

Reducing Repetitive Strain Injuries in Vancouver/Richmond Regional Hospital Pharmacies

A project in partnership with Children's and Women's Health Centre
of BC

Final Report

OHSAH Archive



Occupational Health & Safety Agency for Healthcare in BC

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Executive summary

This initiative was originally a collaboration between the pharmacy departments at Children's and Women's Health Centre (C & W), St. Paul's Hospital, and Vancouver Hospital. Ergonomic risk identification and assessment were conducted at all three sites, however, C & W was chosen as the site to pilot ergonomic interventions. A pre- and post-intervention evaluation was conducted to determine the effects of introducing various control measures to the pharmacy departments.

The pre-intervention phase consisted of an ergonomic risk assessment consisting of observations, analysis of injury statistics, and a pre-intervention questionnaire. Development of control measures for the intervention phase involved a focus group meeting with pharmacy technicians, pharmacists, an MSIP Advisor, and union and management representatives. Fourteen specific control measures were developed and implemented over a 10 month period. During this time, some controls were eliminated because the tasks were no longer performed.

Results of the pre-intervention phase showed that ergonomic risk factors were associated with each pharmacy workstation. The questionnaire revealed that the chemotherapy room, sterile manufacturing area, and the task of delivering medication carts to wards were associated with the highest discomfort ratings. A significant correlation was found between the workers' shift length and the level of discomfort reported. Seventy-three percent of the staff met one of the case definition criteria for MSI. That is, they reported experiencing discomfort in the past 7 days or had at least moderate pain occurring at least once per month or for more than a week in duration over the past year.

The post-intervention questionnaire showed an increase to 88% of staff that met one of the case definition criteria for MSI. The sterile manufacturing area and delivery of medication carts to wards were associated with the highest discomfort ratings. The increase may be due to a short intervention period (not allowing time for the effects of the control to be experienced) or an increase in awareness of MSI signs and symptoms due to the education sessions that were provided.

The dispensary computer workstation was the only workstation that showed a significant decrease in the average discomfort rating ($p < 0.05$). In general, staff found the control measures to be better than the former system or equipment. MSI education for pharmacist and pharmacy technicians, a change in the delivery of medication carts to the ICU, and replacement of a bookshelf were found to be particularly favourable control measures.

A handbook entitled "An Ergonomic Guide to Hospital Pharmacies" was an additional outcome of this initiative. The handbook is a compilation of the data collected on the risk factors associated with pharmacy tasks and potential control measures. This handbook was distributed to all hospital pharmacies in BC. Additional copies are available free of cost.

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Project objectives

1. To identify ergonomic concerns and risk of musculoskeletal injury (MSI) to pharmacy employees;
2. To develop control measures to minimize or reduce any found concerns and risks;
3. To use the information gathered to assist in the development of general guidelines for preventing and reducing injury to pharmacy employees.

Background

This project was funded through OHSAH's Partnership Initiatives Program (formerly Stakeholder Driven Initiatives Program). The project originally began as a collaboration between Children's and Women's Health Centre (C & W), St. Paul's Hospital, and Vancouver Hospital. As the specifics of the project were defined, it was determined that C & W would be the primary site to pilot ergonomic interventions. St. Paul's and Vancouver Hospitals would be used to verify the generalization of the interventions and to provide input for the collaborative ergonomic recommendations.

Management and workers at C & W were concerned about the risk of musculoskeletal injury (MSI) to pharmacists and pharmacy technicians. This concern developed in response to an increase in MSI and time-loss claims. At C & W in particular, over 85% of staff who had worked in the pharmacy for five years or more reported experiencing pain and discomfort when working or were no longer employed in the pharmacy due to injury.

Further investigation was required to assess the risk of injury associated with specific pharmacy tasks.

This report outlines:

- The findings of the ergonomic assessment that was conducted
- The results of the evaluation of meeting the project objectives

Methods

Pre-intervention

Between January and May 2002, various tools and methods were used to collect information, identify and assess the risk of MSI to workers, and develop appropriate control recommendations. Direct observations, photographs, and videotape were used to identify and assess risk factors (Appendix 1 provides definitions of risk factors). Injury statistics were collected and analyzed, and staff job duties and shift schedules were also considered. A pre-intervention questionnaire was administered in May 2002. Staff were asked to rate discomfort experienced during or after working at each of the pharmacy workstations they worked at, to

reveal tasks that may cause pain or discomfort and to receive input from pharmacists and pharmacy technicians on what they felt could be done to prevent or minimize pain or discomfort.

Intervention

Focus group

OHSAH ergonomists conducted a focus group on October 29, 2002. Two pharmacists, three pharmacy technicians, two pharmacy coordinators, a union representative, and an MSIP Advisor participated in the focus group discussions. For each area of the pharmacy, concerns identified through the staff survey and ergonomic assessments were presented. Participants added additional concerns and brainstormed potential risk control strategies. OHSAH ergonomists also suggested potential risk control strategies, which were discussed among the group.

Appendix 2 is a summary of the focus group discussion and provides a summary of the areas of concern, potential control strategies suggested, and risk control prioritization.

Implementation plan

Ten specific controls were proposed by OHSAH based on the following criteria:

- Current risk of injury in selected area of pharmacy
- Impact and potential benefit of control in reducing risk of injury at Children's and Women's Health Centre
- Province-wide application of control
- Priority placed by focus group on areas of pharmacy
- Estimated cost
- General feasibility in implementation

Appendix 3 provides a description of the rationale and potential benefit of each proposed control measure.

After further discussion with C & W Pharmacy representatives, four additional controls were discussed and added to the list. These 14 controls comprised the Pharmacy Implementation Plan developed in February 2003 and are listed below:

- Develop inverted vial holder (Sterile Manufacturing)
- Develop IV bag support (Sterile Manufacturing)
- Purchase laminar flow hood elbow rests (Sterile Manufacturing)
- Rearrange shelving in work area (Sterile Manufacturing)
- Purchase new trays (Sterile Manufacturing)
- Rearrange computer workstations and replace circular bookshelf with rectangular one (Dispensary)
- Purchase telephone headsets (Dispensary)
- Develop "optional" raised platform/bench (Dispensary)
- Purchase new fixed workspace (Wardstock)

- Implement master requisition list (Wardstock)
- Purchase heating slab (Non-sterile Manufacturing)
- Find more useful location for height adjustable table (Non-sterile Manufacturing)
- Purchase new medication transport carts (Cart Fill)
- Conduct MSI education and training for pharmacists and pharmacy technicians

As further investigation was conducted on the actual implementation of the controls, purchase of a heating slab was removed from the plan as it was associated with a task that is now rarely performed. Purchase of telephone headsets was deemed to be a control that would be pursued only if funds remained after all other controls were implemented.

Controls were implemented from March 2003 to January 2004.

