Ergonomic Evaluation Report

Veterinary Teaching Hospital – Clinical Pathology
Clinical Pathology

Report By:
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Risk Management & Insurance
Ergonomic Evaluation Report

Veterinary Teaching Hospital – Clinical Pathology

Executive Summary

Ergonomic evaluation services were requested by Lynne Shanahan of the Veterinary Teaching Hospital (VTH) as part of a desired chair purchase for the Clinical Pathology department. After providing ergonomic evaluation services, the visit revealed an increased potential for injury to employees. Injury risks primarily encompass work with the hands (pinch and power grips) which includes but is not limited to frequent use of a microscope, handling samples, performing computer tasks, gripping and twisting vial caps, etc. Because evaluation of the job tasks revealed an increased injury risk for certain job tasks and appropriate ergonomic design of various areas was not highly considered during building construction and design, it is recommended that changes to environment, equipment and job tasks be made.

With adequate implementation correct ergonomics engineering, administrative and work practice controls the exposure to ergonomics injury risk factors should be reduced. However, staff must utilize equipment and work practice techniques in order to help counteract the injury risk.

Problem Statement

Recent ergonomic evaluation has revealed the need for further changes to help counteract exposure to injury risk factors.

Ergonomic Injury Risk Factors

- Repetitive & forceful use of the hands, fingers, forearms (pinch and power grips)
- Awkward wrist postures (flexion, ulnar deviation)
- Forearm rotation (supination, pronation)
- Awkward neck postures (flexion, rotation and lateral flexion)
- Awkward shoulder postures (flexion and abduction)
- Improper chair support (poor chairs)
- Frequent static standing
- Extended/excessive forward reach

Not all injury risks may be listed
Ergonomics Analysis Tools Utilized

The below ergonomics analysis tools were used in determining injury risk for job tasks performed. The below ergonomics/risk analysis tools were used to help quantify the potential for injury risk as well as prioritize the need for change.

The ergonomics risk analysis tools used below is used to determine upper extremity injury risks for given job tasks.

1. Baseline Risk Identification of Ergonomic Factors (BRIEF)
   a) The BRIEF is an ergonomics posture and force based risk assessment/screening tool that uses a structured and formalized rating system to identify ergonomic acceptability on a task-by-task basis. Along with posture and force, the BRIEF takes into account the overall task duration and frequency to further quantify the amount of ergonomic risk present in a given job task.

2. BRIEF Exposure Scoring Technique (BEST)
   a) The BEST builds on the BRIEF Survey to determine a job hazard score. The BEST adjusts for varying time exposures to ergonomic risk, and takes into account any physical stressors present while performing the job including vibration, glove issues, low temperatures, soft tissue compression and impact stress.
# Ergonomics Analysis Tool Results

## BRIEF

### BRIEF - Risk Scoring Key

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<th>Low</th>
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<tbody>
<tr>
<td>Score</td>
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<th>Elbow Right</th>
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<th>Neck</th>
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<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
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## BEST

### BEST - Risk Scoring Key

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Results Discussion

BRIEF

The highest injury risks in given job tasks is seen in the shoulders, back and hands/wrists. Much of the risk seen is present because of the frequency and duration of reach which most often exceeds 22”. Inappropriate workstation design increases reach (i.e. inadequate leg clearance, work surface depth and equipment layout). With modifications to the leg clearance as well as a rearrangement of equipment and layout, reach can be minimized and risk for injury decreased.

Work on the microscope, which takes place frequently is one reason for the increased risk scores to the back while performing this task is due to the unsupported seating. Additional issues will be discussed below and are broken down by workstation/job task.

- **Hematology slides**
  - This task involves work with hematology slides, vials of blood and computer work at the hematology workstation. Main injury risks while performing this task are, as shown above, to the hands/wrists, shoulders, neck and back.
  - By reorganizing work and using additional tools and equipment to decrease reach, the injury risk for the elbows, shoulders and the back would be minimized. Risks to the hands and wrists are difficult to overcome given the hand intensive nature of the job. Injury risk to the neck is also difficult to eliminate entirely given the nature of the work and visual demands of various tasks. Additional recommendations are shown below which will indicate possible injury risk control methods.

