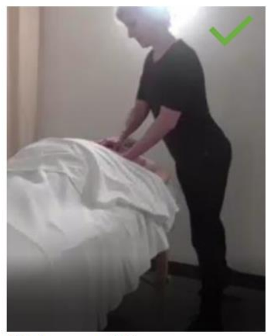
C. Neck Prone Plus Back

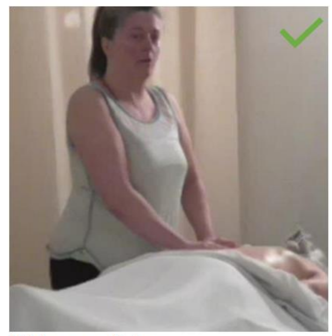
1. Avoid gliding strokes that span the entire length of the spine.

The best way to eliminate this ergonomic risk is to eliminate the task completely. Therapists may consider, instead, separating their techniques into Neck/Shoulder and Low Back Regions to avoid crossing from one region into another without significant changes in posture that include moving the feet.

Note: Accessing the low back near the client's head is even more troubling than crossing the client's midline.


Head end position


Side position


Side position

2. Therapists should consider positioning themselves next to the client.

The massage therapists with the lowest risk scores for this task positioned themselves next to the client, rather than the head end of the client. In this position, they effectively shifted their weight—or even moved their feet— while performing long gliding strokes.

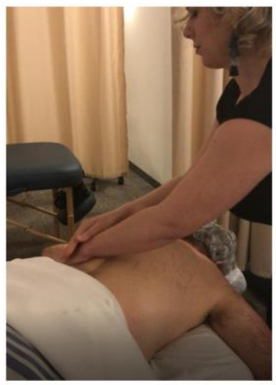
D. Back

1. Avoid climbing on the table.

When massage therapists are on the table, it is difficult for them to minimize a posture, specifically the need to keep the trunk upright.

2. Optimize client positioning during pulling techniques.

Minimize ergonomic risk exposure when certain "pulling" techniques are required to access contralateral tissues. Although reaching across the client's midline is not recommended, sometimes it's essential. With that in mind, therapists should monitor the duration of their application, especially since this technique requires active trunk extension in an unsupported position. To reduce the required moment arm, the client should be positioned as closely as possible to the table. (Therapists may need to position the client's head on the table instead of the cradle.)



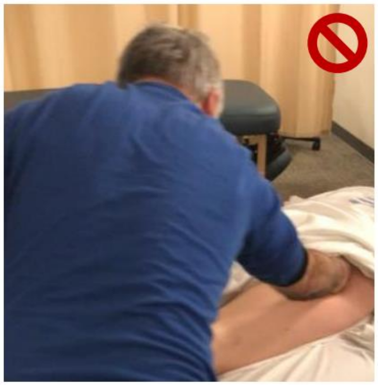
E. Leg (Supine and Prone)

1. Consider working in a seated position.

When working on the legs, therapists with the lowest risk scores sat down, establishing optimal trunk positions.

2. Shorten the reach during gliding strokes.

Legs on the table, in both prone and supine positions, promotes the use of long gliding strokes; these movements often lead to overreaching, shoulder flexion, and trunk-forward bending. As a solution, some therapists shortened their strokes by moving their feet during the gliding strokes in the direction of the stroke.



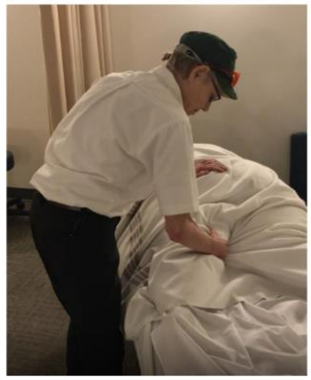
In the above right example, contact is maintained during the stroke while the therapist moves with the stroke, not just by means of weight shifting, but also by moving their feet.