Post-intervention

A post-intervention questionnaire was administered in June 2004. Staff were asked to rate pain and discomfort experienced during or after working at each pharmacy workstation. Pharmacists and pharmacy technicians also provided feedback on the implemented control measures for each area and workstation of the pharmacy that they use.

Differences in means between pre-intervention and post-intervention were analyzed using an independent sample t-test. Data were also analyzed using Pearson correlation between variables.

Results

Pre-intervention

Assessment of risk factors of musculoskeletal injury

The assessment revealed that there are two main worker groups at the C & W Pharmacy: pharmacists and pharmacy technicians. Each group of workers has distinctly different tasks in each area of the pharmacy.

Appendix 4 lists each area of the pharmacy and includes a task overview, potential risk factors and concerns, and potential control measures. Information was collected in April and May 2002.

Consult “An Ergonomics Guide for Hospital Pharmacies” (OHSAH, 2004) for additional potential risk factors and control measures.

Pre-Intervention questionnaire

Nineteen staff (13 full-time, 1 part-time, 3 casual; 2 did not indicate job status) completed a pre-intervention survey. Five were pharmacists, 13 were pharmacy technicians, and 1 did not indicate job classification. Results should be interpreted with caution because of the small sample size.

The chemotherapy room, sterile manufacturing area (editing, compounding, and checking rooms), and delivery of medication carts to wards had average discomfort ratings of 5 or greater on a scale of 0 to 10, where 0 = no discomfort and 10 = unbearable. The ward stock / storage area had the lowest discomfort rating (2.75 out of 10). See Table 1 for a comprehensive list of discomfort ratings.

A significant correlation (Pearson coefficient = 0.878; $p < 0.05$) was found between the workers' shift length and the level of discomfort. A greater level of discomfort is reported in respondents working longer shifts. Shift length is also correlated with how long discomfort lasts when associated with the cart fill area (Pearson coefficient = 0.849; $p < 0.05$).

Researchers have offered these "case definitions" for MSI:

- Nordic-week – pain in the last 7 days (Kuorinka et al., 1987)
- NIOSH definition – at least moderate pain occurring at least once per month or for more than a week in duration over the past year (Bernard et al., 1994)

Fourteen of the 19 staff (73.6%) met one of the case definition criteria for MSI. Thirteen of the staff (68.4%) met the Nordic-week definition and reported pain or discomfort in the past 7 days associated with at least one workstation. Thirteen staff (68.4%) met the NIOSH definition and had at least moderate pain occurring at least once per month or for more than a week in duration over the past year.

Post-intervention

Seventeen staff (13 full-time, 1 part-time, 2 casual; 2 did not answer) completed a post-intervention survey. Six were pharmacist, 11 were pharmacy technicians, and 1 did not answer. Results should be interpreted with caution because of the small sample size.

The new medication transport carts were not evaluated because implementation was not complete at the time of surveying.

The sterile manufacturing area (editing, compounding, and checking rooms) and delivery of medication carts to wards had average discomfort ratings of 5 or greater on a scale of 0 to 10, where 0 = no discomfort and 10 = unbearable. The dispensary computer workstation had the lowest discomfort rating (1.46 out of 10). See Table 1 for a comprehensive list of discomfort ratings.

Pearson correlations did not find any significant relationships between variables.

Fifteen of the 17 staff (88.2%) met one of the case definition criteria for MSI. Twelve of the staff (70.6%) met the Nordic-week definition and reported pain or discomfort in the past 7 days associated with at least one workstation. Thirteen staff (76.5%) met the NIOSH

definition and had at least moderate pain occurring at least once per month or for more than a week in duration over the past year.

Decreases in average reported discomfort were seen for the following workstations: delivery of medication carts to ICU, delivery of medication carts to wards, dispensary computer workstations, dispensary bench, and chemo room (Table 1). However, statistical analysis (t-test) found no significant difference in mean reported discomfort pre- versus post-intervention for any workstation except the dispensary computer workstations. On average, the level of discomfort reported in the post-intervention phase associated with the dispensary computer workstation was significantly lower than the level of discomfort reported in the pre-intervention phase ($p < 0.05$).

Table 1 Comparison of average discomfort ratings pre- and post-intervention

Workstation	Pre-intervention	Post-intervention
Ward stock / storage area	2.75	4.08
Delivery of medication carts to ICU	3.00	2.29
Cart fill area	4.50	4.67
Delivery of medication carts to wards	5.38	5.00
Dispensary computer workstations*	4.86	1.46
Dispensary bench	4.78	3.20
Sterile manufacturing area	5.5	6.21
Chemo room	6.00	3.83

* denotes a significant difference between pre- and post-intervention discomfort

Evaluation of controls

Wardstock

Addition of height adjustable table

Seven out of 10 respondents reported using the height adjustable table “always”, “most of the time” or “sometimes” while 3 reported using the table “rarely” or “never”. All respondents felt that the table was easy to adjust ($n = 9$) and useful ($n = 11$). All respondents felt the height adjustable table was “much better” or “a little better” compared to the former ward stock setup.

Delivery of medication carts to ICU

Of the 5 respondents, 4 felt that the current ICU delivery process was “much better” than the previous ICU delivery process. One felt it was “a little better”.

Dispensary

Rearrange computer workstations

Ten of the 13 (76.9%) respondents felt that the rearrangement of the computer workstations was “very useful” or “a little useful” while three of the respondents felt that the changes were “not very useful” or there was “no difference”. Six of the 8 (75%) respondents found that the MSI education provided about how to set up a computer workstation was “very useful” or “a little useful”.

Replace circular bookshelf with rectangular one

All of the 14 respondents felt the rectangular bookshelf was “much better” or “a little better” than the circular bookshelf. Eight (57.1%) felt the rectangular bookshelf provided “much more” working space while 6 felt it provided “a little more” working space. Half of the respondents felt the storage space of the rectangular bookshelf was “much more” or “a little more” while half of the respondents felt it was “a little less” or there was “no difference”.

Height adjustable bench

Two of the 11 (18.2%) respondents used the height adjustable table “most of the time” or “sometimes” while nine (81.8%) used it “rarely” or “never”. Four (36.4%) respondents found it “very” or “somewhat” easy to adjust while one respondent found it was very difficult to adjust. Compared to the former countertop, four of the 10 respondents (40%) found the height adjustable table was “much better” or “a little better”, 1 found it “much worse” and 5 (50%) felt it made no difference.

Countertop platform

Five of the 13 (38.5%) respondents used the countertop platform “most of the time” or “sometimes”; 8 respondents (61.5%) reported never using it. Five of the 13 (38.5%) respondents found the countertop platform “very useful” or “a little useful” while 5 (38.5%) found it was “not very useful” and 3 (23.1%) found it made no difference.

MSI education for pharmacists and pharmacy technicians

Fourteen of the 15 respondents (93.3%) felt the MSI education was “very useful” or “a little useful” while 1 respondent felt it was “not very useful”. All respondents found the educational material was “very relevant” or “a little relevant” to their job. Sixty-nine percent of respondents felt the length of the session was “just right”.

