“This isn’t going to be easy…”

“Nothing worth while ever is.”

-J. Michael Straczynski

# University of Alberta

An Analysis of Beach Volleyball:
Techniques and Tactics used by Junior Men and Women

by

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## Abstract

Elite beach volleyball can be played with specialized positions (blockers and defenders) yet research addressing the differences between these players is lacking. Moreover, research in junior beach volleyball is very scarce. Therefore, the primary goal of this study was to describe then compare playing techniques and tactics between blockers and defenders (and universal athletes for women only) at the 2011 Junior (U21) FIVB Beach Volleyball World Championships to see whether differences existed between these athletes. Multiple actions from each skill (serving, serve reception, setting, attacking, blocking, defense) were recorded. Results revealed significant differences between serving technique ($p<0.05$) and quality ($p<0.05$) between blockers and defenders for men, as well as blockers, defenders and universal athletes for women (technique, $p<0.001$; quality, $p<0.05$). Lastly, where possible, secondary comparisons were made between junior men and women, as well as between junior and senior athletes.

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Volleyball is a big part of my life and when I moved to Edmonton, there were a few people who helped me stay involved in the game.

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# 1 Introduction

## 1.1 Beach Volleyball

Beach volleyball is a team sport involving control of a ball through rebound and movement (Kulka & Dunn, 2000). Beach volleyball was introduced as a demonstration sport in the 1992 Olympic games and was accepted as an official Olympic sport at the 1996 Olympic Games in Atlanta (Perez-Turpin et al. 2009). The growth of the sport has seen the FIVB World Tour evolve from 6 events and prize money totalling $95,000 in 1992 to a total of 39 events (19 women, 20 men) and prize money totalling $8,300,000 in 2008 (Riggs & Sheppard, 2009). Played outdoors on a sand surface with only two members per team, the goal of beach volleyball is to make the ball hit the ground on the opponent's side of the court, or prevent its return to one's own side of the court (Kulka & Dunn 2000).

The sport of beach volleyball underwent serious changes after the 2000 Sydney Olympics. Previous to 2001, the sport was played using the 'side out' scoring format. Teams only scored points when they were serving, and matches consisted of one game to fifteen points where the victor had to win by two points. The sport is now played with a 'rally point' system where points are scored on every play, regardless of which team possesses the serve. The court dimensions also changed from a 9x18m court to a smaller 8x16m court. Researchers have explored the effect of different scoring systems and court dimensions in the sport (e.g. Kountouris & Laios 2000, Kontourris et al. 2001, Giatsis 2003, Giastis & Tzetis 2003, Grgantov et al. 2005, Kroger 2006). Common findings in the literature suggested that the smaller

court dimensions increased match duration and changed the physiological demands of the sport (Giatsis, 2003). Similarly, skill sets used by winning teams also varied in accordance with a change in court dimension. With side-out scoring, a major difference between winning and losing teams was their ability to receive the serve successfully, whereas in rally point scoring, success was determined by kill efficiency (Grgantov, et al. 2005). At this point it is important to note that literature pertaining to playing characteristics in the sport of beach volleyball published before 2001 will show results that are inconsistent with the way that the modern game is played (personal discussion with Canadian national beach volleyball coach, Lennard Krapp 2011).

Studies in beach volleyball have also been conducted on the playing characteristics of men and women (e.g. Mesquita et al. 2004, Koch & Tilp, 2009a, Perez-Turpin, et al. 2009, Koch & Tilp 2009b, Turpin et al. 2011, Tormo et al. 2011). While most studies focus on a single gender and/or single skill set, some studies have directly examined the differences between the playing characteristics of men and women. Gender comparisons are interesting as they can reveal similarities and differences between how men and women play beach volleyball, however they do not directly compete versus one another. And, studies examining single genders consistently generalize findings to both team members (even if one is a permanent blocker, and the other a permanent defender). Hence, it may be more beneficial for researchers to study team composition in beach volleyball; particularly examining the differences between specialized athletes (blockers and defenders). In order to

increase the knowledge base of the sport, it may be required to understand whether differences exist between these specialized athletes.

## 1.2 Operational Definitions in Beach Volleyball

- **Blocker:** An athlete whose primary role was to block at the net. After serving, they run up to the net and prepare to block the oppositions' attack (Drakich, 2003).
- **Defender:** An athlete whose primary role was defending in the backcourt (Drakich, 2003).
- **Universal Athlete:** Team system where the athletes shared blocking and backcourt defensive responsibilities (Drakich, 2003).
- **Rally**: Time duration from play initiation to play end.
- **Serve:** The action that initiated the rally. A ***jump spin*** consisted of a serve where an athlete tossed the ball in the air and contacted it after a maximal jump with the intention of producing topspin on the ball. A ***jump float*** was a ball contacted with a jump, with the intention of hitting the ball with no spin. A ***standing float*** was similar to a *jump float,* but the ball was contacted while standing on the ground.
- **Reception:** Most often a forearm contact of the ball (though other actions could occur due to the unpredictability of the opposing teams serve) after the serve. A ***midline*** reception consisted of a ball contacted between the knees; an ***outside midline*** reception consisted of a ball contacted outside the knees.

- **Set:** Second contact intended to allow a teammate to attack the ball. Two techniques existed; a ***forearm*** set (similar to a reception), and an ***overhead*** set (a ball contacted overhead with the hand and fingers).
- **Attack:** A contact with the goal of scoring a point. Divided into ***spike, shot, pokey***, and ***second attack*** (i.e. immediately after the pass). ***Spikes*** were defined as an attack with maximal power produced to hit the ball in a downward direction. ***Shots*** were softer contacts intended to direct the ball to the open court with a higher trajectory. ***Pokey*** were a tipping action where the ball was contacted with the knuckles, because opened handed tips are not allowed in the sport of beach volleyball.
- **Block:** Perez-Turpin et al. 2009 defined a ***block*** as "A move performed at the net to prevent the ball from passing into ones court". Blocking was divided into ***block***, and ***peel***. Though some researchers have added attack and shot blocks (attack block involved the blockers' maximum penetration over the net, a shot block is one that included maximum height), these distinctions were not made. A ***peel*** block involved a retreating movement from the net.
- **Dig:** Any ball contacted by a defending player from an attacking player that continued the rally. Digs were divided into three categories. A dig ***in motion*** was a defensive contact where the athlete was moving. A dig ***in the ready position*** was defined as a ball contacted near the body of the defender (as long as they were motionless). A dig ***after moving*** was defined as any contact where the defender leaves their zone before the attacker contacts the ball.

- **Risk**: Perceived ability of a team to use techniques and/or tactics that maximize both the chance of a reward (i.e. direct point) while also increasing the chance of committing an error
- **Freeball:** A non-attack contact where the ball is sent over the net with a speed and trajectory that does not impose a time crisis on the opposition's ability to successfully contact the ball.

## 1.3 Purpose

The purpose of this study was to describe and compare the skill techniques and the execution quality performed by specialized (blocker, defender and universal) male and female junior athletes who were competing in the U21 FIVB (International Volleyball Federation) world championships held in Halifax, Nova Scotia, Canada from August 30th to September 6th 2011.

## 1.4 Significance

The results from this study could have an effect on coaches and the methods they use to train athletes selected to compete in the U21 world championships. If the results can show that certain playing styles and tactics allow for athletes to gain an advantage, new coaching practices may evolve. Similarly, the results of this study may demonstrate to coaches whether their practice organization and drill selection models the patterns of movements and skill techniques used by the elite U21 athletes, as well as providing evidence as to whether not only junior men and women should be trained differently, but also whether junior blockers, defenders and universal positions should be trained differently. This study may potentially not

only benefit coaches; it may also help inform the fields of physiology and biomechanics by providing information on human movement and human exertion on a soft surface in an unpredictable outdoor environment. For example, it may be of interest to know how many blocking jumps or attacking jumps an athlete performs during a match or tournament. Furthermore, results could also benefit the area of indoor volleyball since the skill sets and match format design are very similar. Also, results of this study will benefit the area of beach volleyball by adding knowledge to a field that is lacking research. At the time it was written, no other studies were discovered that compared individual athletes to one another (i.e. blocker vs. defender) as most of the available literature in beach volleyball pertains primarily to the skill analysis (serve, reception, set hit, block, dig, serve) of senior athletes (e.g. Papgeorgiou & Homberg 2004, Mauthner et al. 2007, Koch & Tilp 2009(a)(b), Perez-Turpin et al. 2009, Cortel- Tormo et al. 2011,).