3. Optimize position of the client when accessing the plantar surface of the feet.

The above image shows how incorrect client positioning leads to overreaching. When working on the plantar surface of the feet, therapists may want to consider moving their clients caudally, allowing their feet to be as close as possible to the table. (Alternate means of comfort other than the head cradle may be needed.)

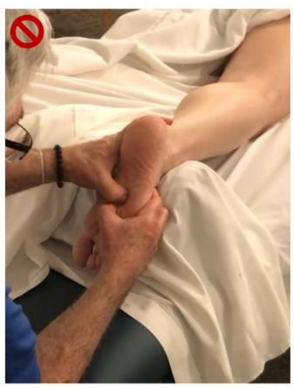
4. Minimize use of pulling techniques by using a staggered stance and optimizing the client's position.

Therapists should be careful when using pulling techniques. This practice increases exposure to trunk techniques that often are unsupported. For best results, use a stance posture, keep the trunk as upright as possible, and position the client's leg as close to the side of the table as possible.



5. Protect the IP, MCP, and CMC joints of the thumb.

Performing compression techniques on the plantar fascia exposes the thumb joint to sustained high force. Overuse of this technique can lead to progressive joint dysfunction, specifically related to hypermobility in the CMC joint.

Although therapists rely on proprioceptive feedback from their skin, this particular task benefits from joint protection and mechanical help. Consider superimposing the opposite thumb for support and/or using the index finger to support the IP joint. Or, as an alternate approach, use the knuckles to apply pressure where needed.

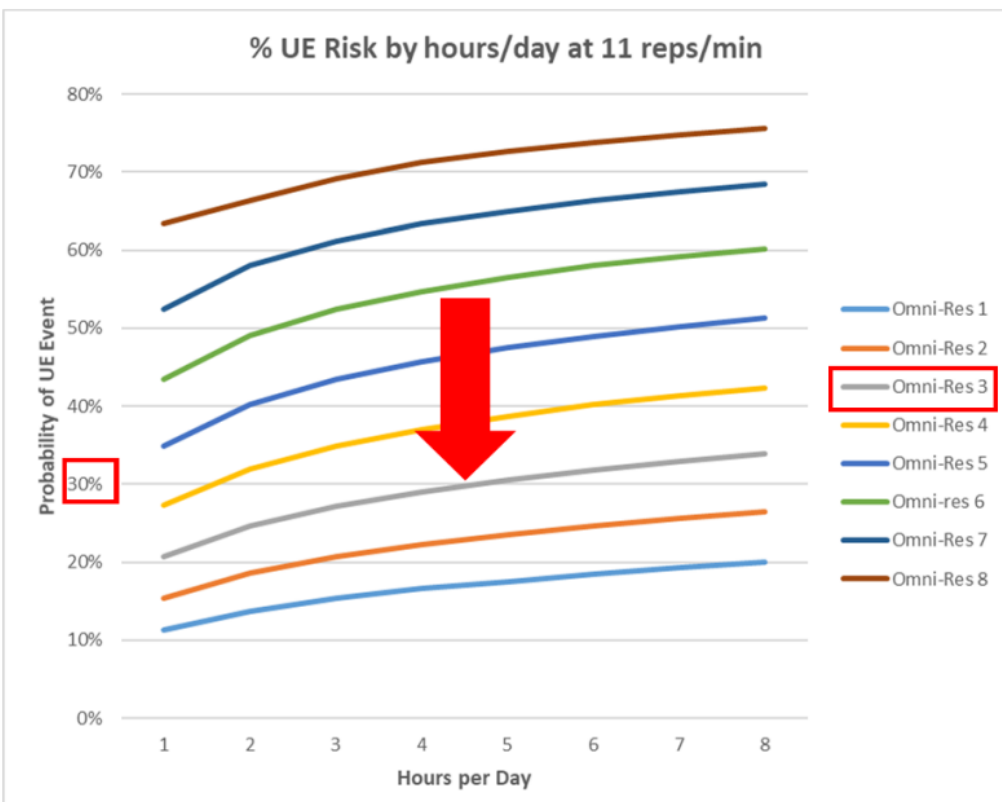
   

Consider using joint-saving tools, such as those pictured above.

