

# SPPH 565 Worksite Evaluation Casino Table Games Dealers

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## **Introduction and Objective:**

A study I read from SKYCITY Casino in Auckland, New Zealand found a relatively high incidence of musculoskeletal disorders and pain or discomfort in casino table games dealers. The most common injuries and discomfort were in the upper extremities (wrists, elbows and shoulders) followed by the back and leg. In addition, a majority of the reported injuries and discomfort were to the right side of the body. (Edwin, 2003) This prompted me to pursue my ergonomics project at a casino. I made contact with Anita Lam, the Labour Relations Advisor for one of the casinos in the Vancouver area. The results of the SKYCITY Casino study were consistent with the information I received from Anita. The main complaints she receives from her employees (from most common to least common) are: wrist pain, shoulder pain, back pain, neck pain and leg discomfort from prolonged standing. The objective of my project is to identify and assess the risk factors for injury for table games dealers and provide recommendations and suggestions to eliminate and/or minimize the risks.

The casino has three levels of dealers dependent upon on the amount of training and experience of the dealer. I focused this project on level one dealers who deal both blackjack and baccarat. Blackjack tables require that the dealer be standing whereas the dealer sits at a baccarat table. The blackjack and baccarat table layouts are shown on pages 7 and 9 respectively. The dealers have a 15-minute break every 45 minutes, and work 6, 8 or 10 hour shifts for a total of 40 hours per week. The casino is open 24 hours per day and therefore dealers may have to work night shifts. Dealers may deal only one game type for the duration of a shift, or a combination of the two depending on demand from the customers. The training to be a level one dealer is 40 hours per week for two weeks. During training, dealers are taught the rules of the games, proper dealing and card handling skills and technique. They are also taught chip cutting and counting techniques and must be able to pick up 40 chips in 20 seconds or less.

The casino has a strict no video or photography policy on the casino floor. I was able to obtain video footage of the head dealer trainer, Rob, in the casino training room. The table set up in the training room is exactly as it is on the casino floor. Rob demonstrated dealing for both blackjack and baccarat. In addition, I was allowed to walk around the casino floor and observe various dealers. The follow pages outline my findings and recommendations.

## **Background Evidence and Literature Review**

### **Sitting vs Standing**

At this casino, blackjack is dealt standing up, while baccarat is dealt sitting. The following is a brief literature review of the association between lower extremity and lower back discomfort and prolonged sitting or prolonged standing. In a study examining leg swelling, comfort and fatigue when sitting and standing, it was found that prolonged sitting increased swelling of the lower extremities as a result of decreased leg muscle activity, and lead to discomfort (Chester, Rys, & Konz, 2002). Another study found that lower extremity swelling while sitting was also a result of thigh and hip area vein compression by the seat of the chair resulting in poor circulation (Shvartz, Gaume, Reibold, Glassford, & White, 1982). Lower extremity swelling was also observed in standing subjects, and was found to be higher while standing than sitting (Seo, Kakehashi, Tsuru, & Yoshinaga, 1996). Lower extremity swelling while standing is the result of venous pooling and decreased muscle activity. Using a survey to examine subjects' level of comfort, Chester et al, 2002, found subjects rated sitting as the most comfortable, followed by using a sit/stand stool, and standing as the least comfortable. The average comfort rating for sitting was 6.3, while the average comfort rating for standing was 4.1 on a scale that ranged from 1-9, with 9 being very comfortable. The lowest comfort ratings while sitting were for the ankles and feet (5.9 and 5.1 respectively). The lowest comfort ratings while standing were ankles, lower legs and feet (4.9, 4.8 and 3.9 respectively). A study performed at the University of Waterloo found that 13 out of 16 subjects (university students with an average age of 24 and no previous history of back problems) experienced low back discomfort when standing for a period of two hours (Gregory & Callaghan, 2008). A study in Denmark examined the association between low back pain and standing and sitting. It was found that workers who spent their entire shift standing were 1.55 times more likely to experience low back pain than workers who did not stand at all during their shift (OR=1.55). Workers who spent half of their shift standing and the other half sitting, were more likely to experience low back pain than workers who did not stand at all during their shift (OR=1.40). Workers who sat down for the entire duration of their shift were 0.84 times more likely to experience low back pain than workers who stood for the duration of their shift. Another interesting finding in this study is that workers who must keep full concentration throughout the duration of their shift are 1.28 times more likely to experience low back pain than workers performing monotonous, easy tasks

requiring minimal concentration. (Xu, Bach, & Orhede, 1997) This finding is very relevant, as dealers must keep full concentration for the duration of their shift.

Overall, health problems associated with prolonged standing are: lower extremity discomfort, fatigue, lower extremity swelling and venous blood pooling, low back pain and entire body fatigue. From the above, it is evident that dealers are at risk of experiencing low back pain and other adverse effects from either prolonged standing or sitting.