- **Running Urine Samples**
  - This task involves work with urine samples, computer and paperwork and other equipment performed at the “bench” workstation.
  - By reorganizing items on the workstation and using additional equipment and tools the injury risk for the elbows, shoulders and the back would be minimized. Risks to the neck, hands and wrists are difficult to overcome given the nature of the job. Additional recommendations are shown below.

- **Computer & Paperwork, etc @ Microscope Station**
  - This task specifically addresses non-microscope related job tasks. This includes paperwork, computer work, grasping slides, etc. while sitting at the microscope.
  - **BRIEF** scores shown for this task indicate an increased risk at the shoulders and back. This is due to excessive awkward reach with the shoulders as well as sustained and repetitive awkward back postures.
    - Using a more appropriate chair and sitting back completely would decrease back injury risks while rearranging the workstation, eliminating leg obstructions to ultimately decrease reach, will help reduce the high risk to the shoulders.
• Injury risk scores would decrease from a 2 to a 1 or 0.
  ▪ Height adjustable workstations with more of an “L” or “U” shape would also be beneficial and would reduce reach (non-value added motion) and would save time for labor to be allocated to other tasks.
• Microscope Work
  o This task involves work on the microscope. The task is variable and does not have defined cycles, however when using the microscope, static postures are seen. The main risks are to the elbows, shoulders, neck and back.
  ▪ As mentioned above, using a more appropriate chair and sitting back completely would decrease back injury risks while rearranging the workstation, eliminating leg obstructions to ultimately decrease reach, will help reduce the risk to the shoulders.
  ▪ Sitting forward unsupported away from the chair backrest (or if a backless stool were to be used) increases risk for injury. Sitting with the back supported would decrease BRIEF scores from a yellow to a green. (Back twisting and side bending would also need to be reduced or eliminated to decrease exposure and injury risk to the back completely.)
• Handling Hematology Vials
  o This task involves handling and checking vials and paperwork. Task is performed on the workstation just behind the front counter sample drop off.
  o Risk to the neck and hands/wrists are difficult to eliminate because of the hand intensive nature of the job. By avoiding reaching across the center or midline of the body to the opposite side, the reach and extension of the elbow will be decreased. Back injury risks can be minimized by pivoting with the feet rather than twisting and avoiding crossing the arm across the midline of the body.
• Processing Hematology Vials
  o This task involves handling vials, using the hematology machine, writing with a pen on the vials and entering data into the computer. This task is performed on the hematology workstation.
  o The risk for neck injury is of greatest concern with this task however can be reduced by reorienting the computer monitors closer to one another and allowing for screen height adjustment. As mentioned above, along with decreasing injury risk, proper rearrangement of the workstation would reduce the non-value added motions such as reach and would allow for labor reallocation to more value added tasks.
The highest priority job tasks shown in the above BEST table should be addressed first. One of the main reasons for increased BEST scores is due to workstation design which has lead to increased reach, inadequate leg clearance as well as increased static awkward postures duration. Appropriate changes to the work environment to reduce modifiable aspects of given job tasks will help reduce BEST scores. Even with any changes, the BEST scores may not reach an ideal safe green zone; however the overall BEST scores and injury risk will decrease with the appropriate changes.

Recommendations listed below will further address methods to help control the level of risk present for the given job tasks. Alternatives may exist other than those listed and further evaluation, analysis and testing will need to be conducted following any changes to determine if injury risk scores have decreased.

Although not all job tasks may create injury, the results of analysis were not surprising. Hand intensive tasks are common for employees, and simple modifications to reduce injury risk can be challenging. Job rotation, rest breaks along with additional engineering controls (when feasible) as well work practice controls and training should be incorporated to reduce potential for injury.
Recommendations

As mentioned above, and as is true for any injury risk exposure, the implementation of engineering controls to eliminate or reduce exposure is most ideal and should be investigated and implemented first. Along with these changes, administrative and work practice controls should also be implemented where needed.