Laslty, this study may benefit coaches in a variety of sports. The methods used in this study allowed the researcher to investigate the effect of multiple variables on one skill or sequence of skills. Research questions may be gained by understanding how pivot tables were used in this study.

## 1.5 Limitations and Delimitations

**Global Tournament**

- This study involved athletes under the age of 21 from many areas of the world. It is therefore possible that regional (proximity to different countries) and geographic (climate, topography) characteristics may have influenced how athletes from different countries approached the game. Since only the

actual play of athletes was the intended focus of this research, these factors were not considered during this study.

**Playoff Format**

- Since the goal of the research was to analyze the tendencies of the best junior beach volleyball athletes, only matches from the 2nd round (quarter finals) to the medal matches were observed. It was assumed that the best and most skilled teams were those advancing further in elimination matches. Thus, as the playoff format was a single elimination playoff format some teams were observed more than others. Teams that advanced to the gold and bronze finals were observed on three separate occasions; teams eliminated in the semi finals were observed twice, and teams eliminated in the round of 8 were observed once. Hence, teams advancing further in the tournament had a higher influence on the data.

  With this said if teams used unusual strategies and advanced to the finals, their results would more heavily influence the data. Since the teams that finished with a higher placing were considered to the best teams, it was assumed that the strategies and playing styles of these athletes reaching the finals was the most effective and ideal.

**Weather**

- This beach volleyball tournament was played outdoors hence weather and environmental conditions could have influenced matches. Coaches and athletes have speculated as to the most efficient techniques and tactics to use in adverse conditions, but no research has confirmed these assumptions.

Weather data was collected during the observed matches (see Appendix 6.2), but due to the uneventful nature of the weather, no further research was pursued. As such, it may be impossible to compare the data from this research, or even expect the same results should the weather change at a future event.

**Technology**

- Technology was also a limiting factor in this study. Ideally, a system comparable to the Amisco Pro® video analysis program, would be used (Mauher et al. 2007). Amisco Pro ® was used in soccer matches to, among others, determine velocities, total distances, time of accelerations and decelerations athletes produced. However the financial and technical requirements of this system were not feasible for use in this experiment. Also, FIVB competition regulations forbid athletes to wear tracking markers for any reason (including video analysis) during competitions. Thus human error was a potential factor when estimating position and motions.
- The use of one base line camera impacted the ability of the researchers to estimate frontal and backward movements. Thus, the locations of serves and movement on defense of athletes recorded may have been incorrect. Nevertheless, the degree of accuracy did not hinder the data collection to the point of eliminating it. Observers could still distinguish between players on the right and left side, as well as distinguish whether the action occurred closer to the net or closer to the baseline.

- Financial constrains limited the number of camera operators per court. Ideally, synchronized cameras positioned at the baseline and sideline would be used, as well as one camera operator per camera. In this study only one camera at the baseline was used. Only a two dimensional analysis was performed. A three dimensional analysis would be too difficult to accurately measure movement in an uncontrolled and unpredictable environment such as beach volleyball.
- Lastly, the cameras were placed in the spectator sections and there were occasions where the spectators interfered with the camera's view (i.e. walked in front of it). When this occurred, data collection from the entire rally was omitted. Since this occurred infrequently, very minimal data was lost (>1%).

**Statistical Analysis**

- The goal of this study was to describe the techniques used by specialized junior beach volleyball athletes, and was not intended to answer specific questions. Secondary and tertiary goals of the study were to compare data obtained from junior athletes to, where available, senior athletes from previous studies. Chi square test for independence was the only statistical calculation done. This test was conducted on single results and did not explore any interactions between variables. For example, attack results were described with relations to reception quality, but comparisons were only made from attack results data. Since no statistical calculations that evaluate interactions between variables were used, only limited information and

conclusions could be made. For example, while chi square testing may show a difference between groups in attack results after a poor pass, only the attack results were investigated and it was not possible to confirm or deny that reception results influenced attacking results. This limited the strength of any conclusions made when multiple variables were described.

## 1.6 Literature Review

### *1.6.1 Motion Analysis in Beach Volleyball*

Human motion analysis has been performed since the early 1970's (Mauthner et al. 2007). Before adequate technology existed, most observational analyses occurred manually and accuracy in terms of observation reliability was consistently a limiting factor. In the early 1990's, researchers used self made, video based systems to observe soccer matches (Erdmann 1992). With the advent and affordability of modern technology, methods based on the combination of video data collection followed by analysis through computer software became the preferred method (Spencer et al. 2005, Harley et al. 2010). Presently, there are many methods to analyze human motion and it is important to understand that there are various limitations to each video method used. For example, biomechanists use markers on the body in order to digitize the data to determine optimum body angles, speeds and movements. These systems allowed for an in-depth three-dimensional analysis of the athletes in question. However, due to possible constraints of placing foreign objects on joints and muscles the markers may influence the athletes' behaviours. Since many sporting rules prohibit the use of film markers during competition the

use of these techniques is a very limited practice (Mauther et al. 2007). Similarly, most biomechanical measurement systems provide extremely accurate data on human movement, but cannot effectively cover large areas (Pers et al. 2002). With this said, the preferred method to analyze volleyball is the use of two synchronized cameras; one at the baseline, and one on the sideline. However, the use of a single camera to record a beach volleyball match is an acceptable and standard method conduct video analysis (Koch & Tilp 2009b). The main advantages to a marker-less recording system is that it does not physically limit the players' movements and there are no concerns that markers could fall off, thereby limiting data collection; yet the trade-off is that human error can increase.

### *1.6.2 Service and Service Reception*

The serve in beach volleyball is the playing action that begins all rallies. Athletes use a variety of serve techniques (*standing float, spin, jump float*) in attempt to limit the opposition's attack (Kirarly 1999). The *jump serve*, particularly at the highest levels, allow teams to score a direct point or place a burden on the opposition to effectively attack the ball (Kiraly 1999). Lopez-Martinez & Palao (2009) compared various serve techniques in both men and women's beach volleyball. Interestingly, results demonstrated similar outcomes for both genders. For example, *jump serves* produced a higher number of errors, such as a serve into the net, points (or the serving team and actions that limited the opponent. Serving the area between both receivers (interference zone/seam) was the most effective regardless of the serve. Furthermore, the preferred serving location for men was to the middle front of the court, while females served the middle back (Lopez-Martinez 2009).

When the frequencies of types of serve techniques used were compared, men preferred the *jump spin*, while females preferred the *standing float* serve (Koch & Tilp 2009a). Kiraly 1999 attested that controlling the serve 'will win more games than any other part of the game, and the most fundamental skill involved (in beach volleyball) is the pass'. However, this book was written before 2001, and research has shown that it was actually the attack that is the most influential skill in the game (Giastsis 2003). Nevertheless, in international beach volleyball, both men and women possessed a high degree of skill in pass execution. 60% of receptions for females and 55% of receptions for males were executed perfectly (Koch & Tilp 2009a, Koch & Tilp 2009b.