7: MANAGING MECHANICAL LOAD / FATIGUE: SUGGESTIONS FOR NEXT STEPS

As mentioned, although force exposure values obtained via force matching provide a "point in time" perspective of ergonomic risk per task, the data set available within the scope of the current project does not permit a projection of the cumulative effect of force exposure on massage therapists' fatigue over time. Also, because "pressure ratings" are specific to the tissue structure of each client, massage therapists, understandably, may lack an awareness of their individual exposure to force when based solely on pressure ratings.

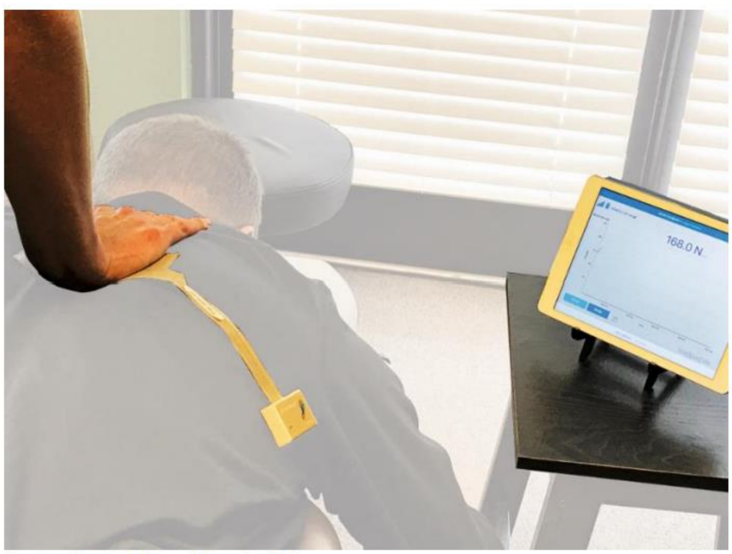
To bridge the lack of cumulative force exposures, the DUET tool was used to establish modeled thresholds for upper extremities across a range of Omni-Res ratings. This modeling —at the lowest observed repetition rate of 11 repetitions per minute — showed that exertion levels should be monitored. Specifically, in order to remain under a reasonable threshold for upper extremity event (about 30 %) exertion levels should not exceed a cumulative Omni-Res level of 3 across a 5-8 hour shift.



An Omni-Res level of 3 corresponds to a 30% Maximum Voluntary Contraction (MVC) or moderate as a verbal anchor. Therapists should learn how to recognize and train their exertion levels. A 0-10 Borg scale can determine whether the exertion level is sustainable for an entire shift. However, note that the therapist's 10-point pressure scale might interfere with their own understanding of exertion because it is relative to the client's tissue makeup.

Looking ahead in the area of massage therapy education, the use of pressure sensors may present an opportunity to help therapists develop a more innate and tactile understanding of how their exertion levels correspond with the pressure scale.

Flexible load pads can be placed on the client's tissue to provide instant readouts of force exerted as opposed to pressure matching on a hard surface. This accurate and versatile system can, first, establish standard force ranges across a spectrum of pressure rating and, second, enable a therapist to determine their 30% MVC— applicable across a wide range of techniques.



(sample vendor: Novel.de)

Similar approaches have been used for training of manual physical therapists. *Petersen et. Al. the effect of real-time feedback on learning lumbar spine joint mobilization by entry-level doctor of physical therapy students: a randomized, controlled, crossover trial. Journal of Manual & Manipulative Therapy, 2019-in appendix).*

Managing Fatigue and Cumulative Exposure

Cumulative fatigue is a key driver for MSDs in the workplace. While the current project provides a task-by-task perspective on ergonomic risk, the cumulative effects of cardiovascular and/or musculoskeletal fatigue —when performing massage work over the course of a full workday, or over the course of several shifts — is unclear.