Further evaluation and analysis of job tasks will need to take place in the future to further identify injury risk potential for various job tasks.

Chemistry Workstation – “COBAS”

- Install monitor arms to improve viewing of monitors.
  - Monitor arms will free up desktop space for other frequently used items.
  - Increase monitor height adjustability for employees of varying statures.
    Employees working in this area vary widely in stature and shorter employees must work with a monitor height which is too high.
    ▪ Monitor height should adjust from 35”-46” for seated work.
    ▪ Distance will vary based on viewing preference but should be within 18-30” from the eyes.
- Further research the “synergy” program which allows for one keyboard and mouse to control multiple computers. [http://synergy-foss.org/](http://synergy-foss.org/). Eliminating one keyboard and mouse will free up desktop space and decrease awkward postures while trying to use two keyboards and two mice. This will also free up space for paperwork, etc.
- Reach for back shelf to obtain binders exceeds 22”. This is outside recommended reach distance guidelines which increases injury risk. Items which are placed beyond 22” should be relocated to decrease reach. See below for reach specifications.
• Varying work surface heights create excessive reach (vertical/horizontal reach) for the printer while seated. Options to improve this and decrease reach are:
  o Relocate printers to adjacent work surface (30”)
  o Raise computer work surface to match printer surface (36”). This would turn this particular work surface into a standing work surface which would require a chair/stool with a higher lift and foot ring.
  o Remove drawers/storage cabinets under work surface to decrease horizontal reach and allow for increased movement from side to side in the chair.

**Leg Clearance**

• Work surface thickness should be no more than 2”
• Knee clearance depth while seated should be greater than or equal to 18”
• Knee clearance width while seated should be greater than or equal to 30”

- Remove anti-fatigue mats where chairs are located (mats are not recommended in the chemistry area). Chemistry workstations are designed for seated work and standing for extended durations appears minimal. Sitting can take place instead of using anti-fatigue matting if standing becomes tiring.
• The power cord under one mat should be relocated in order to decrease trip hazards and obstructions with the chair. If not relocated, this can also be covered by alternative cord covers (as shown below) which take up less space. Ideally however, the cord is re-routed out of the walkway.

![Picture 5](http://www.cableorganizer.com/cord-covers/economical.htm)

• Purchase new chairs for both desk and counter height workstations. Examples shown below.
  o The Clinical Pathology department has had trial period to determine effectiveness and fit for employees. These chairs are available for purchase in a cleanable material. Alternative models are being researched and may be purchased as needed. Chair investigation is ongoing.

• Purchase keyboard trays and monitor arms as needed to free up desktop space and reduce reach and improve viewing the screen. Proper use of the keyboard tray (if purchased) will need to be ensured so this does not create additional reach. This device should ideally be tried first to determine effectiveness. Foot rests/supports may also be needed given workstation height is not easily adjustable for employees of varying stature.
## Recommended Products

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Hematology Workstation - Microscopes

- Reach beyond 22” due to printer location, stapler and other desktop items, etc. (See picture 6). Potential solutions:
  - Remove storage drawer to allow decreased reach (<22”). Reach guidelines are shown below.

<table>
<thead>
<tr>
<th>Picture 6</th>
<th>Picture 7</th>
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<tbody>
<tr>
<td><img src="image1" alt="Picture 6" /></td>
<td><img src="image2" alt="Picture 7" /></td>
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  - Reorganize the workstation and pull frequently used items closer to reduce reach. This will decrease injury risk and BRIEF scores.
  - Consider trying, purchasing and installing a keyboard tray to reduce awkward reach and twist while typing. When the keyboard tray is not in use, it can be pushed under the work surface so that it does not interfere with microscope work and create additional reach.
  - Consider wireless keyboards and mice to allow for each device to be pulled closer to the body.
  - Duplicate equipment and tools used for both microscopes (i.e. 2 electric staplers, 2 calculators, 2 slide holders, etc.) Pull each item most frequently used closer to the body to decrease reach. Desktop space is lacking which pushes items further away from the body and increases reach and risk for injury. (Equipment and slides that must be shared should be easily accessible to two employees working on both microscopes without creating excessive reach).
  - Consider installing monitor arms to free up workspace on either side of the microscope. Rearranging various items on the work surface to either side of the microscope will help decrease reach.
  - Sit back completely in the chair to received appropriate lower back lumbar support. Unsupported seating increases strain and fatigue on the back and
increases injury risk potential. Use of dynamic seated postures (movement) while sitting back in the chair is extremely beneficial and will help reduce strain and fatigue from static postures.