Rearrange shelving in work area (Sterile manufacturing)

In the editing room of the sterile manufacturing area, shelving units were widened, lowered, and centered over the main working counter. Seven of the 9 respondents (77.8%) felt the adjustments to the shelves made “much more” or “a little more space”; two respondents felt the adjustments made no difference. Five of the 9 respondents (55.6%) felt the adjustments to the shelves meant “much less” or “a little less” reaching was required while working. Two respondents felt the adjustments to the shelves meant “a little more” or “much more” reaching was required. Two respondents felt the adjustments made no difference. Seven of the 9 respondents (77.8%) felt overall that the adjustments to the shelves in the editing room were “very helpful” or “a little helpful”. Two respondents (22%) felt they made no difference.

Develop IV bag support (Sterile manufacturing and chemo room)

Respondents did not find the IV support bag to be a useful alternative to hanging the IV bags from the bar in either the sterile manufacturing area or chemo room. They reported using the IV support bag “rarely” or “never”, likely because they found it “not very useful” or made “no difference”. Compared with hanging bags, respondents found the IV bag support to be “worse” or made “no difference”.

Discussion

This project was conducted with three purposes. The first purpose was **to identify ergonomic concerns and risk of musculoskeletal injury (MSI) to pharmacy employees**. This project identified risk factors, including force, repetition, awkward posture, static posture, and contact stress, associated with each pharmacy department and for specific pharmacy tasks. Information collected on these risk factors was incorporated into the OHSAH handbook “An Ergonomic Guide to Hospital Pharmacies”.

The sterile manufacturing area (including chemo room) appeared to be associated with a higher risk of injury than the other workstations in the pharmacy. The cart fill area and delivery of medication carts to wards also appear to be associated with a high risk of injury. The correlation between the workers’ shift length and the level of discomfort confirms the relationship between duration of exposure to risk factors and the level of discomfort.

The second purpose of this project was **to develop control measures to minimize or reduce any found concerns and risks**.

Control measures were developed through a participatory process involving pharmacists, pharmacy technicians, pharmacy coordinators, a union representative, and MSIP Advisor.

The results of the pre-intervention questionnaire showed that 73.6% of the staff met one of the case definition criteria for MSI. This percentage increased to 88.2% for the post-intervention questionnaire (that is, after control measures were implemented). These results suggest a 13% increase in the number of staff meeting one of the case definition criteria of MSI. A possible explanation may be that a greater number of staff reported signs and symptoms of MSI as a result of the MSI education they received. When staff completed the pre-intervention survey, they may have had limited knowledge about signs and symptoms of MSI. When they completed the post-intervention survey, many had received education and training on risks of MSI. The increase in staff meeting one of the case definition criteria for MSI in this project is similar to other projects where staff awareness via formal or information education increased the amount of reporting.

The dispensary computer workstation was the only workstation that showed a significant decrease in average discomfort ratings between pre- and post-intervention. No significant change in the observed average discomfort ratings may be a result of data analysis limitations due to the small sample size or the influence of chronic injuries. It is also likely that 6 months was not a long enough evaluation period to allow for the staff to adjust to changes made and experience the effects. A follow up evaluation would be useful to further assess the level of discomfort of staff.

Despite increase in the percentage of staff meeting one of the case definition criteria for MSI, and limited changes in the reported discomfort ratings, respondents reported that many controls were better than that which was replaced (for example, the delivery of medication carts to the ICU, height adjustable table, more space in sterile manufacturing, usefulness of the MSI education session.) Other control measures may not have received a favourable

evaluation due to poor training and introduction to the control. This indicates the importance of adequately educating and training staff on the use of all implemented control measures.

The third purpose of this project **was to use the information gathered to assist in the development of general guidelines for preventing and reducing injury to pharmacy employees.** As mentioned previously, a handbook was created to address this purpose. The handbook was distributed to all hospital pharmacies in BC and made available to all healthcare workers in BC.

“An Ergonomics Guide for Hospital Pharmacies” is for anyone who needs practical information on how to make hospital pharmacies a safer place to work. Employers will find information that will help them work through the ergonomics process, detecting potential musculoskeletal injury (MSI) risks and implementing effective control measures to prevent injury in hospital pharmacies. Workers will find specific health and safety information that will help them carry out their day-to-day tasks safely and efficiently. The handbook can be used when designing a new pharmacy, renovating an old pharmacy, purchasing new equipment, responding to incidents in the pharmacy, or when developing and implementing a proactive risk management program.

Conclusion

The control measures implemented as a result of this initiative are expected to reduce the risk of MSI to workers within the Pharmacy Department at C & W Hospital. It is recommended that C & W Hospital continue to make MSI reduction an active, ongoing practice.

References

Bernard, B., Sauter, S., Fine, L., Petersen, M., Hales, T., 1994. *Job task and psychosocial risk factors for work-related musculoskeletal disorders among newspaper employees*. Scand J Work Environ Health, 20(6), 417-26.

Kuorinka, I., Jonsson, B., Kilbom, A., Vinterberg, H., Biering-Sorensen, F., Anderson, G., Jorgensen, K., 1987. *Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms*. Applied Ergonomics, 18(3), 233-7.

OHSAH, 2004. *An ergonomics guide for hospital pharmacies*. Vancouver, BC: OHSAH.

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Appendix

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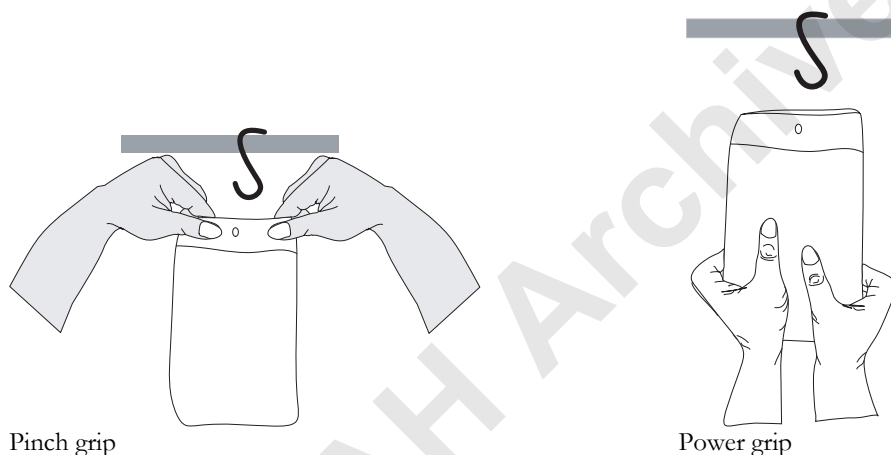
Appendix 1: Definitions of risk factors

Force

Forceful exertion increases the body's energy demands and physically stresses the muscles, tendons, ligaments, and joints, which increases the risk of injury. For example, lifting heavy boxes of medications may require forceful exertion of the muscles of the lower back and upper limbs.