### **Wrist Injuries – Carpal Tunnel Syndrome**

In the wrist, the median nerve passes through the carpal tunnel. The median nerve carries impulses to and from the brain controlling action of the hand and fingers as well as transporting information about temperature, pain and touch sensations. The median nerve is surrounded by the tendons of the fingers. These tendons are enclosed in a sheath, which provides lubricating fluid necessary for smooth and normal tendon functioning. With repetitive or excessive movements of the fingers and wrist, secretion of the lubricating fluid may not be sufficient, resulting in inflammation and swelling. This swelling can put pressure on and squeeze the median nerve resulting in pain, tingling and numbness in the thumb and fingers. If repeated inflammation occurs, fibrous tissue can form and thicken the tendon sheath resulting in decreased tendon movement and thumb and finger mobility. The occupational factors that may contribute to carpal tunnel syndrome are repetitive hand motions, strong gripping, awkward hand postures, vibration and mechanical stress on the palm. (Canadian Centre for Occupational Health and Safety, 2008). Mortazavi (2008) examined table games dealers at two casinos in Nevada to determine if there is a significant association between dealing and carpal tunnel syndrome. Subjects were interviewed, examined by a medical professional as well as tested with a vibro tactile tester under the supervision of a biomedical engineer and a neurologist to diagnose carpal tunnel syndrome. A significant association between dealing and carpal tunnel syndrome was found. Subjects that had 11 or more wrist extensions (number of times wrist was in an extension posture) per minute were 21 times more likely to test positive for carpal tunnel syndrome than those with less than 11 wrist extensions per minute. In addition, subjects that had 9 or more wrist flexions per minute were 16 times more likely to test positive for carpal tunnel syndrome than those with less than 9 flexions per minute. Both dealer age and length of time the subject worked as a dealer did not have a significant effect on the association between dealing and carpal tunnel syndrome. Based on the findings, the researcher recommends that the casino management offer a

training program to teach dealers correct movement patterns and posture to minimize the risk of injury.

### **Neck Problems and Shoulder**

I was unable to find data examining the association between dealing and neck and shoulder injuries. However, the arm and neck movements and positions of a dealer are relatively similar to those of assembly line workers or packers working at waist height (repetitive elbow movements, neck flexion and shoulder abduction, adduction and flexion). A study examining upper extremity disorders in assembly line workers and packers found increased prevalence of neck and upper extremity disorders compared to shop workers whose tasks were less strenuous and repetitive. It was found that 70% of the assembly line workers and packers experienced at least one neck or upper extremity disorder. Tenosynovitis of the wrist and shoulder were the most prevalent of all disorders (53%). Tension neck was found to be the most common neck disorder and had a 37% prevalence. There was a low prevalence of elbow disorders (epicondylitis, 8%), and all cases were associated with another syndrome, either or both of tension neck or tenosynovitis. Tenosynovitis was the most common shoulder disorder, followed by humeral tendinitis which had a prevalence of 12%. (Luopajarvi, Kuorinka, Vitolaninen, & Holmberg, 1979)\* Tenosynovitis is the inflammation of the lubrication secreting sheath surrounding a tendon. The occupational risk factors for tenosynovitis are: repetitive wrist motions, repetitive shoulder motions, sustained hyper extension of arms and prolonged load on shoulders. The symptoms include: weakness, swelling, pain, burning or dull ache of affected area. Tension neck syndrome results from tight neck muscles. The occupational risk factors for tension neck syndrome are prolonged restricted posture and the main symptoms are neck pain and stiffness. Epicondylitis (elbow tendinitis) results from inflammation of the tendons in the elbow. The occupational risk factors for epicondylitis are: forceful or repetitive rotation of the forearm with simultaneous bending of the wrist. (Canadian Centre for Occupational Health and Safety, 2005)

\* This study is from 1979, however it has been cited numerous times in much more recent articles and therefore, I feel that it still provides relevant and useful information.

## Blackjack Dealing

Task Analysis	Associated Risk Factors
After players place their bets, the dealer sweeps their right arm across the table in front of the bets to signal the start of dealing	Shoulder flexion and adduction – shoulder crosses the midline of the body
<p>Deal cards to players</p> <ul style="list-style-type: none"> <li>- slide card out of card shoe with left hand and transfer it to right hand</li> <li>- place card in the “play zone” of each player with right hand – anywhere from 1 to 7 players at a table</li> <li>- place one card in the dealer’s “play zone”</li> <li>- repeat so that all of the players have two cards</li> <li>- depending on the value of each players’ cards, they will decide whether or not to accept another card (hit) or stay, if they choose to hit, the dealer deals them another card (players may hit more than once)</li> <li>- dealers need to be able to add card values quickly and accurately to ensure that the game is played fairly and correctly</li> </ul>	<p>Prolonged standing throughout.</p> <p>Repetitive wrist flexion and extension, repetitive elbow movement, repetitive shoulder abduction, adduction and flexion, and repetitive and prolonged neck flexion.</p> <p>Prolonged concentration and attention to detail – adding.</p>
<p>Collect cards and place them in the discard box on the right hand side of the table</p> <ul style="list-style-type: none"> <li>- when a player busts, their cards are collected with the right hand using the left hand to guide the cards</li> <li>- when more than one player’s cards are being collected, the cards are gathered in the right hand by sweeping the right arm along the table from right to left while using the left hand to push the cards into the right hand</li> <li>- cards are placed in the discard box with the right hand</li> <li>- cards must be collect in order so that if a dispute occurs, the cards can be replayed to resolve the dispute</li> </ul>	Repetitive wrist flexion and extension, repetitive elbow movement, repetitive shoulder abduction, adduction and flexion, and repetitive and prolonged neck flexion.
<p>Payout or chip collection</p> <ul style="list-style-type: none"> <li>- when a player beats the dealer, the dealer provides him/her with a payout, the dealer gets the chips from the chip tray with their right hand and places them next to the player’s bet <ul style="list-style-type: none"> <li>o blackjack pays 3:2 and the dealer must be able to calculate the payout value quickly and accurately</li> </ul> </li> <li>- when a player busts, the dealer collects their chips with their right hand and places them in the chip tray</li> <li>- chips are scooped off of the table quickly by flipping them into the palm of the hand with the fingers</li> </ul>	Neck flexion, repetitive wrist and elbow flexion, repetitive and quick finger movements and concentration and attention to detail.
Dealer must always keep left hand on card shoe (when not needed for other tasks) with fingers over cards to prevent cheating	Prolonged and static wrist, elbow and shoulder posture
All shuffling is done by the automatic shuffler	None