- Build angled shelves or bins to allow for storage of binders, paperwork, etc. Shelves would most likely need to be custom built to allow for adequate space between shelves. Below picture is an illustration of a potential option. This would need to be on a much smaller scale and shelf heights would need to be adjustable and removable to allow for various paperwork, binders and other tools and equipment.
Create an L shaped extension for the current microscope area as shown below. This should be accessible from both sides to allow employees on either microscope to access the additional space. The work surface should be approximately 24 - 36” deep on top to allow for adequate workspace while not increasing reach. If designed to 36” to allow for leg clearance under the work surface, employees should be trained to avoid crossing to the adjacent work surface in order to minimize reach. Any shared equipment would need to be appropriately placed to minimize reach. Pictures below show potential location of an L shaped workstation addition.

- Reach guidelines
  - Should not exceed 11” in the primary work zone
  - Should not exceed 16” in the secondary work zone
  - Should not exceed 22” at any point

![Picture 8](image1.png) ![Picture 9](image2.png)

![Picture 10](image3.png)
By reducing reach, BRIEF scores will be decreased. In addition, the time motion savings and product output can be increased. Below are best estimates of time motion savings.

**Time motion savings**
- Initial reach = 0-6” – 24-30”
- Proposed reach = 0-6” – 6-12”

- Annual Motion Savings
  - Projected $1250.00
  - Conservative $812.50

**Output increase**
- Projected - 3000 additional units
- Conservative - 1950 additional units
Below crude drawing indicates a potential redesign of the microscope station incorporating and “L” shaped workspace. Layout also includes potential layout of materials. Right side/Eastside microscope workstation is a “mirrored” layout of the Westside workstation.
Recommended Products

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- To reduce soft tissues compression which contributes to increased BEST scores, soft edge protectors or forearm supports and wedges should be implemented. Each of these options can be tried to determine effectiveness.

<table>
<thead>
<tr>
<th>Soft Edge (Edge Protector)</th>
<th>Wedge-Ease Ergonomic Forearm Supports</th>
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Hematology Machine Workstation

- Placement of computers used at this station creates excessive neck rotation while referencing screen on right for input to screen on left.
  - Potential solutions:
    - Relocate computer and monitor on the right.
      - Computers monitors should be as close to one another as possible.
      - Monitor height should be adjustable from ~54”-71”. (Because of shorter stature full time employees, a lower monitor height is appropriate. A 54” monitor height is the 1st percentile female standing eye height. An even lower monitor position may be needed if corrective lenses are used while viewing these or other monitors.
    - Use of a monitor arm will help free up desktop space.
      - Relocate printer, etc on opposite side of the right side monitor to allow for monitors and keyboards to be close to one another.
  - Distance of monitors from adjacent work tasks is increased. The number of steps taken due to workstation layout increases time to complete tasks. With reorganization, footsteps and wasted motions will be reduced.
By reorganizing the workstation and equipment to decrease even a few footsteps, task efficiency will be improved. Reducing steps will not impact injury risk and BRIEF scores; however the time motion savings, increased product output and reduction of cycle time can be seen.