Power grips versus pinch grips

A power grip involves the entire hand. A pinch grip uses the fingertips only. A power grip is preferable because it takes less muscular effort than a pinch grip to provide the same amount of force.

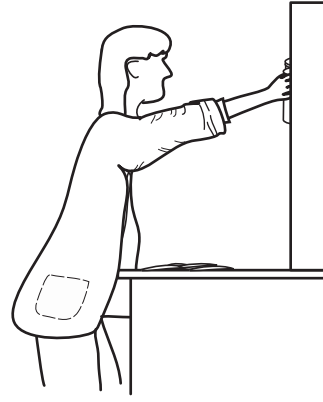
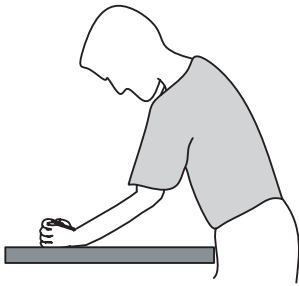


Repetition

A repetitive task is a task that uses the same muscles repeatedly. For example, filling syringes with medication may be a repetitive task.

Awkward posture

Awkward posture occurs when the body has to work in a position that is not considered neutral. Neutral postures are those in which the muscles, tendons, and joints function optimally and require the least amount of effort to maintain. Awkward posture increases the amount of stress on muscles, tendons, ligaments, and joints and is of greatest concern when it is sustained for prolonged periods or combined with other risk factors. For example, reaching for items on high shelves may result in awkward back and shoulder postures. What is considered awkward may be different for each body part.

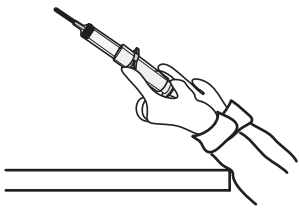


(left) Looking down at a low countertop may result in awkward neck and upper back posture. (right) Reaching for items on a high shelves may result in awkward back and shoulder postures.

Static posture

Static posture is a body position that requires physical effort and is held for a prolonged period. The level of risk that static posture presents depends on the level of muscular exertion and the posture being held. For example, looking down at work surfaces in laminar flow hoods may place the neck and back in a static posture. If muscles do not have enough time to recover from the static posture, they may tire quickly.

Contact stress



Contact stress occurs when body parts come in contact with hard or sharp objects, for example, when depressing syringe plungers with the palm of the hand or resting the wrists against a sharp table edge. Contact stress concentrates force on the underlying tissues and interferes with normal blood flow and nerve function. This can result in injury to tissues beneath the skin.

Appendix 2: Focus group summary

Date: Tuesday, October 29, 2002
Location: Pharmacy Library, Children's and Women's Health Centre

Attendees Carlo, pharmacist Elaine Lee, Project Coordinator
Kathleen, Pharmacist Justin LoChang, Project Coordinator
Laurie, Pharmacy tech. Dan Robinson, Ergonomics Consultant
Patty, Pharmacy tech
Sandra, Pharmacy tech.
Paul Koke, Coordinator
Lynne Taylor, Receptionist
Marianne Tofan, Coordinator
Natasha White, OH&S

Purpose

A focus group session was held to:

- Provide an update of the project to pharmacy representatives
- Provide an outline of the results of the staff survey and ergonomic assessment
- Identify and clarify areas of concern within each area of the pharmacy
- Allow pharmacy representatives to contribute to the development of control strategies through brainstorming and discussion
- Prioritize areas to focus on for control strategies

Areas of concern

For each area of the pharmacy, concerns identified through the staff survey and ergonomic assessment were presented first. Pharmacy representatives added any additional concerns and brainstormed potential risk control strategies. Finally, suggestions for potential risk control strategies (proposed by OHSAH) were presented.

The following section contains a list of all of the concerns appended by the pharmacy representatives during the brainstorming session to the list presented by OHSAH in the PowerPoint presentation:

1. Dispensary computer workstations (pharmacists)

- Mouse falls off; needs replacing
- Keyboard trays; when pulled out to type, need to reach to write
- When answering the phone, neck and shoulder bent
- Computer system- size and resolution of screen; changing between multiple screens; all activity uses the computer; increase in keyboarding since Pyxis (May/ June)

2. Dispensary bench (pharmacy tech.)

- 3 work surface heights- What is correct?
- Checking computer- too low, no place for mouse, lack of space
- Opening bottles

3. Cart fill

- Lifting high above shoulder (even empty cassettes)
- Computer workstation- mouse/ keyboard gets knocked

4. Cart transport

- Pushing vs pulling
- Wheel maintenance
- What is the best system?
- All cassette holders on wards are too high (e.g. above Pyxis med stations)

5. Wardstock

- Reading labels
- Mini-bags- extra stock stored high
- Boxes of solution- heavy and jammed in too tight; greater than 12L
- Lip on shelf above
- Hard to get close to load for lifting (stuff on the floor)
- Shelves height
- Boxes of old stuff (CPS)

6. Receiving

- Accumulation of biohazardous materials
- Challenging workload

7. Long-term (non-sterile) area

- Too much stuff; no space for mouse

8. Control / editing room

- Very heavy door
- Not enough counter space
- Counter height- too low, drug trays on wall block view
- Book shelves too high; lack of space to open reference books
- Keyboard trays loose
- Phone is used a lot
- Setting heavy trays (with IV bags)
- Checking computer- too much stuff
- Label printer is noisy; works poorly, jams; too much stress

9. Compounding room

- Old hoods (e.g. 2nd pump hood) is not great
- Lifting 2 to 3 L bags; need to hold hook so only have one arm available to lift
- Need to stand to use syringe gun

10. Checking room

- Heat sealer requires too much force
- Table is too low for reading
- Syringe labels are bent in bags so are difficult to read
- Difficult to wrap elastics around bags
- Chair is broken
- Hands get caught in pass-thru handle
- Transport carts are in the way

11. Chemo room

- Time pressure
- Long durations without breaks (but getting better)
- Staffing/ scheduling

12. Oncology office

- Desk is too deep, requires reaching
- Screen faces windows creating glare

Potential control strategies

The following section contains a list of all of the ideas and suggestions for potential control strategies discussed during the brainstorming session:

1. Dispensary computer stations (pharmacists)

- Headset for telephone
- Touch screen or pen tablets for computers
- Job rotation – rotate between checker and order entry
- Mouse arms / mouse rests
- Better / proper location for the mouse
- Switch binders to an electronic database
- Move door buzzer
- Give door buzzer to technicians counter as well
- Larger computer screens
- Smaller CPU's (save space)

2. Dispensary bench (pharmacy tech.)

- Height adjustable table (perhaps the one in the long term area?)
- Move computer to the far left end of the dispensary bench
- Check orders from a paper copy instead of the computer (eliminate the computer)
- Smaller CPU
- Suspend monitor from supports in the wall (save counter space by taking monitor off counter)
- Bottle holder, to reduce force required when opening bottles
- Use snaptops rather than childproof caps
- Check on vendor's ability to change caps (away from childproof caps)
- A bottle opener for childproof caps?