### *1.6.3 SETTING*

Setting is the act of distributing the ball from one player to the other with intent of optimizing their ability to attack the ball (Kirarly 1999, Kulka & Dunn 2000). Techniques of men and women differed greatly with respect to second contacts. Men used an *overhead* technique more frequently than women (Koch & Tilp 2009a). Research into this area could demonstrate concrete reasons for this discrepancy. However, one can only speculate as to reasons for this discrepancy. Since the rules using the *overhead* technique on beach volleyball are very strict, it is possible that women have limited the use of this technique to avoid penalization by the referee (Koch & Tilp 2009a).

### *1.6.4 ATTACKING AND BLOCKING*

Research involving attacking and blocking encompasses a wide breath from skill-based analysis to jump based comparisons. For example, when attacking patters were analyzed, Koch & Tilp (2009a) discovered that men used *spike* attacks 59% of the time compared to the women who used *spike* and *shot* attacks with similar percentages (50%). Women used the *shot* with increased frequency compared to men, and, perhaps because the best counter to defend a *shot* is to peel off the net (Kiraly & Shewman 1999) women used the peel block more than men (Koch & Tilp 2009a). When the peel block was used; the women succeeded 67% of the time, compared to males, 58% of the time (Koch & Tilp 2009a).

Both attacking and blocking involve a jump and an investigation into jumping ability on the sand was done by Riggs & Sheppard (2009). Their study was very unique as they observed squat and counter movement jumps on a soft surface, a surface similar to the sand that beach volleyball athletes competed on. Their results showed differences in countermovement and squat jumps in both male and female elite beach volleyball players. They discovered that the mean jump height measured by center of mass displacement, was 8.33 cm greater for males than females. It would be interesting to note the height of the athletes investigated as well to explore how this difference may affect the playing techniques used by both sexes.

Finally, block jump techniques can be further divided into a vertical jump and a 45-degree jump/sideways jump (Kiraly & Shewman 1999). At the time this paper was written, no academic literature was found examining the technique and forces involved in a sideways jump. This tactic is used to “show and take away”. For

example, if a blocker appears to be blocking the line shot, the hitter may chose to hit the open cross court shot. By jumping sideways (at or about a 45 degree angle), the blocker is now taking the open shot away (Kirarly & Shewman 1999).

### *1.6.5 DEFENSE*

Cortell-Tormo et al. (2011) defined a defensive contact in beach volleyball as 'any move performed to save the ball in a clear attack by the opposing team and prevent the opponent from winning a point.' Perez-Turpin et al. (2009) determined that defensive movements (block, reception and actions of defense) were used less frequently than offensive movements (attack, attack approach and placement). In terms of actual technique, Koch & Tilp (2009a) discovered that male athletes were able to defend attacks more often without any movement (*digs in the ready position*) while women often performed defensive actions after moving.

# 2 Methods and Procedures

## 2.1 Study Design

The study design was a non-experimental design. There was no random assignment and there was no control group. Purposive nonprobability sampling was performed because only the athletes who attain the quarterfinal rounds were observed. Similar to Lopez-Martinez & Palao (2009) this was done in order to determine the playing characteristics of the best and most elite athletes in junior beach volleyball. Four cameras and two-camera operators filmed the matches on each playing court. The cameras were placed at the baseline, 5m from the court and elevated no higher than 20 meters. One camera per court was used to record matches and each camera operator was responsible for two cameras. Since the this tournament was played outside where weather can be unpredictable all reasonable efforts were made to ensure that weather did not affect the data collection. If video could not be viewed due to player or fan obstruction, data collection was categorized as 'lost' (Koch & Tilp 2009a, Koch & Tilp 2009b).

At the end of each day, match data was transferred onto an external hard drive for transportation and future data analysis.

## 2.2 Subjects

A total of 32 athletes were observes, 16 male, (average age 19.9 ±0.826) and 16 female (average age 19.75 ± 1.71). Anthropometric data was unavailable for the majority of athletes, as was any strength measurement, spike jump and block vertical jump heights. A total of 16 matches (n=8 male, n=8 female) were observed and analyzed, starting with the 2nd round of playoffs and continuing to the finals. It

was theorized that the goal of the athletes in this tournament was to win and that a maximal effort was given. Therefore, techniques and tactics of the athletes observed would not deviate from the standard play in the sport. All athletes were required to fill out the FIVB WT - 01 Player's Agreement (see appendix 6.1). Paragraph 7 and 8 explained the use of athletes' likeness for promotional and group licensing rights. Although athletes who are competing in tournaments were considered to be public person, they were not identified or named in the study.

Lastly, ethical approval was obtained for this research from the University of Alberta in Edmonton, Alberta, Canada.

## 2.3 Execution Criteria

Beach Volleyball is an interacting sport and it was therefore important to differentiate quality ratings on whether the interaction occurred with an opponent or teammate (Kiraly & Sherman 1999, Koch & Tilp 2009a). In beach volleyball, skill execution can be affected by a team's tendencies. For example, both a high pass on serve reception, and a low, fast pass on serve reception can be classified as 'good contacts'. Therefore, a modified four point criteria scale, similar to that of Koch & Tilp (2009a), was used with most skills, blocking being the exception.

**Skill execution classification**:

1. Point
    - Direct point was scored
2. Good
    - Contact put teammate in an optimal position
    - Opposition could not counter attack with ease

3. Poor/Weak
    - Opposition could counter attack with ease
    - Partner had difficulty or could not execute desired skill
4. Error
    - Point awarded to opposition

Due to the infrequency of the block contacting the ball, blocking execution criteria was defined as:

1) Direct point (slam)
2) Continuation/Touch (ball kept in play)
3) Tool (ball out of play touched last by the blokcer, attacker scored)
4) Fault (net violation)
5) No contact

## 2.4 Technique, Criteria and Skill Analysis Design

The following skills were observed in iMovie and coded on an excel spreadsheet; Serve, Reception, Set, Attack, Block, Defense. Furthermore a distinction was made between a blocker, defender, and universal athlete before each skill was analyzed. Unless mentioned directly in the following, skill execution followed the exact criteria described in section 2.3.

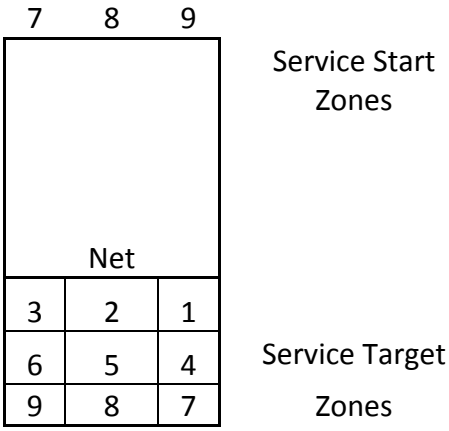
Lastly, each result section included descriptions of overall results, as well as more in-depth descriptions of the play styles when receiving the serve, or when serving for defensive purposes (blocking and digging). These distinctions were made in an

attempt to potentially help coaches and stakeholders understand how points are scored after serve, as well as describe defensive trends immediately after the serve.

### *2.4.1 SERVE*

The serve was divided into three categories; *jump spin, jump float* and *standing float.* Characteristics of the serve included the initial start position and end location of the ball (as shown in Table 1), as well as execution quality. Serve results were divided into four categories, *ace, good, poor, error*. An *ace* led to a direct point for the serving team, while an *error* led to a direct point for the receiving team. For a serve to be considered *good*, the trajectory must have been low and flat, the speed of the ball fast, or the serve resulted in a player having to make a pass under time crisis (i.e. move the player a long distance). 'Poor ' serves lacked one of the above criteria.

***Table 1. Service and service target zones***




### *2.4.2 RECEPTION*

Reception categorizations included location the ball was contacted relative to the body as well as body position during contact. A distinction was made between ***midline*** and ***outside body*** receptions. Lastly, if the ball was passed outside the

midline, a distinction was made between whether the ball was contacted on the left or right side of the body.

