

Naval Facilities Engineering Command Ergonomic Risk Assessment for Naval Hospital

Laboratory

INTRODUCTION

This report summarizes the ergonomic risk assessment conducted at a hospital July 2002. A Certified Professional Ergonomist based this assessment upon a walk-through and interviews with workers, supervisors, an industrial hygienist, and safety personnel. The assessment process also incorporates results from OPNAVINST 5100.23F Ch. 23 Ergonomic Program, Appendix-A Ergonomic Survey Tools.

The laboratory area presents the opportunity to reduce the risk of Work-related Musculoskeletal Disorders (WMSDs). Recommendations to the command to reduce the probability of injury include considering equipment purchase¹, redesigning processes, and implementing administrative controls². Alterations to the workstation or work methods may require specific quality control and or safety practices to conform to the variety of regulating agencies.

Musculoskeletal Disorders (MSDs) are injuries and illnesses that affect muscles, nerves, tendons, ligaments, joints, spinal discs, skin, subcutaneous tissues, blood vessels, and bones. Work-related Musculoskeletal Disorders (WMSDs) are:

- Musculoskeletal disorders to which the work environment and the performance of work contribute significantly, or
- Musculoskeletal disorders that are aggravated or prolonged by work conditions.

Representative vendor information³ is included in the recommendations to assist in the evaluation of products and services. Recommendations to the command include gathering input from the workers, safety specialists, occupational health professionals, and other personnel to evaluate equipment before purchasing. This process will increase product acceptance, test product usability, and durability, and take advantage of worker experience.

The command may request additional funds from the Chief of Naval Operations (CNO) Hazard Abatement (HA) Program to abate the risk of injury. Naval Facilities Engineering Command (NAVFACENGCOM) manages the CNO Hazard Abatement Program, which is a centrally managed fund to correct safety and health deficiencies beyond the funding capabilities of the activity. Information about the HA program can be found on the Naval Facilities Engineering Command web site www.navfac.navy.mil/safety and in OPNAVINST 5100.23F. Ch 12 Hazard Abatement.

LABORATORY

Purpose of the Operation

The primary functions of the hospital laboratory are to perform analytic tests and procedures on body fluids and tissues taken from patients and to provide the results of these tests to physicians in order to confirm diagnosis, determine prognosis or ascertain or assess the patient's treatment. The laboratory medical staff function in an atmosphere of continual pressure from the responsibility of providing accurate and precise information with no margin of error. Results must be carefully checked and rechecked since the responsibility for treatment of the patient depends on the reports issued from the laboratory.

Population

Active-duty personnel work eight hours a day, 40 hours a week. Personnel rotate shifts to cover weekends and evenings. The laboratory operates 24 hours a day.

Injury Data

None available.

Observations

General: Equipment additions and layout design for the laboratory was not well planned. Specific work cells within the laboratory require further evaluation. Of the areas evaluated, equipment necessary for microbiology, chemistry and histology operations are not within the work cell. Separating the equipment from the work cell reduces productivity by requiring workers to transport material from one work area to another. Workers are also less attentive to equipment they are not actively monitoring, meaning a sample analyses could be complete but the worker is unaware of it. In addition, the increased handling of samples may increase the likelihood of damage, rework, or error. The goal is to provide a work environment that is sensitive to comfort, aesthetics and human needs by providing an atmosphere that helps to minimize the stressful environment.

Future planning might include movable modular workstations that can be expanded and easily rearranged or reused allowing minor or major reconfigurations with changes in new technology.

Hematology: Hematology is the area of the lab in which blood samples are analyzed to determine the number and type of red and white book cells and platelets. Complete blood counts are also performed. Specimens are also smeared on slides for microscopic inspection. Workers stand in front of equipment during the analysis but typically sit on laboratory stools while using microscopes and entering data. Refer to photo 1.

Chemistry: Blood, urine and other body fluids are analyzed in the chemistry lab for their chemical constitutes. Reagents preparation is often done as well. In most labs, chemistry will be the busiest area, with the greatest workload. The chemistry lab was divided among manual, semi-automated and automated processes. Workers stand in

front of equipment during the analysis process or sit when entering and retrieving data. Refer to photo 3.

Technicians / technologists pipette sixty percent of the time. Results from the Physical Factor Checklist (OPNAVINST 5100.23F.23 Appendix-A) considers this task a WMSD hazard due to the highly repetitive motion combined with awkward neck postures and bent wrist. In order to reduce the risk of injury, the hazard level should be reduced to the lowest degree technologically or economically feasible.



Left: Photo 1: Standing hematology workstation – recommended improvement: anti-fatigue matting or sit / stand stool.



Right Photo 2: Microscope workstation hematology – possible improvements detailed in recommendations below. Standing hematology workstation has anti-fatigue matting.



Left: Photo 3: Seated chemistry workstation – recommended improvement – adjustable laboratory or task chair.