**Time motion savings**
- Initial Footsteps – 5-6
- Proposed Footsteps – 3-4

- Annual Motion Savings
  - Projected $1733.33
  - Conservative $1126.67

**Output increase**
- Projected - 3328 additional units
- Conservative - 2163 additional units

**Recommended Products**

| 223 | **Space Arm, Single Arm, Bolt Through Mount**  
Product ID: SA01BT | $189.00 | Colorado Correctional Industries (CCI)  
(800) 685-7891  
(303) 320-1210  
[http://www.coloradoci.com](http://www.coloradoci.com) |
Hematology Slide Station

- Reach for biohazard container and other objects/tools exceeds 22”
  - Pull this and other items closer to decrease reach.
  - Follow the same reach specifications as indicated above. Ensuring a decreased reach will decrease injury risk potential as well as save time and reduce non-value added tasks.
- Knee space depth should be greater than or equal to 6”
  - Knee space depth is inadequate for standing while at this workstation. This however is nearly impossible to correct.
- Anti-fatigue mats are decreasing in quality. These need to be upgraded due to wear and tear and to decrease likelihood of trips and falls. Mats can be purchased to a custom size. Contact the vendor for additional information.
- Where anti-fatigue mats are used, chairs should not be used. Chairs will not effectively roll over anti-fatigue mats due to their cushion.
  - Anti-fatigue mats should be at least 0.5” – 1.5” thick and should be placed at least 8” under the work surface to prevent uneven standing surfaces.

### Recommended Products

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<td><strong>Kare Products</strong>&lt;br&gt;(800) 927-5273&lt;br&gt;(303) 443-2522&lt;br&gt;<a href="http://www.kareproducts.com">www.kareproducts.com</a></td>
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</tbody>
</table>
• Counter height is 36.25”
  o Hand working height varies from 36.25” – 41.25”
  o Ideal hand working height is 38” to 47”. Hand working height at this station appears appropriate and within acceptable ranges which helps keep injury risk potential low.
Front Counter/Sample Drop Off Station

- Sample ledge reach exceeds 22”
  - Counter depth will cause excessive forward reach which should not exceed 22”.
- Desk surface thickness is 3”
  - Surface thickness should be no greater than 2”

- Counter depth and reach at this workstation will be nearly impossible to eliminate. Employees should stand when dealing with individuals on at the window and when reaching for items as sitting will increase reach and risk for injury.
- Remove cabinet under work surface to provide adequate leg clearance.
  - Current work surface width is 23” and should be at minimum 30”
- Relocate reference sheet to side of monitor to reduce neck rotation and decrease unnecessary motions.
- Move paper basket as needed to reduce reach.
- Purchase monitor arms to free up desktop space and allow for monitor to be pulled closer to the body and scope as needed.

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<th>Description</th>
<th>Price</th>
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<td>Copy Holder Clip, Blk</td>
<td>$9.67</td>
<td>3M 800-328-6276 <a href="http://www.3m.com">www.3m.com</a></td>
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<td>Product ID: MMMDH240MB</td>
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<td>223</td>
<td>Space Arm, Single Arm, Bolt Through Mount</td>
<td>$189.00</td>
<td>Colorado Correctional Industries (CCI)</td>
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<td>Product ID: SA01BT</td>
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<td>(800) 685-7891 (303) 320-1210 <a href="http://www.coloradoci.com">http://www.coloradoci.com</a></td>
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General Recommendations

1. Avoid awkward wrist postures whenever feasible. Concentrate on keeping the wrists as straight as possible in a neutral position (handshake posture) and avoid unnecessary and awkward bending of the wrists. Awkward bending of the wrists (extension, flexion, radial or ulnar deviation) can drastically decrease grip strength and will increase injury risk and BRIEF scores. In combination with a pinch grip, these awkward postures can be harmful to the body.

2. Alternate hand use as much as possible to decrease repetitive and forceful motions.
   a. Alternating hands may help reduce injury risk scores previously indicated.

3. Use tools and equipment designed to incorporate use of the entire hand, not just one finger and thumb. Pinch gripping should be avoided whenever feasible. Unfortunately pinch grip and grasp is difficult to prevent.
   a. For frequent (>2/min) one-handed pinch-grips, the force should be below 2.9 pounds/force.

4. Maintain a 90 degree elbow angle while working. Avoid awkward shoulder postures and work overhead. Use stools if the work is too high.

5. Avoid unnecessary pinch or grasp whenever feasible. Use a grasp rather than a pinch when possible. Power grasp, or use of the entire hand and all fingers, is approximately 15 – 25 times stronger than a pinch grip (thumb and one finger).