Figure 1: This picture shows the table layout for blackjack with seven players.

## Baccarat Dealing

Task Analysis	Associated Risk Factors
After players place their bets, the dealer sweeps his/her right arm across the table in front of the bets to signal the start of dealing	Shoulder flexion and adduction – shoulder crosses the midline of the body
<p>Dealer will deal two cards to the player and two cards to the banker</p> <ul style="list-style-type: none"> <li>- dealer removes four cards from the card shoe with his/her left hand</li> <li>- the cards must be alternated between player and banker, so the first card is placed in front of the chip tray and the second beside, the third card is placed under the first card and the fourth card is placed under the second card</li> <li>- the dealer then slides the two cards that are in front of the chip tray to the player zone with their right hand and the two cards that are beside the chip tray to the banker zone with his/her left hand (cards are face down)</li> <li>- player's cards are then flipped over by rotating the right wrist clockwise and banker's cards are flipped over by rotating the left wrist counter-clockwise</li> <li>- the dealer must quickly and accurately add the values of the player's cards and the banker's cards to determine if any more cards need to be dealt or if the game is over and who wins</li> <li>- the maximum number of cards dealt in a baccarat game is 6</li> </ul>	<p>Prolonged sitting throughout.</p> <p>Repetitive wrist and elbow flexion, repetitive shoulder flexion and adduction</p>
<p>Payout or chip collection</p> <ul style="list-style-type: none"> <li>- when a player loses, the dealer collects his/her chips with both hands and places them in the chip tray located directly in front of the dealer</li> <li>- chips are scooped off of the table quickly by flipping them into the palm of the hand with the fingers</li> <li>- when a player wins, the dealer gathers chips from the chip tray and</li> </ul>	Repetitive wrist and shoulder flexion and repetitive and quick finger movements
<p>Discards played cards</p> <ul style="list-style-type: none"> <li>- after the payout and chip collection, the dealer collects the cards from the player and banker and places them in the discard box to his/her right with their right hand</li> </ul>	Repetitive shoulder adduction and flexion.