Chair pictured does not offer back or shoulder support and is too low for the equipment (which is at a fixed height). In addition, four-base chairs are considered unstable

Histology : Histology prepares microscopic slides of tissue removed from patients during biopsy surgery and autopsy. Workers sit at desks for cutting. The area is too small for the tasks, i.e. equipment for histology is located distal to the work cell. The unique aspect of the histology lab's environment is the considerable cleaning problem caused by the large amount of paraffin used – often in the melted state.

Blood Bank: Blood undergoes compatibility testing, typing and cross matching for preparation and distribution. The current workstations appear appropriate for the task and do not present any ergonomic hazards at this time.

Microbiology: Microbiologists study specimens to isolate and identify disease-causing organisms and test for resistance to antibodies. Workers perform the preparation while standing and the microscopy while seated. Refer to photos 4-6.

As with the histology work areas, equipment necessary for microbiology is located elsewhere. Workers are continuously transporting samples from the microbiology room to other parts of the laboratory to process samples. Transporting samples interrupts process flow from other areas and can be more likely to introduce errors or increased processing time.

Cytology: Cytology is the specialized preparation and reading of microscopic slides of exfoliated cells, refer to photos 7 – 9.. Pap smears make up the majority of the tests performed. Results from the Physical Risk Factor Check List (ONAVINST 5100.23F.23 Appendix A) would consider this area a WMSDs hazard due to the highly repetitive hand motions in static postures while using the microscope. Reducing the WMSDs hazards should curtail the risk of injury.

Phlebotomy: Phlebotomists typically assume static postures with the back and neck deviated at 30 to 45 degrees for 4 or more hours a day. The patient chair is nonadjustable, therefore the phlebotomist must flex at the back and neck while drawing blood samples. Phlebotomy personnel often share work space with staff in specimen control and receiving. Results from the Physical Risk Factor Checklist (OPNAVINST 5100.23F.23 Appendix-A) consider this task a WMSD hazard due to the sustained awkward postures.

Ergonomic Issue Description:

Microcopy: Workers in the hematology and microbiology areas spend at least half their day performing microscopy and workers in the cytology area spend the entire day.

Microscopes are designed to maximize viewing capabilities rather than user comfort. Ergonomic stressors associated with microscope use include neck inclinations, bent back postures, non-neutral arm positions, wrist deviations, and contact stress to the forearms and elbows. While short-term microscope use can be tolerated, sustained awkward postures can cause fatigue and discomfort and place the employee at risk of developing a WMSD. Microscope work is a visually demanding task that requires workers to bend over the eyepiece. These postures can irritate soft tissues such as muscles, ligaments, and spinal discs.

Microscope operators who sit on laboratory stools typically dangle their feet or place them on a ring-style footrest. If the footrest is not adjusted properly, this posture can lead to contact stress on the popliteal fold (back of the knees), and pooling of blood in the feet.





Recommendations:

- Following are some basic guidelines for achieving and maintaining neutral body positions while using a microscope:
 - Eyes – eyepieces should rest just below the eyes with the eyes looking downward at an angle of 30 to 45 degrees below the horizontal; interocular distance of binocular eyepieces should be adjusted to ensure that both eyes are focusing comfortably. Ensure the environment is free of glare and reflections from overhead fluorescent light and the external and internal microscope lights are adjusted to compensate for this artifact.
 - Neck – the neck and head should deviate as little as possible, preferably no more than 10 – 15 degrees below the horizontal.
 - Back – the individual should be sitting erect, leaning the entire body slightly forward with the lower back and shoulder blades supported by the chair and or lumbar support.
 - Arms/wrists – the upper arms should be perpendicular to the floor, elbows close to the body (not abducted away), the forearms parallel to the floor and the wrist straight.
 - Legs – feet should rest firmly on the floor or a foot rest.
- Provide fully adjustable task chair or laboratory stool (with built-in solid footrest) to maintain the natural curve of the spine when sitting. Refer to seating criterion attachment A.
- Avoid contact pressure from the forearms resting on sharp bench or counter edges by placing padded edge protectors. Operating the focus or stage controls with the forearms separated from the bench (lifted) for extended periods can induce static loading which can be reduced with proper supports such as padded and tilted arm rests.
- If the laboratory geometry permits, utilization of cut-out work tables allow the operator to spread out and more efficiently employ auxiliary equipment necessary for microscopy observation. Adjustable workstations for technicians / technologists who exclusively perform microscopy is highly recommended. The adjustable feature enables the workers to vary their postures from seated to standing throughout the day. The ability to change postures reduces fatigue, and the risk of injury, to a single muscle group.
- Provide microscope positioning plates to raise, lower, and tilt the microscope position to meet the individual needs of the operator.
- Some older microscopes can be retrofitted with extended eye tubes. The tubes enable the operator to move away from the bench while maintaining a more supported neutral posture during extended observations.
- Ensure workers are educated in proper sitting posture and encouraged to take stretch breaks and rotate tasks frequently.
- Ensure sufficient knee and leg space is available to reduce twisted postures