### 2.4.3 SET

Observations for the set included the technique, *underhand*/*overhead*, and quality. The quality of the set was based on location; height and ease that partner could attack the set. Thus a low fast trajectory set to an attacker who was ready for it was considered a *good* set, while a high set to a location the attacker was not ready for was a considered poor. Setting characteristics were also recorded based on reception quality.

### 2.4.4 ATTACK

Attacking was divided into 3 categories as seen in section 1.2. Other studies (Mesquita & Teixeira 2004, Kiraly & Shewman 1999) have additionally discriminated the attack into 'wrist shots', 'cobra shots' and 'cut shots'. For the purpose of this study, all of the aforementioned criteria fell under the category of *shots*. Attacking results were also analyzed when receiving only, as well as analysed based on reception results.

### 2.4.5 BLOCK

Blocking was divided into *block* and *peel*. Previous articles have included shot blocks (Koch & Tilp 2009a), or distinguished between *line* or *cross* zones (Mesquite & Teixeira 2004). Unlike Koch & Tilp (2009a), no distinction was made between a '*shot'* block and '*attack'* block due to the difficulty in differentiating the two. Lastly block contact criteria (*tool, slam, block touch, no contact*) was also recorded.

### 2.4.6 *Defense*

Categories included the technique (*moving, after moving, near body*) used to contact the ball as well as the outcome of the contact (good/poor). Any ball that was contacted and kept in play by a blocker on a peel was considered a digging motion.

## 2.5 Action Sequences

Every skill in each rally was analyzed, coded and recorded on a spreadsheet using the above criteria. The design of the table, as shown in appendix 6.3, was such that action sequences flowed from one skill to another. If a skill was not executed, the table allowed for input into the next logical action. For example, set criteria was left blank if the ball was contacted for a 2nd hit attack.

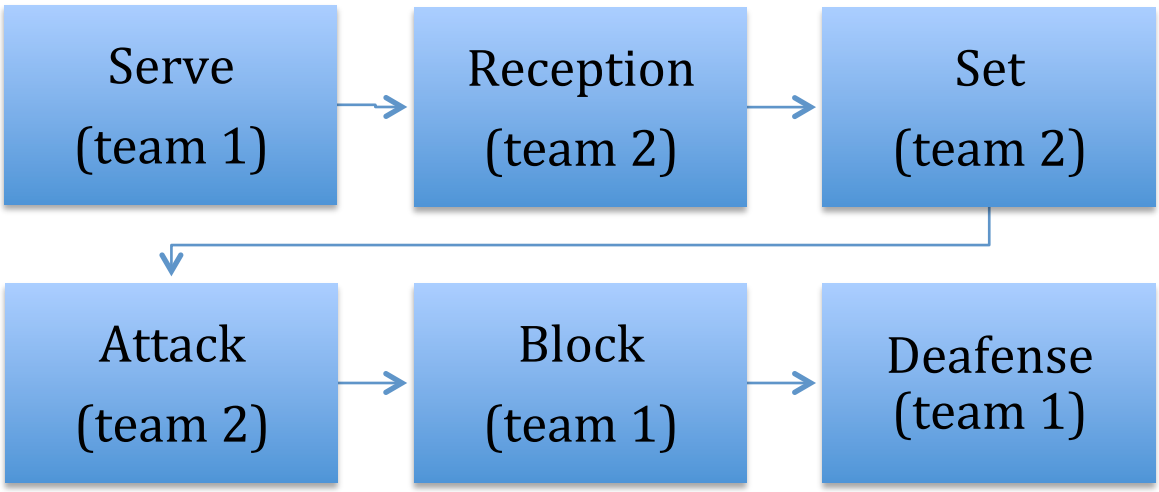



***Figure 1 Flow chart of action sequences analyzed off of serve receive***

Finally, throughout the text, comparisons were made between 'serve receive' techniques and action, and overall actions. Figure 1 above shows the service, service reception, set, attack, block and defending actions that were considered 'serve receive' data only. If the rally progressed after defence, or if the sequence was interrupted, these data were considered to be part of the 'overall' actions.

Figure 2 below outlines the flow of play after the initial rally (i.e data that was not considered to be serve receive). The figure shows that the flow of action sequences is very fluid. This is due to the chaotic nature of the rallys in beach volleyball. It is possible for at a team to defend an attack, and defend another attack immediately. The flow chart ended when the rally ended.

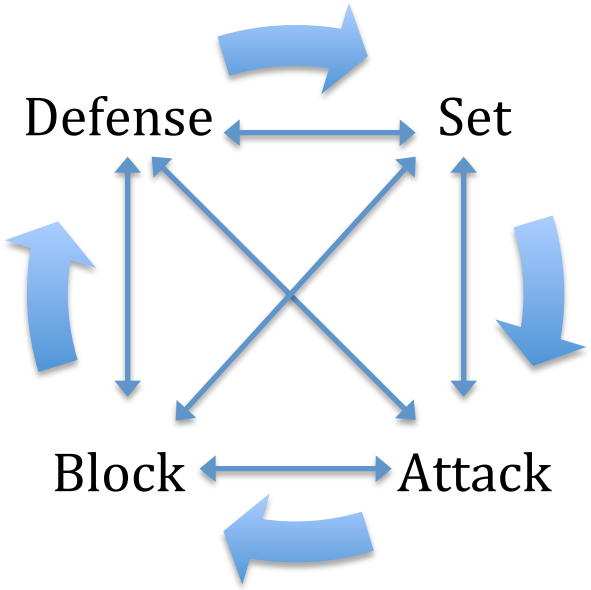



***Figure 2. Action sequence flow chart after serve receive***

The use of pivot tables in Microsoft excel for MacBook Pro, enabled the researcher to categorize the data in a way that allowed variables to be filtered. With the use of these pivot tables, the researcher not only had the ability to review the quality of one skill, but also could review the data of one skill based on previous skills. For example, coaches could analyze attacking execution, based on pass quality. Or, review blocking techniques after a spike attack, when the set quality was poor. See Table 2 on the following page for a pivot table readout example.

***Table 2. Pivot table read-out example: Attacking results based on pass results for junior women.***

| | |
|---|---|
| B D U Attack | (All) |

| **Count of B D U Pass** | Column Labels | | |
|---|---|---|---|
| Row Labels | Good Reception | Poor Reception | Grand Total |
| Continue | 103 | 63 | 166 |
| Error | 60 | 29 | 89 |
| Kill | 186 | 77 | 263 |
| **Grand Total** | **349** | **169** | **518** |

## 2.6 Statistical Analysis

### *2.6.1 Pearson Product Moment Correlation (PPMC)*

Both inter and intra rater reliability was calculated using the Pearson product moment correlation. This calculation was used to determine the extent at which the data inputted by the various observers was related. The PPMC calculation outputs a coefficient between +1.00 and -1.00. A perfect positive correlation (+1.00) occurred when an observer received a high numerical score on one variable and also received high numerical scores on another variable (Vincent 1995, p.88). Therefore, if two observers agreed perfectly, a coefficient of +1.00 would exist. The formula to calculate the coefficient used was as follows:

$$r=\frac{\sum\{(Zx)(Zy)\}}{N}$$

Where Zx and Zy are Z scores for each subject on X and Y variables, and N is the number of observations (Vincent 1995 p.90). For this study, reliability was used to

test construct validity; to ensure that those measures that the researchers wished to examine, were indeed those measures (Trokim 2010).

#### *2.6.1.1 Inter Rater Reliability*

Inter rate reliability was used to ensure that the observations entered by one researcher agreed with data entered by other experts in the field. Inter rater reliability was calculated by comparing the researchers analysis of one match with an analysis done by another beach volleyball expert of the same match. The expert analyzed one entire match after being trained in the analysis methods by the researcher. 797 total actions were analyzed. This number was higher than those reported by Koch & Tilp (2009a). For their study, only 100 scenes were analyzed, though numbers of actions were not reported, and their reliability was 0.93. In this study, overall inter-rater reliability was 0.90. The lowest agreements occurred when observing defense (0.78), while set technique, attack quality, block quality all had perfect relationships (1).