Wearable sensors may present an opportunity to capture the second-by-second, cumulative demands of massage work:

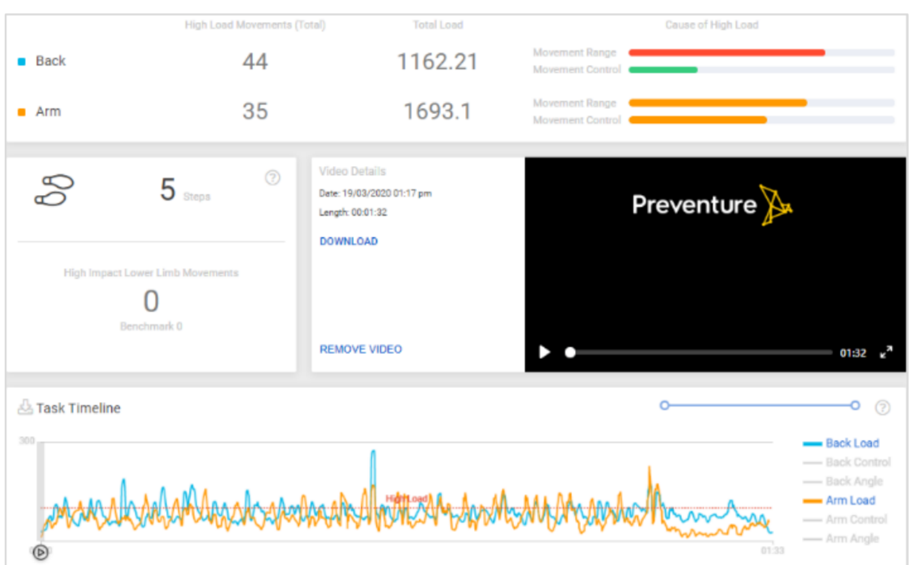
1. Ergo Pro System by GoX Labs

This wearable sensor system captures more than 30 separate parameters to assess movement and physiological responses. GoX Labs uses an algorithmic approach to estimate work output using heart rate data in combination with a movement sensor collecting kinematic data on trunk movement. GoX's system dashboard allows tracking of the user's cumulative workload (expressed in %VO_2(max) across an entire work shift. Movement parameters for the GoX system are specific to trunk movement; they do not capture kinematics of the upper extremity. While other sensor systems provide better kinematic data, systems like GoX Ergo Pro provide better data on physiologic fatigue through their algorithmic estimation of workload expressed in %VO_2(max).

2. Preventure System

Preventure is an easy-to-use movement sensor system based on using separate movement kinematic sensors for the trunk and the arm. Movement totals and risk are calculated through a combination of measurements of an individual's range of motion, body control, and duration of movement. These movement patterns are captured on a live dashboard accessible to the user, ergonomic specialist, or supervisor. The movement tracking can be collected in two different ways.

First, a "task assessment" function allows for easy and accurate analysis of movement during a specific task. This data can be individually analyzed or compared to different repetitions of the same task to highlight similarities and differences. Sensor data can be collected independently or in conjunction with self-syncing video.



Second, a "movement coach" function allows for easy and accurate analysis of movements over the course of an entire workday with the added ability to provide live feedback throughout the shift when the user is moving in a way that increases their injury risk. This information is found in a live dashboard that also calculates the progressive or cumulative load throughout the entire shift.

The use of a wearable sensor system like Preventure or GoX Studios would enable the capture objective task specific metrics in combination with ergonomic exposure data for an entire workday, all with minimal disruption of the therapist's workflow.

8. PHASE TWO OF PROJECT

To go forward with Phase Two of the project, here is how we plan to proceed: A cohort of therapists will perform a full day of massage on a consistent group of clients, allowing comparative data trend analysis not only between clients —for the same therapist— but also between therapists for the same client.