6. Set down hand tools when not in use. Alternate hands and use a relaxed pace when performing repetitive tasks.
   a. Repetitive and forceful pinch grip and grasp are common however are difficult to eliminate. Use of job rotation and work practice controls are needed.

7. Ensure any hand tools used have adequate dimensions and weights. Hand tool specifications should be as follows:
   a. Hand tool handle length should be 3.8 inches (3.8” – 6.0”).
   b. Power grip handle diameter should be 1.2 to 1.7 inches.
   c. Precision grip (e.g. pinch grip) hand tools should have a diameter of 0.3” – 0.6”
      Precision tools should not weigh more than 1 lb.

8. Most microscopes have adjustable eyepieces. For scopes which do not already have the following adjustment capabilities, those purchased in the future should meet the below specifications.
   a. Eyepiece height adjustability should be greater than or equal to 4”.
      i. Allowing for optimal seated eye height from 35” – 46” above floor surface.
b. Vertical displacement angle adjustability should be 0 – 180 degrees.
c. Seated microscope work is recommended over standing.

9. Take occasional breaks away from hand intensive and repetitive tasks whenever feasible. Although it is very difficult to eliminate exposure entirely, rest breaks may be beneficial. Stretches and exercises may also be beneficial. Job rotation to less fatiguing tasks should be incorporated as well.
   a. Implementing a 5-minute break for another activity every hour is recommended for continuous, highly repetitive tasks.

10. For standing work surfaces, all leg obstructions should be removed. Clearance is as follows:
   a. At least 30 inches while sitting
   b. At least 6 inches while standing.
   c. Foot clearance depth while standing should be at least 4 inches deep and 4.5 inches high.

11. As mentioned above, try to avoid reaching across the midline of the body. This increases reach and injury risk potential. Organize work, tools and equipment to avoid unnecessary and/or awkward motions.

12. Continue to rotate job tasks regularly. Ideally job rotation should allow for task rotation following 2 hours of performing continuous moderately fatiguing tasks. Switching to a task that is less fatiguing and requires use of alternative muscle groups is ideal. Intensive work should be broken into smaller units. Best environment for fatigued muscles is light, dynamic work which stimulates blood flow to affected muscles and allows lactic acid waste removal. Job rotation may be difficult given many pharmacy job tasks are hand intensive.

13. Ensure proper foot wear and foot care to help reduce back, knee and foot fatigue.
   a. Athletic shoes are better for the feet. Shoes that are adjustable (i.e. laces, Velcro) are recommended. Slip-on shoes are not recommended for work use. Shoes should have cushioning under the heel and the balls of the toes. Shoes should have proper midsole thickness. A soft, flexible insole inside the shoe can also be worn. Shoes should be flexible and will reduce the chance of slipping. Flat, rubber outsole or similar low-profile pattern is ideal. Shoes should have a perforated or mesh top to allow for adequate ventilation.

14. Organize items placed on storage shelves to reduce lifting overhead or below the hips. Purchase additional step stools as needed. Reaching or lifting items above shoulder height (over 50 inches) is made easier with step stools. Overhead reach should not exceed 74” for infrequent overhead work. Overhead reach should not exceed 62” for tasks with high frequency and/or force.
a. Storage for step stools should be designated so that they are easily accessed by quickly stored.

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<thead>
<tr>
<th>Step Stool Option 1</th>
<th>Step Stool Option 2</th>
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<tbody>
<tr>
<td><img src="image1.png" alt="Step Stool Option 1" /></td>
<td><img src="image2.png" alt="Step Stool Option 2" /></td>
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</table>

1. Target
2. Amazon
3. Step Stool Universe

15. Provide ergonomics awareness training for employees to include manual materials handling and back safety. Please contact me directly for assistance with the setup of training.

Additional evaluation will need to be performed at the VTH Clinical Pathology in order to determine additional injury risks and potential solutions. Please contact Risk Management for further assistance with any of the recommendations made as well as for assistance in ensuring ergonomic design guidelines are met.

Report By:

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END OF REPORT