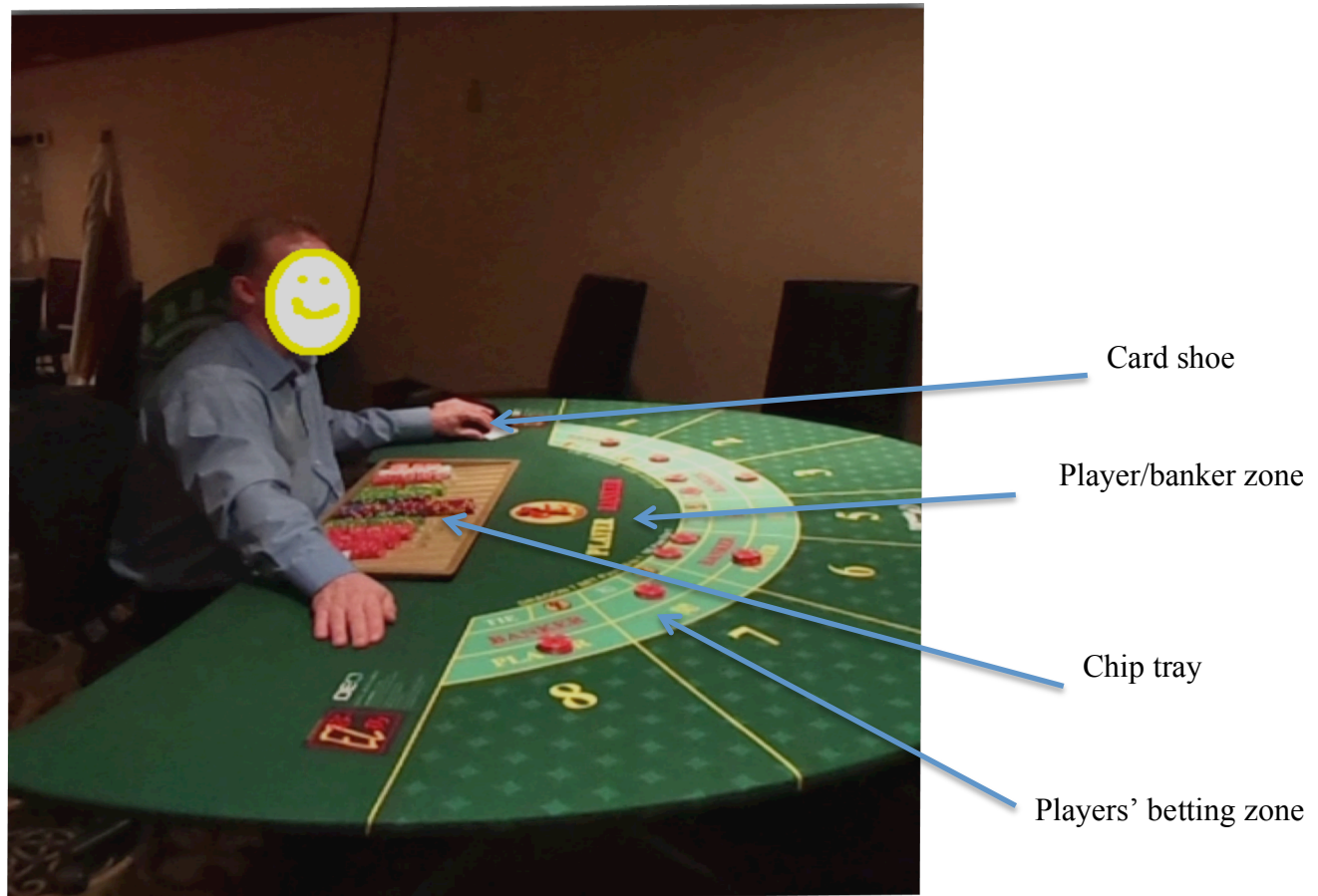


Figure 2: This picture shows the table layout for baccarat with eight players.

### **Summary of risk factors:**

Casino table games dealers are susceptible to various physical risk factors for work related musculoskeletal disorder (WMSDs) including the following: prolonged standing (blackjack), prolonged sitting (baccarat), repetitive wrist, shoulder and elbow movements, repetitive and quick finger movements, neck flexion, shoulder abduction, adduction and flexion, and back bending. In addition, dealers are subject to psychosocial risk factors including: high levels of and prolonged noise, bright lights and stimulation, stressful situations, and prolonged concentration and attention to detail. Individual factors such as age, fitness level, weight, smoking, diabetes and pre-existing health problems can also increase the risk of WMSDs. The above stated physical risk factors are further examined and quantified using various risk assessment tools outlined on the following pages.

## **Risk Assessment**

I used multiple tools to perform a risk assessment to quantify the risks identified from the task analysis for both blackjack and baccarat dealing. I used the Moore-Garg Strain Index, the WorkSafe BC Worksheet A and B, ACGIH TLV and the RULA and the REBA. Additionally, I used the Genaidy (1993) guidelines as it is one of the only assessment tools that can be used for finger motion other than typing, and allowed a comparison of the repetition of motions between blackjack and baccarat. I chose not use the NIOSH equation, ACGIH lifting TLV, liberty mutual tables or the manual handling checklist because no lifting, pushing, pulling or carrying of objects was required of the dealers. The results of my assessments are outlined below and the completed assessments are attached on pages 23 through 36.

### *Moore-Garg Strain Index*

The Moore-Garg strain index was developed by J. Steven Moore and Arun Garg to provide a quick and systematic assessment of the risk of injury to the hands, wrists and elbows. Dealers perform repetitive motions with their hands, wrists and elbows, and therefore, I used the Moore-Garg strain index tool for both the blackjack and baccarat video footage. For both clips, I used the worst case scenario of paying out/collecting the chips from the players zone and examined both the left and right hands and arms. When dealing blackjack, dealers predominantly use their right arm, wrist and hand. Upon assessment, the right hand had a strain index of 10.1, indicating hazardous risk and the left hand had a strain index of 1.5 indicating that paying out/collecting chips is safe, or is not a risk for the left hand. When dealing baccarat, dealers use their left and right hands relatively equally. Both the left and right hands had a strain index of 6.75, which indicates some risk and changes may be necessary.

### *WorkSafe BC Worksheet A and B*

The WorkSafe BC Worksheet A allows the identification of risk factors that may contribute to musculoskeletal injury and quantifies them as moderate risks, while Worksheet B further examines the risks identified in Worksheet A to determine if they are high risk factors. High risk tasks require immediate intervention to eliminate or minimize the risk. I used Worksheets A and B for both blackjack dealing and baccarat dealing. I examined the entire duration of the dealer's shift, and assumed the shift was eight hours long and the dealers only dealt one game type for their entire shift and did not rotate to another game. Worksheet A identified repetition of wrist, elbow, shoulder and neck and awkward posture of the neck as blackjack and baccarat as moderate risks. It should be noted that back bending greater than 30° does occur, but is not for more than two hours

total per day and is therefore not classified as a risk. Worksheet B further identified repetition of shoulders, elbows and wrists as a high risk for both blackjack and baccarat, indicating immediate intervention is needed. The same shoulder, elbow and wrist motions are performed for more than six hours total per day. Awkward posture was not classified as a high risk because neck flexion was not more than 45°. Awkward posture remains a moderate risk and immediate intervention at this time is not necessary. One of the downfalls of the WorkSafe BC worksheets is that they may overlook factors resulting in “false negatives” and real injuries being missed. Back bending greater than 30° may be an example of this, as it is not classified as a risk because it does not occur for greater than two hours total per day and therefore, I used the RULA and the REBA to further examine the risk associated with back bending.