- Recommended features when replacing microscopes include: swinging eyepiece tubes, extended eyepiece tubes, tilting riser. Refer to table 1.
- Further information on solutions for common laboratory equipment can be found at:
 - National Institute of Environmental Health Science Health and Safety Guide to Laboratory Ergonomics.
<http://www.niehs.nih.gov/odhsb/ergoguid/home.htm>.
 - Centers for Disease Control and Prevention – Laboratory Ergonomics Guide <http://www.cdc.gov/od/ohs/Ergonomics/labergo.htm>

Table 1: Microscopy - Representative Equipment

| Vendor | Product | Price | Figure |
|---|---|-------------|---|
| Edge Protector | | | |
| Alimed 1-800-437-2966 | SoftEdge (30" in length) #JA70459 | \$17.95 |  |
| | Deluxe Edge Rest (22" in length) #JA73075 | \$29.95 | |
| Microscope Accessories | | | |
| Scopeease http://www.imebin.com/IMEB/pages/scopeease.html 1-800-543-8496 | Scopeease Microscope tilter and arm supports | \$159-\$259 |  |
| Alimed www.alimed.com 1-800-437-2966 | Microscope Arm Support #JA73911 | \$120-\$180 |  |
| Ergosource http://www.thomaregister.com/olc/ergosource/rests.htm A-Z Microscope www.az-microscope.on.ca R&D Ergonomics www.morencyrest.com | Labtop- Adjustable forearm support | \$120-300 | |

| Vendor | Product | Price | Figure |
|--|---|--|---|
| Bay Optical www.bayoptical.com (415) 431-8711 Tel | Ergoadaptor Leika and Nikon model specific | \$860 |  |
| Bi Optics Paul Means 408-736-2116 | Bi Optics carries adjustable retrofit accessories for various microscopes. | Contact the vendor for products and pricing specific to each microscope model | |
| Bay Optical www.bayoptical.com (415) 431-8711 | Extended Eye Tube Leika model specific | \$1300 |  |
| Furniture | | | |
| Third and Fourth Microscope Service John Massey 217-425-2657 | Microscope Table DV 100 Dual Viewing Microscope Table 48"x32" Table with height adjustable option | \$400 \$900 |  |
| Alimed 1-800-225-2610 | Hand Crank Adjustable Height Work Tables | \$805- \$1,325 |  |
| New Dominion 1-800-850-8559 X132 | Hand Crank Adjustable Height Table | \$1,123- \$1,325 | |

| Vendor | Product | Price | Figure |
|---|---|---|---|
| Lab Safety 1-800-356-0783 | Adjustable Workbenches | \$1018- \$1190 | |
| Vestil 1-800-348-0868 | Adjustable Work Benches | \$965 (30"x60") | |
| Alimed 1-800-225-2610 | Dyna-Lift Retrofit a table to become height adjustable | \$449 |  |
| Chairs | | | |
| ErgoCentrix Ergocentrix.co m | ergoF200 | \$180 GSA |  |
| ErgoSource Ergosource.co m | Spider | \$250 | |
| Alimed | 2966Advantage Surgeon's Chair JA93-1001 | \$2,495 (chair) \$599 (armrests) |  |
| Hag www.haginc.com Ken Krauss/Bonnie Momsen Chicago, IL (312)321- 0761 | Hag Capisco* | \$442 |  |
| ErgoResource Charles Hartman (919) 661- 0300 (GSA Contract) | Hag Capisco*- Vinyl Cover Seat Height Adjusts from 16" to 20" Seat Height adjusts from 20" to 27" (ideal for bench work) | \$436.25 \$445.74 | |



The Capisco can be straddled and used to support the chest and upper extremities. The Capisco has a large range of adjustability and could be used as a laboratory stool.

Prolonged Standing: Workers in hematology, microbiology, and phlebotomy spend extended periods standing on hard surfaces. Hospital policy does not allow workers in the laboratory to wear soft-soled shoes. Workers in hematology complained of back, leg, ankle, heel, and foot pain from the long hours of standing.


Recommendations:


- Consider allowing the medical staff to wear soft-soled shoes.
- Provide medical staff with innersoles.

Phlebotomy:

Recommendations:

- Providing adjustable phlebotomy chairs will greatly reduce the occurrence of awkward back and neck postures because the patient can be positioned to best meet the needs of the medical provider.

| Vendor | Product | Price | Figure |
|---|----------------------------|-------|---|
| Draw Chairs and drawing aids | | | |
| Custom Comfort Inc 1-800-749- 0933 www.customconf ort.com | A1201R-AT and A1201L-AT | |  |

| Vendor | Product | | Price | Figure |
|---------------|---------|-----------------|-------|---|
| Custom Inc | Comfort | Comfort support | |  |