Apart from the potential to further inform the cumulative physical demands of a community massage therapist, wearable sensors could play a powerful role in the control of individual ergonomic risk exposures. They could enable therapists to self-monitor and correct their own technique via a continuous feedback mechanism accessed on an individual personal dashboard. Additionally, there is the ability to enable haptic feedback to further enhance the self-monitoring of ergonomic risk throughout the day.

Wearable sensors could provide a useful adjunct to traditional massage therapy education by providing instructors a telemetric option to provide individualized body mechanics and technique coaching. For example, each student could use a sensor set in their various practice settings. Then, the instructor would be able to monitor, coach and critique using both objective sensor data as well as video analysis. Using this system, instructors could enhance their ability to identify students that may require additional coaching in terms of body mechanics. They could also identify the tasks that present individual students with the greatest ergonomic risk. This concept is viable using the Preventure system because of its self-synchronous video capture and remote capabilities — using a smart phone during a massage session.

The Massage Therapy Foundation looks towards the future in planning this second phase and conducting the data collection. In contrast to Phase One, this data will be collected via smart phone with individuals self-reporting over a course of several days. Anticipate outreach from the Foundation in recruiting therapists and practitioners from a variety of work environments to participate.

9. APPENDIX

Helpful links:

- Massage Therapy Foundation—Ergonomics Project
- Massage Therapy Foundation—Resources
- MassageNet Practice-Based Research Network
- International Journal of Therapeutic Massage and Bodywork

10. GLOSSARY

Applied force: A force which is applied to an object by another object or a person.

Biomechanics: The study of the mechanical laws relating to the movement or structure of living organisms.

Caudal: Of, at, or near the tail or the posterior end of the body.

Distal: Situated away from the point of attachment or origin or a central point, especially of the body.

DUET (Distal Upper Extremity Tool): A method of evaluating the risk associated with tasks involving the upper extremities. Based on *fatigue failure theory,* it's a system that gauges the cumulative when exposed to repeated stress.

Ergonomics: 1) An applied science concerned with designing and arranging things people use so that the people and things interact most efficiently and safely— also called biotechnology, human engineering, human factors. 2) The design characteristics of an object resulting especially from the application of the science of ergonomics.

Ergonomic risk: Movement situations that cause wear and tear on the body and can cause injury, including repetition, awkward posture, forceful motion, stationary position, direct pressure, vibration, extreme temperature, noise, and work stress.

Fatigue Failure Theory: A system that gauges the cumulative damage of the musculoskeletal system when exposed to repeated stress.

Force matching: A method that is widely used to measure forces. It relies on the individual reproducing the force immediately after performing a task and using this reproduction to determine the force required.

Force vector: A representation of a force that has both magnitude and direction.

Moment arm: The length between a joint axis and the line of force acting on that joint. Every joint that is involved in an exercise has a moment arm. The longer the moment arm is, the more load will be applied to the joint axis through leverage.

Musculoskeletal: Of, relating to, or involving both musculature and skeleton.

Prone: Having the front or ventral surface of a body facing downward—lying with the chest and stomach positioned downward (a client placed in a prone position).

Proximal: 1) Situated close to — proximate 2) next to or nearest the point of attachment or origin, a central point, or the point of view especially located toward the center of the body.

QEC (Quick Exposure Check): Estimates the exposure of the four body areas at greatest risk for work-related musculoskeletal disorders — the back, shoulders and arms, hands and wrists, and the neck. The QEC involves both the practitioner and the subject to conduct an assessment and find the highest risk scenario for each body part.

REBA (**Rapid Entire Body Assessment):** Rates ergonomic risk in terms of posture. Six different body parts are scored, using factors like force, coupling and activity rate. The REBA is like a snapshot; it measures risk at a moment in time.

Supine: Lying on the back or with the face upward.

Sources

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Merriam Webster Medical dictionary: https://www.merriam-webster.com/medical

Forceinphysics.com: https://forceinphysics.com/what-is-applied-force/

Velocity EHS: ehs.com

https://fhs.mcmaster.ca/safetyoffice/documents/QuickExposureCheck.pdf