#### *ACGIH TLV for Hand Activity*

The American Conference of Governmental Industrial Hygienists provides a threshold limit value (TLV) and an action level for hand activity to evaluate the risk factors associated with hand and wrist activity. The TLV is 0.78 and the action level is 0.56. This tool is used to assess the hand activity level and level of effort for a typical posture of a short cycle, or repetitive task. The hand activity level is found using a 0-10 scale rating with 0 being no motion for most of the time and 10 being rapid, constant motion or difficulty keeping up with the task. The calculated result for the task, which is compared to the TLV and action level, is a ratio of normalized peak force over 10-hand activity level. For blackjack dealing, I evaluated the freeze frame of the most common posture, dealing cards with the right hand while the left hand is resting on the card shoe. The calculated ratios are 0.14 and 2.0 for the left and right hand respectively. The left hand ratio of 0.14 is well below the action level, and therefore no intervention is required. The right hand ratio of 2.0 is well above both the action limit and TLV and therefore, intervention is required.

#### *REBA/RULA*

Both the RULA and the REBA provide a comprehensive and validated assessment of the risk of developing a musculoskeletal injury associated with a particular task of a job. The RULA assesses the risk for the shoulder, elbow, wrist, neck and trunk. The REBA assesses the risk for the neck, trunk, legs, shoulder, elbow and wrist. I chose to use the REBA for the blackjack dealers because it is used to assess the entire body and provided a better assessment than the RULA because the blackjack dealers are standing up. Conversely, I chose to use the RULA for the baccarat dealers because it provides a comprehensive assessment of the upper limbs, and was a better fit for the sitting baccarat dealers than the REBA. For the blackjack dealers, I used the REBA twice, once

with a freeze frame of the most common posture (dealing with right hand, while left hand rests on card shoe) and a second time with a freeze frame of the worst-case scenario, paying out/collecting the chips from the players' zone. The final REBA score for the most common posture is 4, indicating a medium risk requiring further investigation and intervention may be necessary in the near future. The final REBA score for the worst-case scenario was 11 indicating a very high risk and intervention is required. For the baccarat dealers, I used the RULA to evaluate the most common posture, which is also the worst-case scenario posture. The most common posture is paying out/collecting chips. The final RULA score is 5, indicating further investigation is required and intervention may be necessary in the near future. One benefit of the RULA and the REBA is that because scores are assigned to each body part individually, it can be used to identify areas of concern. In the worst-case scenario for blackjack dealing, the areas of concern are the trunk, the legs and the shoulders. In the most common posture and worst-case scenario for baccarat dealing, the areas of concern are the shoulders, elbows and neck. One downfall of both the RULA and the REBA however, is that they do not take repetition into consideration. The WorkSafe BC Worksheets A and B provide a good compliment to the RULA and the REBA as they examine repetition.

#### *Genaidy (1993)*

The Genaidy (1993) guidelines are based on an eight hour shift, and are used to compare fingers, hand/wrist, elbow, shoulder and neck motions to an action limit and to a maximum permissible limit (three times the action limit). If repetitions are below the action limit, minimal risk exists, if above the maximum permissible limit (MPL), high risk exists. The values for repetitions over an eight hour shift were extrapolated from viewing two minute video footage (enough for two dealing cycles) assuming the dealers took a 15 minute break every 45 minutes and dealt only one game type per shift. The values only provide a rough estimate as repetitions will vary depending on the number of players at the table as well as the circumstances of the cards. On the following page is a table summarizing my findings using the Genaidy (1993) guidelines.

Joint	Blackjack Dealing	Baccarat Dealing
Fingers	7200 – less than action level, minimal risk	7920 – greater than action level but lower than MPL, moderate risk
Hand/Wrist	15120 – greater than MPL, high risk	6120 – greater than action level but lower than MPL, moderate risk
Elbow	13680 – greater than MPL, high risk	6840 – greater than MPL, high risk
Shoulder	14400 – greater than MPL, high risk	6480 – greater than MPL, high risk
Neck	2520 – greater than MPL, high risk	2880 – greater than MPL, high risk

Table 1. Summary of finger, hand/wrist, elbow, shoulder and neck repetitions over an eight hour shift and subsequent results using the Genaidy (1993) guideline.

Risk Assessment Tool	Evaluation of	Blackjack Dealing Results	Baccarat Dealing Results
WorkSafe BC Worksheet A and B	Risk factors: contact stress, repetition, grip force, lift/lower force, awkward posture and vibration	Repetition – high risk, shoulders, elbows and wrists Awkward Posture – moderate risk, neck	Repetition – high risk, shoulders, elbows and wrists Awkward Posture – moderate risk, neck
REBA	Neck, trunk, legs, shoulder, elbow and wrist	Most frequent posture (dealing) – 4, medium risk, further investigation, change soon Worst case scenario (paying out/collecting chips) – 11, very high risk, investigate and implement change	Not Examined (N/E)
RULA	Shoulder, elbow, wrist, neck and trunk	N/E	Most frequent posture/worst-case scenario (paying out/collecting chips) – 5, further investigation, change soon
ACGIH TLV for Hand Activity	Hand and wrist	Left Hand – 0.14, no intervention required Right Hand – 2.0, intervention required	Left Hand – 0.2, no intervention required Right Hand – 0.25, no intervention required
Moore-Garg Strain Index	Hand, wrist and elbow	Left Hand – 1.5, Safe Right Hand – 10.1, Hazardous	Left Hand – 6.75, Some Risk Right Hand – 6.75, Some Risk

Table 2. Summary of the results from the risk assessment tools.