#### *2.6.1.2 Intra Rater Reliability*

Intra rater reliability was used to ensure that initial observations by the principal researcher agreed with later observations of the researcher. To establish intra rater reliability, the researcher allowed considerable time pass before reanalyzing one match. Again, over 750 actions were coded and a reliability value was established. The relationship between the initial and review data was again very high. The overall agreement between the same observers was 0.93. The lowest agreement

was between the serve receive location (0.86) and again perfect agreements were found between attack quality and block quality.

### *2.6.2 CHI SQUARE TEST*

Chi square tests were used to determine whether significant differences existed between varying groups. Chi square tests determined how well the obtained sample proportions fit the population proportions specified by the null hypothesis (Gravetter et al. 1999). It can be used from data that is simple to obtain, as there is no sample mean necessary; all that is needed is count frequency per category. For example, the number of *jump serves* was considered a frequency count (Gravetter et al 1999). The equation used to calculate the *p*-value for this test was:

$$\chi^2=\sum\frac{(O-E)^2}{E}$$

Where O=Observed frequencies
E=Expected frequencies

As the research data collected was non parametric in nature, the chi square test allowed researchers to test significance for a multitude of different distributions. Chi square tests are used with nominal data, data with high frequencies, and to test non-parametric data. Also, since variability can be drastically different between two samples and the intervals between two successive scale points can vary (Sprinthall 1997), the chi square test can compare these sets of data versus the null hypothesis. This test was also a common method used in academic journals comparing beach volleyball athletes, and genders (Lopez-Martinez, & Palao 2009).

# 3 Results and Discussion

Data was collected and coded for all positions (blockers, defenders and universal athletes). However, the nature of the men's game was such that these teams heavily favoured a specialized blocker and a specialized defender team composition, hence insufficient data was collected to discuss universal athletes playing characteristics' on the men's side, therefore only the blocker and defender were discussed in the men's result section. However, there was enough data to describe the playing styles of all three types of athletes on the women's' side.

NOTE: All numbers in brackets in all figures represent the frequency of occurrence for the associated skill.

## 3.1 Serving

### *3.1.1 Descriptive Results and Discussion (Men)*

A total of 589 serves were observed during the tournament and results for all junior men are shown in Figure 3. Junior men used all three service techniques, but favoured the *jump float* serve *(*43%) compared to the *jump spin* serves (30%) and *standing float* serves (28%). The *standing float* serve resulted in the greatest percentage of poor serves, while the *jump spin* was associated with both the highest percent of *good* serves, and the highest error percentage. As shown below in Figure 3, overall service quality suggested that junior men serve results resulted in more errors than aces (12% vs. 3%), while over half of their serves were considered poor.

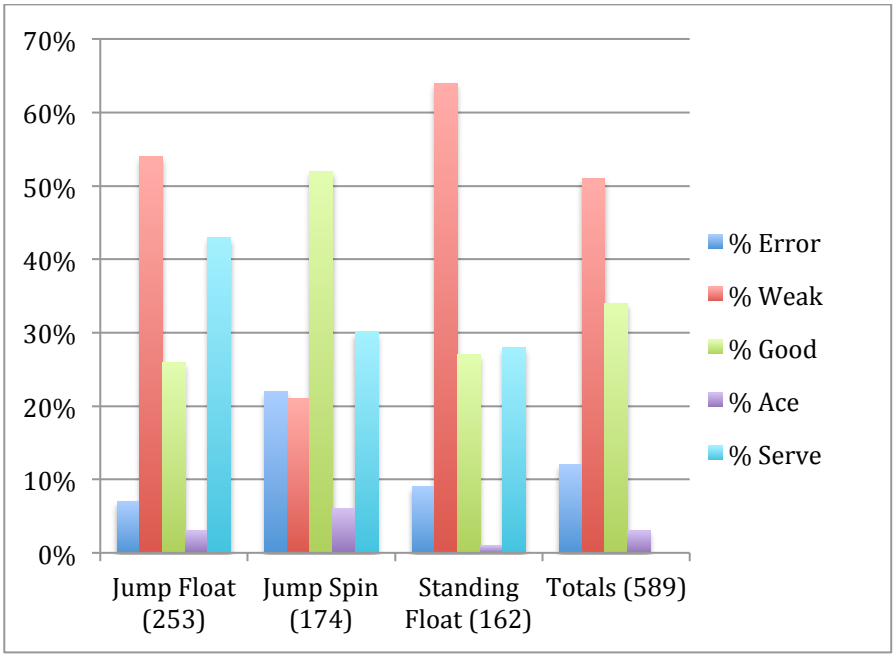



***Figure 3. Serving technique and results for junior men***

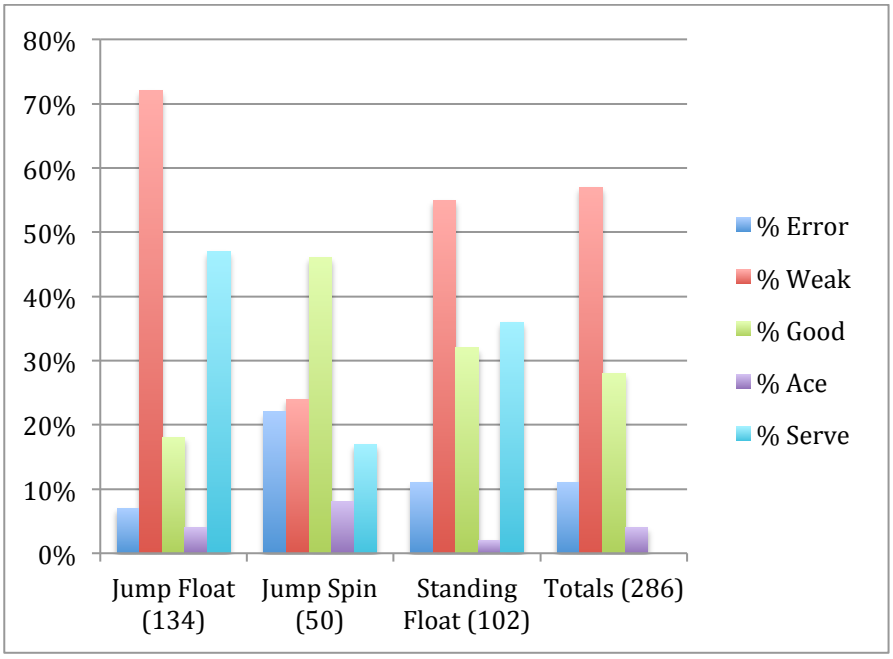



***Figure 4. Junior male Blocker serving characteristics***

#### *3.1.1.1 Blockers and Defenders*

Blockers served 286 times and their results are shown above in Figure 4. The *jump float* comprised almost half of the total serves (47%), while just over a third (36%) were *standing floats* and 17% were *jump spins*. Interestingly, only the *jump spin*

serves had a positive ratio of *good* serves to poor serves. All other serves produced a ratio of less than 1. Overall, junior male blockers scored aces in only 4% of their total serves, while 28% of serves resulted in a direct point for the opposition.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **7** | % | n | **8** | % | n | **9** | % | n |
| | JF | 15% | 43 | JF | 6% | 16 | JF | 16% | 45 |
| | JS | 2% | 7 | JS | 4% | 11 | JS | 4% | 12 |
| | SF | 15% | 44 | SF | 6% | 16 | SF | 7% | 21 |
| | | **33%** | **94** | | **15%** | **43** | | **27%** | **78** |
| | **4** | % | n | **5** | % | n | **6** | % | n |
| **Target** | JF | 1% | 4 | JF | 0% | 1 | JF | 4% | 11 |
| **Locations** | JS | 1% | 3 | JS | 0% | 0 | JS | 2% | 5 |
| | SF | 1% | 2 | SF | 1% | 2 | SF | 2% | 6 |
| | | **3%** | **9** | | **1%** | **3** | | **8%** | **22** |
| | **1** | % | n | **2** | % | n | **3** | % | n |
| | JF | 0% | 1 | JF | 0% | 0 | JF | 1% | 4 |
| | JS | 0% | 0 | JS | 0% | 1 | JS | 0% | 0 |
| | SF | 0% | 0 | SF | 0% | 0 | SF | 0% | 0 |
| | | **0%** | **1** | | **0%** | **1** | | **1%** | **4** |
| | | | | NET | | | | | |
| | | % | n | | % | n | | % | n |
| | JF | 7% | 19 | JF | 30% | 85 | JF | 10% | 30 |
| | JS | 7% | 19 | JS | 5% | 14 | JS | 6% | 17 |
| | SF | 3% | 8 | SF | 8% | 22 | SF | 25% | 72 |
| | | **16%** | **46** | | **42%** | **121** | | **41%** | **119** |
| | | **9** | | | **8** | | | **7** | |