3. Cart fill

- Lighter material for cassettes
- Better handles for cassettes
- Exchange individual cassettes instead of the entire thing
- Smaller CPU at computer station
- Smaller typewriter
- Print labels from a computer instead?
- Streamline transfer system by eliminating transfers between carts
- Cut off the top of the Herman Miller Carts (improve visibility)
- Preventative maintenance schedule for carts

4. Cart transport

- Keep cassettes in ward, and change delivery mode (no exchange?)
- Hang cassettes low (in the wards) wherever possible
- Ward level education
- Redesign ward layouts (joint effort with wards)
- Better cart system
- Optimize use of Pyxis, to reduce the amount of drugs needing transport
- Adjustable cart handles
- More effective exchange system (like ward stock)

5. Wardstock

- Adjustable bedside tables
- Easily transportable step stools
- Better use of space
- Ladder
- More staff to put away stock
- Remove old materials / outdated meds
- Better requisition sheet – use a master list with all medications and wards, to avoid making repeated trips while stocking for wards

6. Receiving

- Better platform truck (smaller)

7. Long-term (non-sterile) area

- Increase counter space
- Make methadone in larger batches – will need more storage space, and a method of dealing with 2L liquid volumes
- New coffee grinder
- Training on proper working heights
- Heating pad for making ointments (makes mixing easier – check UK suppliers?)

8. Control / editing room

- Push plates for doors or slide doors
- Wireless mouse
- 2nd monitor at checking table
- Re-design storage area to reduce reaches and awkward postures
- Better keyboard trays
- Best practice guidelines for tray handling
- Telephone headsets
- Smaller trays
- Lighter trays
- Set limits for the amount of meds and materials placed on trays (keep weight lower)
- Handles for trays
- Better label printer (less noisy)

9. Compounding room

- Telephone headset
- New fume hoods / laminar flow hoods
- Trial different syringes – use one with least force requirement
- Allow 1 technician per hood only
- Arm rest for fume hoods
- Use IV bag for arm rest
- Wrist cast for repeated syringing
- Best practice guidelines for syringe handling and IV bags

10. Checking room

- Use whole arm for heat sealer
- Push plate for door or slide door
- Move bins closer to counter
- Change labeling system for syringes (make them easier to read and sort)
- Use smaller elastic bands to wrap meds (easier to wrap)
- New chairs

- Bigger handle on the pass-through doors
- Anti-fatigue matting
- Remove the carts that are stored in the room

11. Chemo room

- New fume hood
- Raise the level of the hood ~ 6 inches
- Rules for availability of C2 person – there should always be a C2 on schedule
- Avoid consecutive days in the chemo room
- Job rotation / split days (reduce repetition)

12. Oncology office

- L-shaped or desk with corner cut-out
- Move desk to corner (reduce glare)
- Chair with adjustable arm rests

Risk control prioritization

The focus group pharmacy representatives identified three main areas of concern that they felt should be a priority for risk control: *Dispensary Computers, Cart Fill / Cart Transport, and the Sterile Area*. Within each area, controls were prioritized by allowing each participant to identify what they perceived to be the three most important controls. The controls that were identified as important by the participants include:

(NOTE: The number in parentheses indicates the number of pharmacy representatives that identified the control strategy as one of their three most important controls for each area.)

1. Dispensary computers:

- Telephone headset (6)
- New book shelf (4)
- New position for mouse / new mouse (3)
- Smaller CPU (2)
- Rearrangement of workstation to improve work flow (2)
- Job rotation within shift (2)
- Larger monitor (1)
- Wall-mounted monitor (1)
- Chair with arm rest (1)

2. Cart fill / cart transport:

- Redesign of medication rooms on wards (7)
- New delivery system for transporting meds (5)
- Optimize Pyxis use to minimize the amount of meds transported (4)

- Better (newer) cart systems (3)
- Computer workstation rearrangements (2)

3. Sterile area:

- Redesign of the prep-technician area (5)
- New TPN label printer (5)
- Push plates for doors or slide doors (4)
- Best practice education for syringing and general working heights (3)
- New laminar flow hoods (2)
- Better keyboard trays (1)
- A second computer screen (1)

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Appendix 3: Proposed ergonomic controls

The controls outlined below were proposed by OHSAH to reduce the risk of musculoskeletal injury at Children's and Women's Health Centre Pharmacy, based on consideration of the following criteria:

- current risk of injury (based on ergonomic risk assessment and injury data) in the selected area of the pharmacy;
- anticipated impact of a control in reducing risk of injury in the pharmacy;
- the potential for province-wide application of a control;
- priority ranking by pharmacy representatives during the focus group;
- cost; and
- general feasibility of implementation.

The criteria for selecting the controls that have been proposed by OHSAH include a requirement for those controls to have the potential for generic application in pharmacies throughout British Columbia. In addition to the control strategies outlined below, additional controls that are specific to Children's and Women's Health Centre Pharmacy may be developed through consideration of other ideas generated during the focus group with pharmacy representatives. It is recommended that resources provided by Children's and Women's Health Centre Occupational Health and Safety department be used and any changes implemented in the Pharmacy be documented in detail.

1. Sterile area

Proposed controls:

A. Inverted vial/ medication bottle holder (custom device from Vancouver General Hospital (VGH))

- Holds inverted vials up to 200 mL in spring-loaded metal clamp
- Can be adapted for use in a laminar flow hood (i.e. can be hung from a hook) or on a countertop (i.e. on a stand)

Potential benefit:

- Minimize awkward hand and wrist postures that are required to hold a vial in an inverted position and to manipulate syringe with other hand.