### **Summary of Risk Assessment:**

The results of the risk assessment indicates that the biggest risk factor for both blackjack and baccarat dealers, is repetition of wrist, elbow and shoulder motions. Blackjack dealers deal many more cards during a shift than baccarat dealers, and therefore perform more repetitive wrist, elbow and shoulder motions (as outlined in table 1 on the previous page). Dealing is a repetitive job, and aside from automating the process, the repetitive nature of the job cannot be reduced. However, the risk of injury due to repetition can be reduced for both blackjack and baccarat dealers by taking time to stretch and relax during natural pauses in game play as well as on their breaks. This is particularly important for blackjack dealers. The risk of suffering a wrist injury as a result of repetition can also be reduced for both blackjack and baccarat dealers by keeping their wrists firm and minimizing flexion and extension (see figure 3 on page 15). In addition, dealers can further minimize their risk of injury by dealing smoothly and at a comfortable pace.

The REBA indicated a very high risk for the awkward posture involved in the worst-case scenario for blackjack dealers of paying out/collecting chips. The major areas of concern are for the legs, back and shoulders. The risk of suffering an injury as a result of the awkward posture involved in paying out/collecting chips can be reduced by using the stepping block provided (see figure 4 on page 16). In addition, customers can assist the dealers and minimize their reaching by passing their chips and cards and collecting their payout directly to/from the dealer.

Prolonged standing is not thoroughly quantified using the risk assessment tools, but I believe it is a significant risk factor for blackjack dealers. Blackjack dealers should change their postures and weight distribution frequently to help stimulate blood flow and help reduce fatigue and discomfort. The casino provides a stepping block to aid dealers when reaching to pay out or collect chips. Dealers can use this block to change their weight distribution and rest one of their feet (see figure 5 on page 16). Both blackjack and baccarat dealers can reduce the risk of a neck injury by minimizing neck flexion by using their peripheral vision. During natural breaks in game play as well as when they are on their 15 minute breaks, dealers should look up to stretch their necks.

### Conclusion of Risk Assessment:

Rob has been a dealer for many years, and has never developed an injury from dealing. He has excellent technique: keeps wrists firm and straight, does not flex neck (uses his peripheral vision). I was not able to take video footage of the actual dealers on the casino floor, but was allowed to walk around and observe them for approximately an hour. I noticed some of the dealers had very poor technique including: quick jerky movements, dealing at their maximum speed and/or with unnecessary force, not keeping their wrists firm, flexing neck instead of using peripheral vision, slapping the cards on the table forcefully, and maintaining a bent posture leaning over the table for prolonged period of time. When Rob trains new dealers, he shows them the proper technique and explains that poor technique can lead to injury. Walking around the casino with Rob, it was very evident that management staff provides a very supportive environment for staff, and dealers are never pushed to deal at their maximum speed capacity. They may deal at a pace that is comfortable to them, so long as the flow of the game is not interrupted. Overall, dealing is a very repetitive job and awkward postures are involved, however, risk of injury can be reduced if proper technique is used.

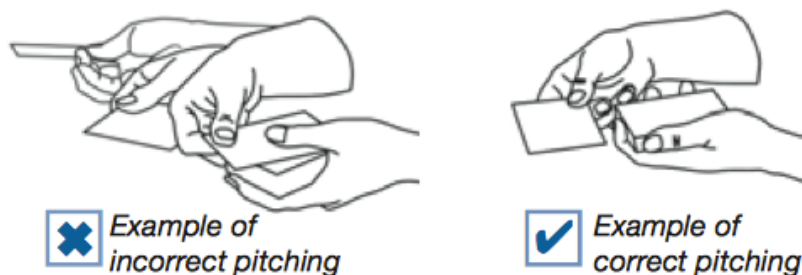


Figure 3. Incorrect and correct dealing technique. In correct dealing technique the wrist is kept firm and flexions and extensions are minimal.

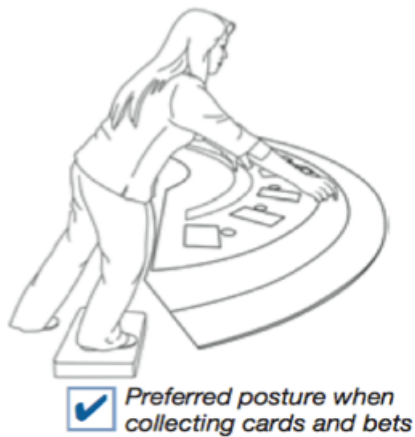


Figure 4. Proper technique to minimize awkward postures associated with paying out/collecting chips and collecting cards from the players' zone. Lifting one leg helps to maintain the natural curves of the back. (WorkSafe BC, 2013)

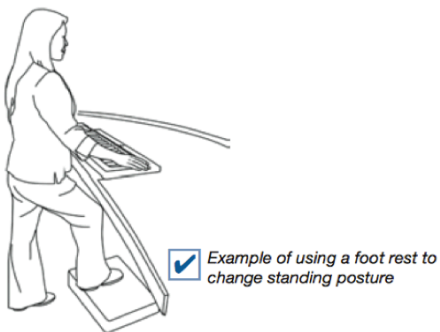


Figure 5. Example of how to use the step block to change posture and weight distribution while standing.