**Serve Locations** %=n/total serves

***Figure 5. Male blocker serving, starting and target service locations***

Also analyzed were the start and end locations of the ball position from the serve. Seen in Figure 5 blockers' preferred start location when serving was from *zone 7* and *8* (41%). Serving from *zone 9* only accounted for 16% of the total serves. Three quarters of the serves ended in the back zone of the court (2-3 meters from the

baseline) while the middle zone and the front zone of the court accounted the other 25 %. In the middle zone, *zone 6* was challenged the most (8% serves), compared to the *zone 5* (1%) and *zone 4* (3%).

When defenders were analyzed, they served a total of 305 times. As shown below in Figure 6 defenders used the *jump float* serve and *jump spin* serve with regular fashion, and appeared to use the *standing float* sparingly. While using the *standing float* almost 80% of the totals serves were considered poor and defenders did not score a single ace with its use. Conversely, the *jump spin* produced the highest percent of *good* serves, the lowest percent of poor serves, as well as the highest percent of aces.

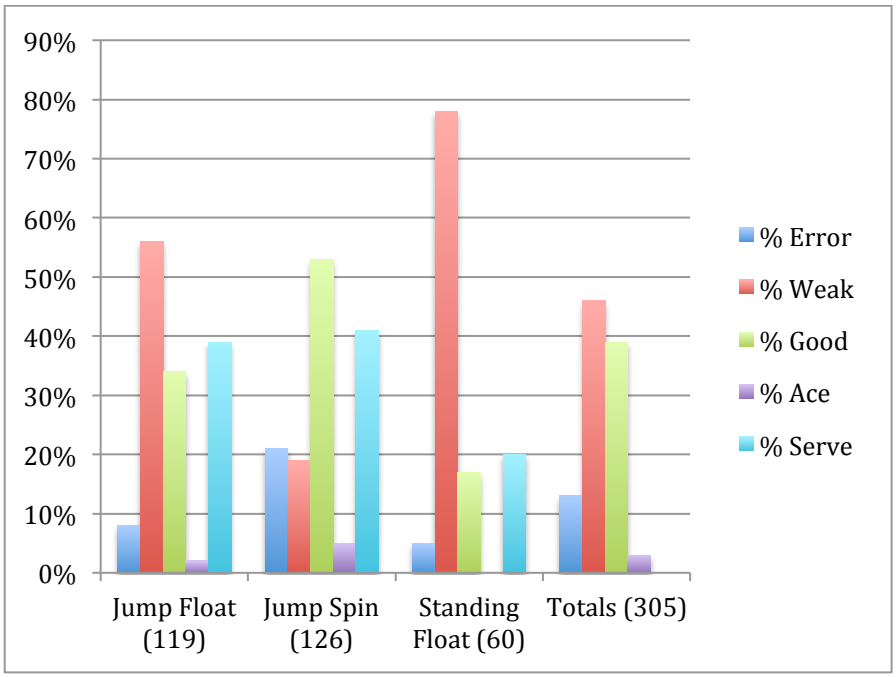



***Figure 6. Junior male defender serving characteristics***

Figure 7 below shows the initial and the end service locations for the defenders. Based on the data, 50% of the serves occurred in the *zone 8,* with 22% of serves starting in *zone 9* and 27% in *zone 7*. Similar to the blockers, the front zone was

rarely challenged while the back zones (7, 8, 9) again dominated as service targets. However, the spread of service locations in the end zone was more uniform (24%, 27%, 24%).

| | **7** | % | n | **8** | % | n | **9** | % | n |
|---|---|---|---|---|---|---|---|---|---|
| | JF | 8% | 25 | JF | 11% | 32 | JF | 10% | 30 |
| | JS | 11% | 33 | JS | 10% | 31 | JS | 9% | 26 |
| | SF | 5% | 14 | SF | 6% | 18 | SF | 6% | 18 |
| | | **24%** | **73** | | **27%** | **82** | | **24%** | **74** |
| | **4** | | n | **5** | | n | **6** | | n |
| **Target Locations** | JF | 1% | 4 | JF | 1% | 4 | JF | 5% | 14 |
| | JS | 1% | 4 | JS | 0% | 1 | JS | 1% | 2 |
| | SF | 1% | 3 | SF | 0% | 0 | SF | 1% | 3 |
| | | **4%** | **11** | | **2%** | **5** | | **6%** | **19** |
| | **1** | | n | **2** | | n | **3** | | n |
| | JF | 0% | 1 | JF | 0% | 1 | JF | 0% | 0 |
| | JS | 0% | 0 | JS | 0% | 0 | JS | 0% | 0 |
| | SF | 0% | 0 | SF | 0% | 0 | SF | 0% | 0 |
| | | **0%** | **1** | | **0%** | **1** | | **0%** | **0** |

NET

| | % | n | | % | n | | % | n |
|---|---|---|---|---|---|---|---|---|
| JF | 3% | 9 | JF | 28% | 85 | JF | 8% | 25 |
| JS | 16% | 49 | JS | 10% | 29 | JS | 15% | 46 |
| SF | 3% | 10 | SF | 13% | 39 | SF | 4% | 11 |
| | **22%** | **69** | | **50%** | **154** | | **27%** | **82** |
| | **9** | | | **8** | | | **7** | |

**Serve Locations** %=n/total serves

***Figure 7. Male defender serving, starting and target service locations***

### 3.1.2 DESCRIPTIVE RESULTS AND DISCUSSION (WOMEN)

Results, shown in Figure 8 indicated that junior women preferred the *float* serves (*standing* and *jump*), while minimizing their use of the *jump spin*. Moreover, the *jump spin* contributed the highest percent of errors attributed to any of the three serves. The *jump float* was the preferred choice, accounted for over half of the total serves. This serve also produced the highest total number of aces, highest total number of *good* serves, and had the highest ratio of aces to errors for any of the three serves. Lastly, the *standing float*, though used in almost 40% of all cases, produced the lowest ration of *good* to poor serves, as well as the lowest ratio of aces to errors.