Rationale:

- There have been high injury rates related to syringing at C&W, St. Paul's, and VGH; at C&W Pharmacy between 2000 and 2002, 14 out of 31 incidents were related to syringing
- Province-wide application

Approximate cost:

- \$100 each (including parts and labour)

B. IV bag support

- Plexiglass slanted surface to place IV bags while injecting manual additives; approximately 3 to 4 inches above the surface of the laminar flow hood

Potential benefit:

- Minimize awkward posture and high force associated with lifting and hanging IV bags while allowing sufficient airflow

Rationale:

- There have been high injury rates related to the sterile area at C&W, St. Paul's, and VGH; at C&W Pharmacy between 2000 and 2002, nine out of 31 incidents were related to sterile room activities
- Province-wide application
- High risk of injury

Approximate cost:

- \$200 per support

2. Dispensary computer workstations

Proposed controls:

A. Rearrangement of the computer workstations, replacement of circular bookshelf with a rectangular bookshelf

- See diagram on following page
- Also includes desktop rearrangement

Potential benefit:

- Improved communication and coordination between all pharmacists at computer workstations

Rationale:

- High risk of injury at C&W Pharmacy; between 2000 and 2002, four out of 31 incidents were related to computer workstation activities
- Province-wide application of control
- Priority placed by pharmacy representatives on areas of pharmacy

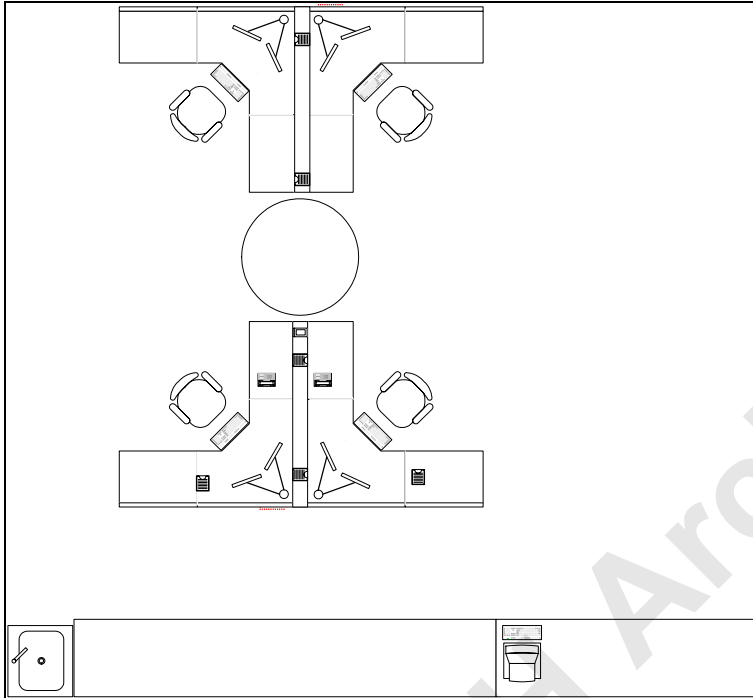
Approximate cost:

- \$300 to 700, depending on style

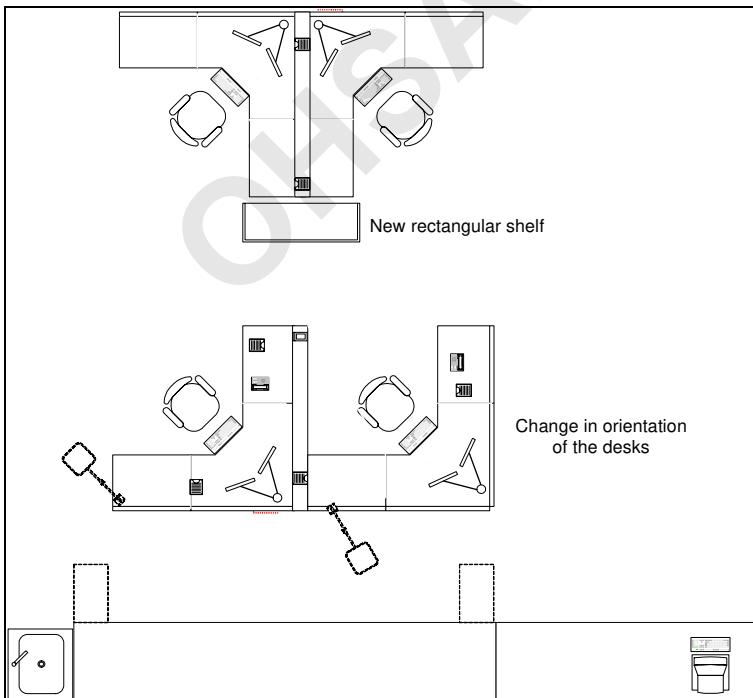
Children's and Women's Health Centre Pharmacy

Proposed Layout for Dispensary Computer Workstation

Before



After



B. Telephone headsets

- Hands-free telephone headsets

Potential benefit:

- Improved communication and coordination between all pharmacists at computer workstations

Rationale:

- High risk of injury at C&W Pharmacy; between 2000 and 2002, four out of 31 incidents were related to computer workstation activities
- Province-wide application of control
- Priority placed by pharmacy representatives on areas of pharmacy

Approximate cost:

- \$20 to 90 each, depending on style

3. Wardstock

Proposed control:

A. Designated wardstock workstation

- There was no designated wardstock workstation; carts or other available surface were used
- Includes a new table/bench or a cart to place all required medications onto
- A new table/ bench would allow the workers to sit or stand while performing wardstock duties as well as provide storage space for wardstock equipment
- Could be located near back door

Potential benefit:

- Improve work flow
- Decrease congestion in area

Rationale:

- Impact and potential benefit in reducing risk of injury as a result of reaching and bending that is performed to accommodate the variety of surfaces used to perform this task at Children's and Women's Health Centre; potential to improve wardstock task efficiency and decrease stress related to the time constraints of this task

Approximate cost:

- Cost of table/bench ~\$600
- Cost of new cart ~ \$300

B. Master requisition sheet that shows all wards on a single list

- Lists all wards and medications on a single sheet

Potential benefit:

- Decrease multiple trips to collect the same meds
- Improve work flow
- Decrease congestion in wardstock area

Rationale:

- Impact and potential benefit in reducing risk of injury at Children's and Women's Health Centre; would reduce number of trips to shelves, reduce frequency of reaching, and reduce duration of task by making more efficient

Approximate cost:

- Labour costs to design and test new requisition sheet; no capital expenditure required

4. Dispensary workbench

Proposed control:

A. "Optional" raised countertop

- Covers approximately half the depth of the dispensary bench and is raised approximately 3 inches

Potential benefit:

- Allows many workers of varied heights to work comfortably
- Is portable and can be used when desired, and stored out of the way when not required

Rationale:

- Province-wide application
- High risk of injury; at C&W Pharmacy between 2000 and 2002, five out of 31 incidents were related to non-sterile activities

Approximate cost:

- Approximately \$200

5. Non-sterile manufacturing

Proposed control:

A. Heat slab for ointment levigation

- Heat slab placed under glass surface

Potential benefit:

- Minimizes the force required to mix powder into ointments

Rationale:

- Province-wide application
- High risk of injury; at C&W Pharmacy between 2000 and 2002, five out of 31 incidents were related to non-sterile activities

Approximate cost:

- Approximately \$150

6. Control room – Sterile manufacturing

Proposed control:

A. Reorganization of control room shelving

- Provide workers with a better line of sight to work surface and with easier access to shelves containing frequently used items

Potential benefit:

- Improves workflow and decreases congestion
- Minimize awkward posture associated with reaching to shelves and looking down to work surface

Rationale:

- High risk of injury; at C&W Pharmacy between 2000 and 2002, nine out of 31 incidents were related to sterile room activities
- Identified as a high priority area by focus group participants

Approximate cost:

- Labour costs to design and test new shelf organization
- Possible capital expenditure required, depending on materials required for reorganization

7. Training and education

Proposed control:

A. Training and education

- Provide workers with a better understanding of topics such as:
 - Signs and symptoms of musculoskeletal injury
 - Risk factors for musculoskeletal injury
 - Choosing the correct workstation height
 - Organization of workstation
 - How to adjust computer workstation components
 - Best practices of syringe tasks, sterile room tasks

Potential benefit:

- Increase awareness of potential risk of injury
- Prevention of injury due to awareness
- Empower workers to make good choices about their health and safety

Rationale:

- Studies show that re-education on a regular basis has demonstrated to have a positive effect on health and safety training

Approximate cost:

- OHSAH in kind contribution
- Wages of workers during training time

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Appendix 4: Task overview, potential risk factors and control measures

1. Dispensary Computer Workstations

A. Task Overview (Pharmacists)

- Orders for medications are sent via the tube system or faxed from the wards, and placed in the pharmacist's inbox.
- The orders are entered into a computer workstation, and then placed in one of two outboxes, either "to be made" or "to be tubed".
- Labels are printed on the label printer located on the dispensary bench.
- When the "to be made" orders have been filled, they are placed on a cart, and pushed to a pharmacist.
- The pharmacist (the one who did not enter the order into the computer) checks all orders. This is usually done at the computer workstation.

B. Potential Risk Factors and Concerns

- The door may contribute to awkward neck posture for the pharmacist closest to the dispensary door.
- Using the door buzzer on the ledge above and between the two pharmacist workstations may require awkward arm and shoulder posture.
- Placing the finished orders into the "outbox" on the ledge above and between the two pharmacist workstations may contribute to awkward arm and shoulder postures.
- Rotating the circular bookshelf may require excessive force.
- Keyboarding for long durations at computer workstations may require repetitive motions of the hands and wrists, as well as awkward posture.
- Checking orders at poorly arranged computer workstations may contribute to awkward neck, shoulder, back, arm, wrist, and hand postures when keyboarding, writing, and reading.

C. Potential Control Measures

- Rearrange the workstation layout to allow the pharmacist closest to the dispensary door to view both the door and the dispensary bench.
- Place a door buzzer at each pharmacist workstation to allow both pharmacists to open the door without having to reach.
- Provide both pharmacist workstations with a separate "outbox" to place finished medication orders.
- Remove the circular bookshelf and replace with a smaller rectangular bookshelf that would allow employees to walk from station to station, and eliminate the need to exert high forces to rotate the shelf.
- When setting up dispensary computer workstations, consider the:

- logical process flow of medication orders, beginning with the request for the medication order and ending with delivery of the medication to the ward
- frequency and type of communication between pharmacy technicians and pharmacists (for example, speaking or passing order forms or orders)
- number of different workers using the workstation
- variety of tasks performed at the workstation

2. Dispensary Bench

A. Task Overview

- Pharmacists place “to be made” order sheets into an “outbox” and at the same time print labels for the medication (the printer is on the dispensary bench). Pharmacists will also place certain orders in a “to be tubed” outbox, for those medications that can be sent immediately by the tube system (these are usually medications that come pre-packed in standard sizes and are already prepared).
- Pharmacy technicians retrieve the order sheets and the labels and place them on the bench in preparation for making the orders. Making orders involves several tasks, depending on the type of medication being made:
 - Syringe filling
 - Pill crushing
 - Mixing two or more fluids into a common container
 - Pill counting
 - Pill sorting
 - Measuring liquids
- When orders have been completed, they are labeled and placed on a small cart behind the bench where the orders are double-checked by the pharmacists.

B. Potential Risk Factors and Concerns

- Reaching for and preparing medications may contribute to awkward neck and shoulder postures.
- Preparing medications may require repetitive arm, hand, and wrist motions.
- Uncapping and capping medication bottles may require repetitive, forceful finger motions.
- Congested working area due to small space, multiple personnel, and the presence of a cart to place unchecked medications.
- The “to be tubed” outbox can be difficult to reach, as it is located in an area behind the dispensary computers, requiring the pharmacy technician to have to walk around the entire workstation to access it.
- Standing for long periods of time on hard flooring may fatigue the back and legs.

C. Potential Control Measures

- Provide a platform or pullout shelf on the dispensary bench to place unchecked medications, instead of using the cart which takes up working space near the dispensary bench
- Provide a smaller cart to place the unchecked medication on, which would allow the medication to be transported to either of the two pharmacists for checking.

- Determine proper working counter height for majority of staff
- Provide an adjustable countertop or an optional countertop addition.
- Place the “to be tubed” outbox in a more central location for pharmacists and pharmacy technicians.
- Attach pullout shelves near the ends of the dispensary bench, to create temporary U-shaped work areas for the pharmacy technicians. This would increase the working surface.
- Investigate the feasibility of a “V-shaped” bottle opener to aid in opening medication bottles
- Provide a mechanism to support/hold medication bottles when filling syringes. The device should be adjustable in the tilt angle, to allow liquid to flow out when filling syringes but pushed up when not being used.
- Investigate the feasibility of using a syringe gun.

3. Cart Fill Area

A. Task Overview (Pharmacy Technicians)

- Orders for the wards are printed from the computer workstation nearby.
- The pharmacy technician then gathers the required medications for each patient’s individually labeled “mini-cassette” and places them inside. Some pharmacy technicians leave the mini-cassettes on the C-cart (large transport cart), while others pull the mini-cassettes out of the transporter and place them on another cart with a lower work surface height.
- A pharmacist checks all orders for accuracy and completion.
- Cassettes are delivered to the wards at 3 p.m. (See description under “Cart Transport”.)
- Once cart fill orders are finished, the pharmacy technician completes extempts for next day (this will usually start after lunch).

B. Potential Risk Factors and Concerns

- Lifting mini-cassettes to and from the transport cart may contribute to repetitive, awkward shoulder postures, and may require high force
- Placing medications in cassettes on the C-carts may result in repetitive and awkward shoulder, arm, elbow, and wrist postures.
- Filling cassettes that are low in the delivery cart may contribute to awkward trunk flexion.
- Pulling a C-cart may contribute to awkward trunk and shoulder postures
- Pushing or pulling a C-cart may require high force.

C. Potential Control Measures

- Replace old C-carts (transport carts) with newer, lighter, shorter carts, which allow employees to push rather than pull.
- Ensure the regular maintenance of the cart casters.
- Ensure the work surface is at the appropriate height for medication preparation

4. Cart Transport

A. Task Overview – Process Flow for Using the C-carts (Pharmacy Technicians)

- The C-cart is released from hook on the wall.
- The cart is pulled to the appropriate ward on the 3rd floor. If the C-carts are not used, the cassettes are placed on a general use cart and pushed to the wards.
- On the ward, old medications are removed and put in the “returns” bag. They will either be thrown out or recycled. Reusable medications, such as liquid doses, are left in the ward.
- The old cassette is removed and replaced with the new cassette.
- The cart is pulled back to the pharmacy.