**Recommendations:**

After completing a task analysis and risk assessment using the Moore-Garg Strain Index, WorkSafe BC Worksheet A and B, ACGIH Hand Activity TLV, the RULA and the REBA, I recommend the following to minimize the risk of injury for blackjack and baccarat dealers:

- Continue training proper techniques to new dealers, but also, management should observe dealers to determine whether they have developed risky dealing habits. Dealers that have developed bad habits should be reminded of proper techniques, or be given a refresher dealing course. In addition, an incentive program could be implemented and may help motivate dealers to use proper dealing techniques. Dealing does involve a lot of repetition, but if proper technique is followed, many breaks are taken during a shift, dealers take time to stretch every now and then, the risk of injury should be greatly minimized.
  - Providing frequent breaks should be continued. Currently, dealers may deal blackjack or baccarat for an entire shift, or a combination of the two. A systematic schedule should be implemented so that dealers will alternate between baccarat and blackjack after each break. For example, if a dealer is working an eight hour shift, they will deal blackjack and baccarat four times each, alternately. This will help reduce the risk of prolonged standing or sitting, as well as provide a change of pace for the dealers.
  - For dealers dealing blackjack, an ergomat or anti-fatigue mat should be provided to minimize leg discomfort from prolonged standing. In addition, dealers should be provided a stipend to purchase comfortable footwear and/or shoe insoles.
  - Currently the blackjack tables are at a fixed height and a step box is provided for shorter dealers. The ability to adjust the table height will reduce the strain on dealers' shoulders. For example, if a dealer is too short for the table, they will have to have their shoulders elevated for the duration of their shift. If the dealer is too tall for the table, they will be constantly reaching and will not be able to place their lower arms flat on the table to rest.
  - Customers should be provided with adjustable height chairs such that if the dealer needs to adjust the height of the table, customers can adjust the height of their seats accordingly.
- In addition, blackjack dealers should be provided with a sit/stand stool or a high swivel chair with footrest. This will help reduce discomfort and risk associated with prolonged standing.

- To decrease the amount of noise, flashing lights and stimulation that the dealers are exposed to, the table games should be segregated from the slot machines. Adequate lighting should be installed about the tables so that dealers are able to clearly see the cards and chips.
- The tables should be fitted with a soft edge to minimize contact stress when the dealers are reaching to pay out or collect chips and cards. In addition, a softer edge may allow the dealers to rest slightly on the edge of the table alleviating some of their body weight from their legs.
- Having the customer assist can minimize the awkward postures involved in the paying out/collecting of chips and collecting of cards. The dealer can count the chips for payout within their primary reaching zone and at a comfortable location of the table that is still visible to the customer, they can then pass the chips to the customer instead of reaching to place them in front of the customer. In addition, the customer can assist by passing their cards and chips to the dealer. This change can only be implemented if casino policy allows.
- Awkward postures and reaching distance associated with the paying out/collecting of chips can be reduced by moving the chip tray forward and adding a semi-circle cut-out in the table for the dealer. If the dealer is sitting, there needs to be ample leg space under the table. This would impede the space available for the chip tray, so the chip tray could be cut in half and one half placed on the left side of the dealer and the other placed to the right of the dealer (shown in figure 6 below).