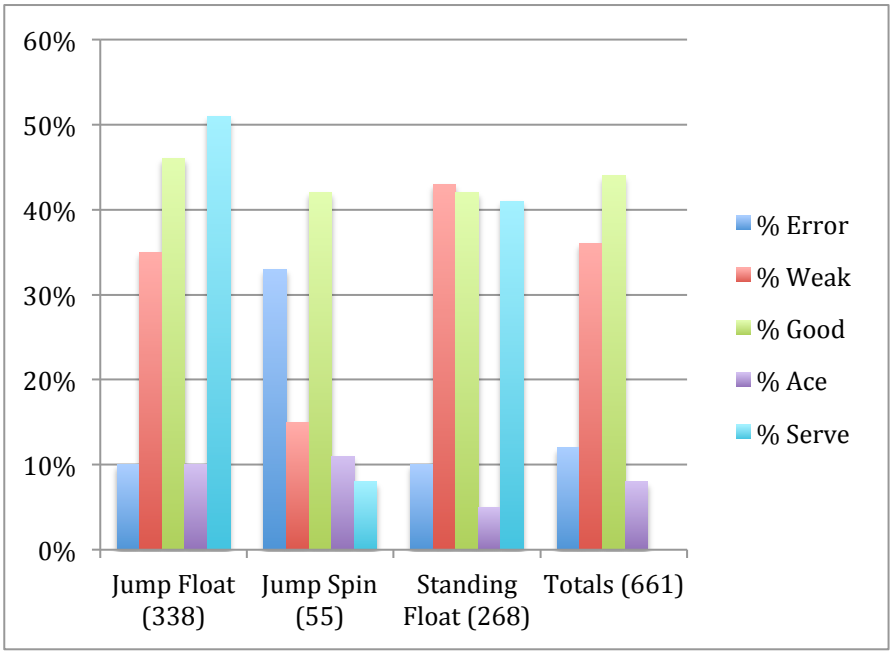



***Figure 8. Serving technique and results for junior women***

#### 3.1.2.1 Blockers, Defenders, and Universal Positions

In total, female blockers served 241 times and scored a direct point in 11% of all instances while 13% of all serves lead to a direct point for the opposition. Figure 9

below displayed serving data for junior female blockers. It appears as though female blockers preferred the use of the *jump float* while again avoiding the use of the *jump spin*. Since the *jump spin* was used in 3% of total serve (*n=7),* it was difficult to draw any conclusions for this technique. The *jump float* serves produced the highest ratio of *good* to poor serves and aces to errors ratio, whereas the use of the *standing float* serves produced more errors than aces.

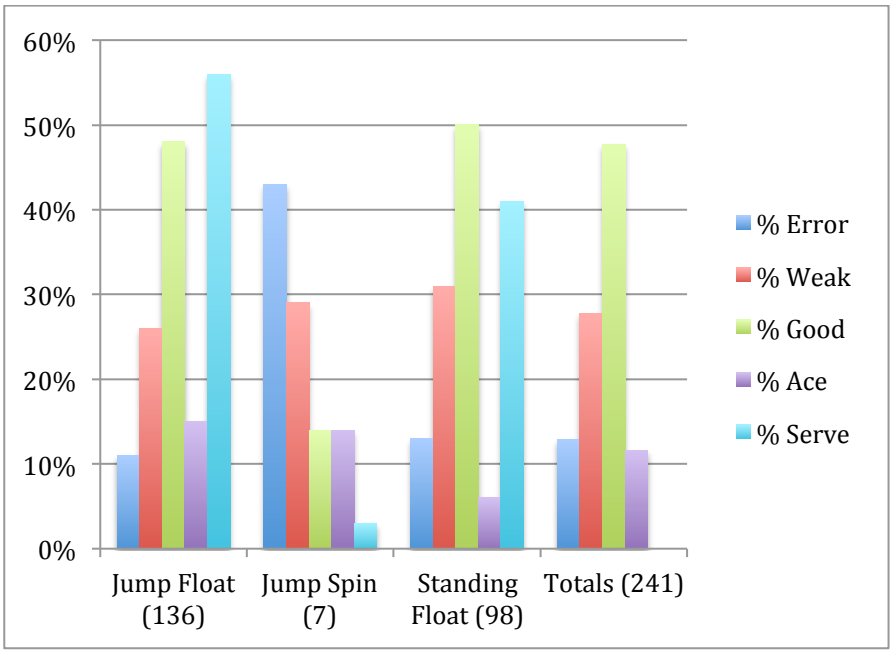



***Figure 9. Junior female blocker serving characteristics***

In terms of service start and target locations, as shown in Figure 10, the vast majority of blocker's serves started from the middle of the court. 58% of all serves were from the middle service zone (*zone 8)* while only 15% of the serves were from the *zone 9* and 29% from the *zone 7*. Similar to their male counterparts, women served the back zones of the court (7,8,9) in the majority of instances (75%). Serving from the middle of the court created the shortest distance for blockers to challenge the interference zone (seam) between players. A detailed analysis of individual initial serve location may yield greater detail into serving trends.

| | **7** | % | n | **8** | % | n | **9** | % | n |
|---|---|---|---|---|---|---|---|---|---|
| | JF | 9% | 21 | JF | 19% | 45 | JF | 13% | 31 |
| | JS | 0% | 1 | JS | 0% | 0 | JS | 1% | 2 |
| | SF | 14% | 33 | SF | 8% | 20 | SF | 11% | 26 |
| | | **23%** | **55** | | **27%** | **65** | | **24%** | **59** |
| | **4** | % | n | **5** | % | n | **6** | % | n |
| **Target** | JF | 2% | 6 | JF | 1% | 2 | JF | 5% | 13 |
| **Locations** | JS | 0% | 0 | JS | 0% | 0 | JS | 0% | 1 |
| | SF | 1% | 2 | SF | 0% | 0 | SF | 2% | 5 |
| | | **3%** | **8** | | **1%** | **2** | | **8%** | **19** |
| | **1** | % | n | **2** | % | n | **3** | % | n |
| | JF | 0% | 1 | JF | 0% | 1 | JF | 0% | 1 |
| | JS | 0% | 0 | JS | 0% | 0 | JS | 0% | 0 |
| | SF | 0% | 0 | SF | 0% | 0 | SF | 1% | 2 |
| | | **0%** | **1** | | **0%** | **1** | | **1%** | **3** |

NET

| | % | n | | % | n | | % | n |
|---|---|---|---|---|---|---|---|---|
| JF | 5% | 11 | JF | 41% | 99 | JF | 11% | 26 |
| JS | 2% | 6 | JS | 0% | 1 | JS | 0% | 0 |
| SF | 21% | 50 | SF | 16% | 39 | SF | 4% | 9 |
| | **28%** | **67** | | **58%** | **139** | | **14%** | **35** |
| | **9** | | | **8** | | | **7** | |

Serve Locations %= n/total serves

***Figure 10. Female blocker serving, starting and target service locations***

Female defenders serve results seen in Figure 11 show a total of 201 service attempts. As with blocker, defenders preferred the use of the *jump float* and *standing float* serves while curtailing the use of the *jump spin* serve. It appeared that the quality of serving between the *float* serves were very similar, with the difference that the ratio of aces to errors for the *jump float* serve was below one, (1:2) where as for every error, the standing float produced an ace (1:1 ratio).