B. Potential Risk Factors and Concerns

- Pulling the C-cart may result in high forces exerted, while in an awkward shoulder posture
- Contact stress on cart handle.
- Heavy lifting above shoulder height, when replacing cassettes.

C. Potential Control Measures

- Replace the old C-carts (transport carts) with lighter, shorter carts, which would allow employees to push rather than pull.
- Modify the cart to create a “harness” or U-shaped handle that would allow employees to push rather than pull the cart
- Use a motorized push-puller to transport the carts.
- Use a general cart to transport, as opposed to the C-carts
- Ensure regular maintenance of the cart casters.

5. Replenishing ward stock

A. Task Overview (Pharmacy Technicians)

- The pharmacy technician receives a list of required medications for each ward.
- Medications for each ward are picked from the storage shelves; the pharmacy technician will often use a hand held shopping basket or cart if available to gather the medications.
- The medications are placed in delivery bags for each ward and stored on an available cart or shelf in the ward stock area.
- Medications are delivered to their respective wards.

B. Potential Risk Factors and Concerns

- Reaching for items stored on high shelves may result in awkward shoulder posture.
- Bending down for items stored on low shelves may result in awkward back and shoulder postures.
- Repeated trips are taken to retrieve the same medication. The drugs are collected by ward as opposed to type, and thus the same medication is often retrieved multiple times.

- The medications are at risk of falling and breaking or falling and injuring someone as there is no 'guard' or 'catch' to prevent movement. This is especially dangerous in the event of an earthquake.
- Pharmacy technicians working in the area are cramped and do not have a designated area to collect the required medications.

C. Potential Control Measures

- Attach a guard or catch on the shelves to prevent medications from falling.
- Provide a proper working surface to place collected medications.
- Change the requisition forms so that drugs are collected by type rather than by ward to prevent repeated trips to collect the same medication.
- Reorganize shelves to reduce the need to reach above shoulder height. Store lighter or less frequently used items on the top shelves.
- If high shelves must be used, provide stepstools so workers can access the shelves without excessive reaching.

6. Storage and Receiving

A. Task Overview

Shipping, receiving, storing, and ordering supplies

- Supplies (drugs, office, etc.) arrive by delivery; often multiple boxes are stacked on a wooden pallet. Supplies are unloaded onto shelves manually.
- Expired medications are packed and returned to manufacturers.
- Computer records are kept of in- and out-going items.

Disposal of biohazardous materials

- Biohazard materials are placed into designated containers.
- The receiver uses a special cardboard box insulated with a yellow plastic bag and places the containers in the box. The box is sealed, weighed, and placed in the hallway where it is picked up by environmental services and disposed of.

B. Potential Risk Factors and Concerns

- Opening and lifting boxes of supplies may result in awkward back and shoulder postures and may require high force.
- Reaching for items stored on high shelves may result in awkward shoulder postures.
- Bending down for items stored on low shelves or pallets may result in awkward back and shoulder postures.
- Standing for long periods on hard surfaces may fatigue the back and legs.

C. Potential Control Measures

- Use a cart or dolly to transport boxes through the ward stock area rather than carry them.
- Open larger boxes and unload the contents individually (as opposed to lifting and carrying the single, heavy box).
- Use smaller biohazard boxes, to ensure the weight lifted is below the acceptable limit.
- Keep biohazardous waste and supplies for shipping in close proximity to minimize handling.

7. Non-Sterile (Long-term care)

NOTE: During the life span of this project, several of the tasks performed in the non-sterile area were modified or eliminated due to changes in the Pharmacy department service delivery. For example, the volume of creams made and pills packed has been reduced significantly. The descriptions below reflect the information collected in April and May 2002.

A. Task Overview

- Orders are filled on the long-term care dispensary bench including pills, creams, and suspensions.

B. Potential Risk Factors and Concerns

- Pressing down with spatulas may result in repetitive and awkward shoulder, elbow, hand, and wrist movements, as well as forceful exertions of the shoulder, arm, hand, and wrist.
- Manually crushing pills (for example, using a mortar and pestle) may result in repetitive and awkward shoulder, elbow, hand, and wrist movements as well as forceful exertions of the shoulder, arm, hand, and wrist.
- Popping pills from blister packs may result in awkward wrist and hand postures.
- Looking under the lid of a pill packing machine may result in awkward neck and back postures.

C. Potential Control Measures

- Move more frequently used items closer to the workers.
- Remove drawers to allow workers to move closer to the edge of the work surface with adequate leg room while seated.
- Purchase pre-made ointments whenever possible, to minimize the amount of manual mixing required.
- Provide an automated pill crusher to crush pills.
- Use lower work surface height for power tasks such as making cream. Provide an electric mixer to combine powders with creams whenever possible.
- Use higher work surface height for precision tasks such as counting pills or filling syringes.
- If workers have to make suspensions manually, ensure that they use working surface heights suitable for exertion of downward force.

8. General – Filling Syringes

Risk Factors/ Concerns:

- Drawing up and adding medications may require repetitive, forceful pinch grips. These are usually one-handed tasks that may require force as a result of working with:
 - gloves or gloves covered with alcohol
 - viscous medications
 - large volume syringes

- small bore needles
- Depressing syringe plungers may result in contact stress on the palms of the hands.
- Preparing medications may result in repetitive arm and wrist motions as well as awkward neck and shoulder postures.
- Holding inverted vials or medication bottles may require static wrist posture and awkward hand posture.
- Resting elbows on the work surface may contribute to contact stress.

Controls:

- To minimize the risk of contact stress, provide soft padding on the work surface, or bevel the sharp edges of countertops.
- Provide a mechanism for supporting inverted medication bottles. This will allow staff to use two hands to draw syringes, and not have to manually support the bottle.
- Use a higher work surface height, as syringe filling is a precision task.
- Provide an automated syringe filling device such as a syringe gun.
- Depress plungers slowly when using filters.

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ABOUT THIS DOCUMENT

The Occupational Health and Safety Agency for Healthcare (OHSAH), which operated from 1998-2010, was a precursor to SWITCH BC. Conceived through the Public Sector Accord on Occupational Health and Safety as a response to high rates of workplace injury, illness, and time loss in the health sector, OHSAH was built on the values of bipartite collaboration, evidence-based decision making, and integrated approaches.

This archival research material was created by OHSAH, shared here as archival reference materials, to support ongoing research and development of best practices, and as a thanks to the organization's members who completed the work.

If you have any questions about the materials, please email hello@switchbc.ca or visit www.switchbc.ca