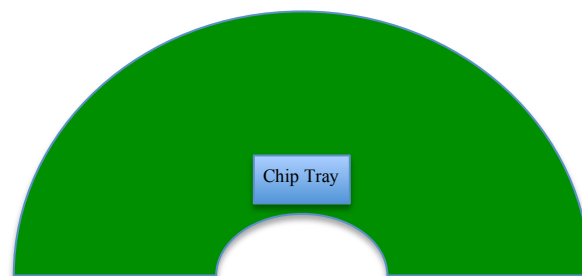
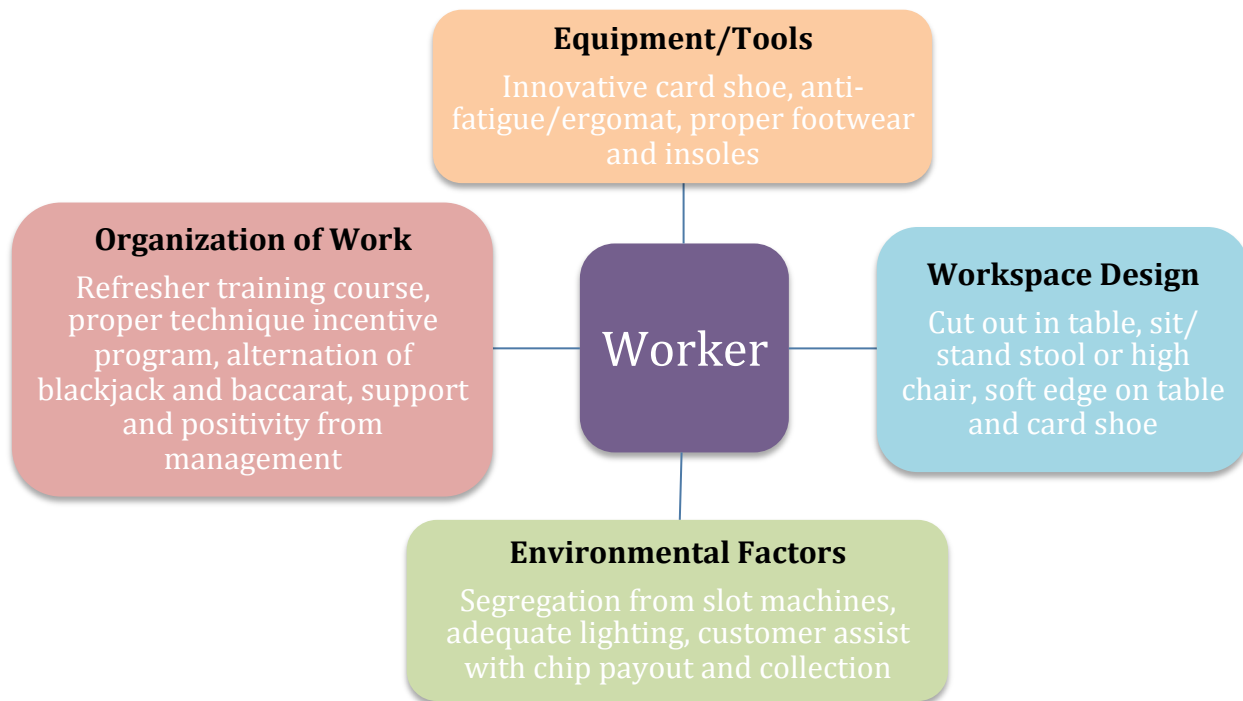


Figure 6. Table design with semi-circle cut-out to minimize awkward postures and reaching.

- The card shoe should have rounded edges, or cushioning to minimize contact stress when the dealer rests their left hand over the cards to prevent cheating. Dealers should also make sure to adjust the position of the card shoe when they first arrive at a table to make sure that it is in comfortable position. This will reduce awkward wrist postures when the dealer removes a card to deal and when they rest their left hand on the shoe. A better alternative is a new card shoe provided by Ergonomics Inc. It is an innovative product that allows the cards to come up from

underneath the table. This will allow the dealer to rest their hand over a flat surface eliminating any potential awkward wrist postures and contact stress. <http://www.ergoinc.com/case-study/blackjack-card-shoe>

I have outlined the above recommendations in the systems approach chart below.



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**References:**

- Canadian Centre for Occupational Health and Safety. (2005, December 12). Work-related Musculoskeletal Disorders (WMSDs) : OSH Answers. Retrieved November 23, 2013, from <http://www.ccohs.ca/oshanswers/diseases/rmirsi.html>
- Canadian Centre for Occupational Health and Safety. (2008, October 15). Carpal Tunnel Syndrome : OSH Answers. Retrieved November 22, 2013, from <http://www.ccohs.ca/oshanswers/diseases/carpal.html>
- Chester, M. R., Rys, M. J., & Konz, S. A. (2002). Leg swelling, comfort and fatigue when sitting, standing, and sit/standing. *International Journal of Industrial Ergonomics*, 29(5), 289–296. doi:10.1016/S0169-8141(01)00069-5
- Edwin, M. J. (2003). *Improving the Odds: Redesigning Blackjack Tables for Injury Reduction*. Retrieved from <http://www.optimiseltld.co.nz/Improving%20the%20odds%20paper%20pdf%2016.07.04.pdf>
- Gregory, D. E., & Callaghan, J. P. (2008). Prolonged standing as a precursor for the development of low back discomfort: An investigation of possible mechanisms, 28(1), 86–92.
- LUOPAJÄRVI, T., KUORINKA, I., VIROLAINEN, M., & HOLMBERG, M. (1979). Prevalence of tenosynovitis and other injuries of the upper extremities in repetitive work. *Scandinavian Journal of Work, Environment & Health*, 5, 48–55.
- Seo, A., Kakehashi, M., Tsuru, S., & Yoshinaga, F. (1996). Leg Swelling during Continuous Standing and Sitting Work without Restricting Leg Movement, 186–189.
- Shvartz, E., Gaume, J. G., Reibold, R. C., Glassford, E. J., & White, R. T. (1982). Effect of the circuitone seat on hemodynamic, subjective, and thermal responses to prolonged sitting. *Aviation, space, and environmental medicine*, 53(8), 795–802.
- WorkSafe BC. (2013, June). Preventing Injuries to Casino Card Dealers - Ergonomics tips for the Hospitality Industry. Retrieved November 25, 2013, from [http://www.worksafebc.com/publications/health\\_and\\_safety/by\\_topic/assets/pdf/casinocarddealers.pdf](http://www.worksafebc.com/publications/health_and_safety/by_topic/assets/pdf/casinocarddealers.pdf)
- Xu, Y., Bach, E., & Orhede, E. (1997). Work environment and low back pain: the influence of occupational activities., 54(10), 741–745.