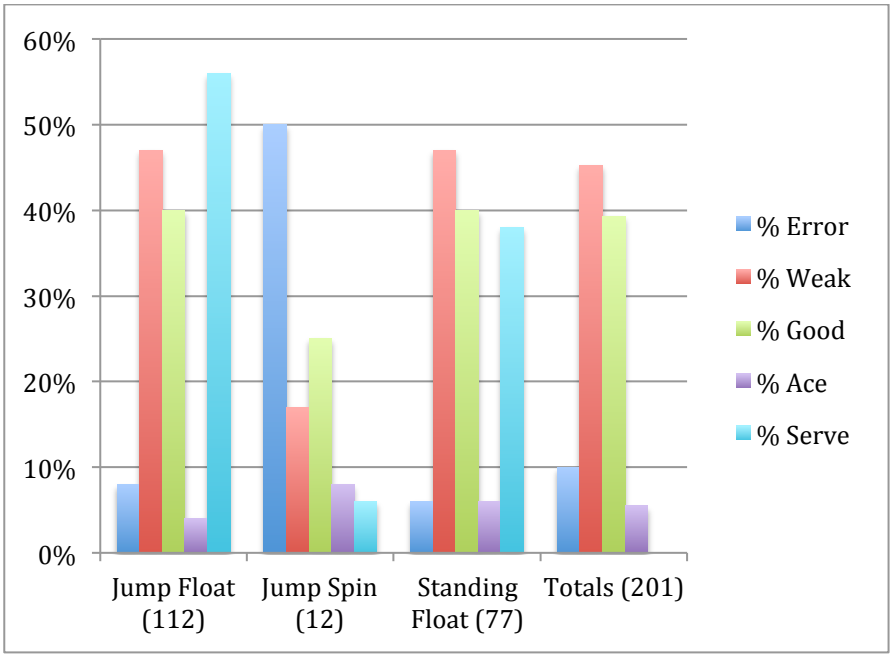



***Figure 11. Junior female defender serving characteristics***

From Figure 12, defenders appeared to prefer to start their serves from the middle of the court, more than 60% of their serves originated from this location. Again, serving from the middle of the court allowed for the shortest distance to target the interference zone or seam between players. However, it was interesting to note that defenders preferred serving to the left side of the court (*zones 3, 6 and 9*). In total, almost half of all attempts landed on the left side. Finally, limited data was collected from serves to the front zones.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **7** | % | n | **8** | % | n | **9** | % | n |
| | JF | 7% | 15 | JF | 13% | 27 | JF | 23% | 47 |
| | JS | 0% | 0 | JS | 1% | 2 | JS | 2% | 4 |
| | SF | 4% | 9 | SF | 12% | 25 | SF | 11% | 23 |
| | | **12%** | **24** | | **27%** | **54** | | **39%** | **74** |
| | **4** | % | n | **5** | % | n | **6** | % | n |
| **Target** | JF | 2% | 4 | JF | 0% | 0 | JF | 4% | 9 |
| **Locations** | JS | 0% | 0 | JS | 0% | 0 | JS | 0% | 1 |
| | SF | 1% | 3 | SF | 0% | 0 | SF | 5% | 10 |
| | | **3%** | **7** | | **0%** | **0** | | **10%** | **20** |
| | **1** | % | n | **2** | % | n | **3** | % | n |
| | JF | 0% | 0 | JF | 0% | 1 | JF | 0% | 0 |
| | JS | 0% | 0 | JS | 0% | 0 | JS | 0% | 0 |
| | SF | 0% | 0 | SF | 0% | 0 | SF | 1% | 2 |
| | | **0%** | **0** | | **0%** | **1** | | **1%** | **2** |

NET

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | % | n | | % | n | | % | n |
| JF | 8% | 17 | JF | 37% | 75 | JF | 10% | 20 |
| JS | 1% | 2 | JS | 0% | 0 | JS | 5% | 10 |
| SF | 9% | 18 | SF | 26% | 52 | SF | 3% | 7 |
| | **18%** | **37** | | **63%** | **127** | | **18%** | **37** |
| | **9** | | | **8** | | | **7** | |

Serve Locations %= n/total serves

***Figure 12. Female defender serving, starting and target service locations***

Figure 13 below shows the serving tendencies for universal athletes. Universal athletes served a total of 218 times and preferred the *standing float* (46%) and *jump float* (45%) to the *jump spin* (18%). The *standing float* was the only serve where the percent of *good* quality serves was below 40%, and ace percentage was below 5%.

The *jump float,* and *jump spin,* both had good serve percentages above 40% and ace percentages near 10%.

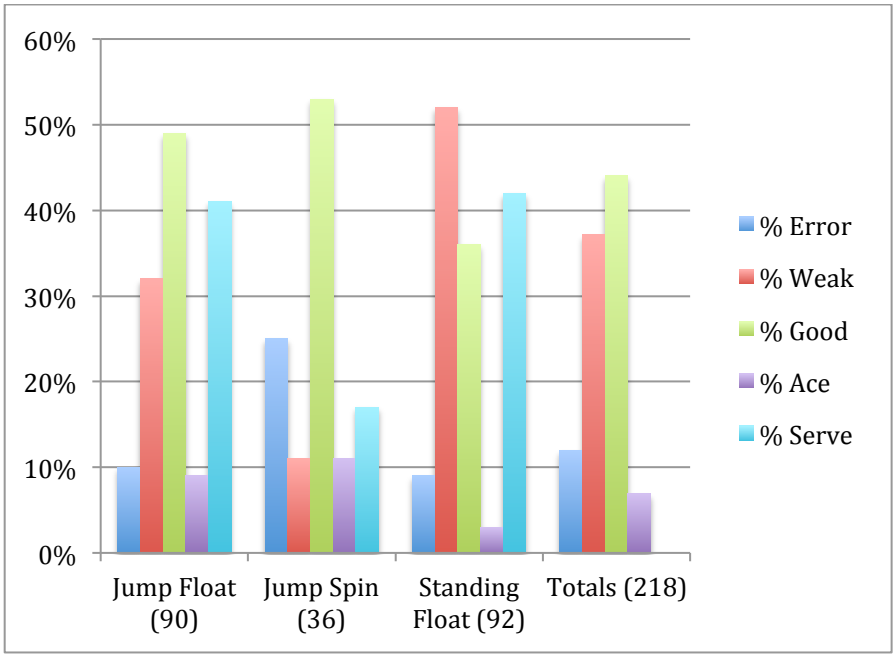



***Figure 13. Universal serving characteristics for junior women***

In terms of serving locations universal athletes differed from female blockers and defenders. It appeared that they preferred serving from the wings, or the zones closer to the sidelines, versus the middle zone. With this said, of the wing positions, their preferred start location was from *zone 9* (63%). In terms of ball end locations universal athletes did not appear to favour a specific location. A relatively even distribution of serves to the end zones did not show a definitive tendency as *zone 7* *zone 7* and *zone 9* were served with similar frequency (26%, 28%, and 22% respectfully). Minimal data was again observed when serving to the front zones, *zones 1, 2* and *3.*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **7** | % | n | **8** | % | n | **9** | % | n |
| | JF | 12% | 27 | JF | 11% | 25 | JF | 9% | 19 |
| | JS | 4% | 9 | JS | 4% | 8 | JS | 3% | 6 |
| | SF | 10% | 21 | SF | 13% | 28 | SF | 10% | 22 |
| | | **26%** | **57** | | **28%** | **61** | | **22%** | **47** |
| | **4** | % | n | **5** | % | n | **6** | % | n |
| **Target** | JF | 1% | 3 | JF | 2% | 4 | JF | 2% | 4 |
| **Locations** | JS | 0% | 0 | JS | 0% | 0 | JS | 1% | 3 |
| | SF | 1% | 3 | SF | 0% | 0 | SF | 5% | 10 |
| | | **3%** | **6** | | **2%** | **4** | | **8%** | **17** |
| | **1** | % | n | **2** | % | n | **3** | % | n |
| | JF | 0% | 0 | JF | 0% | 0 | JF | 0% | 0 |
| | JS | 0% | 0 | JS | 0% | 0 | JS | 0% | 0 |
| | SF | 0% | 0 | SF | 0% | 0 | SF | 0% | 0 |
| | | **0%** | **0** | | **0%** | **0** | | **0%** | **0** |
| | | | | | NET | | | | |
| | | % | n | | % | n | | % | n |
| | JF | 18% | 39 | JF | 0% | 0 | JF | 23% | 50 |
| | JS | 12% | 26 | JS | 0% | 0 | JS | 5% | 10 |
| | SF | 34% | 74 | SF | 5% | 11 | SF | 4% | 8 |
| | | **64%** | **139** | | **5%** | **11** | | **32%** | **68** |
| | | **9** | | | **8** | | | **7** | |

Serve Locations %= n/total serves

***Figure 14. Female universal serving, starting and target service locations***

### *3.1.3 COMPARATIVE RESULTS AND DISCUSSION (MEN)*

#### *3.1.3.1 Blockers and Defenders*

***Figure 4 and Figure 6 above, show the serving techniques of junior men. It appeared as as though blockers avoided the jump spin (n=50) while defenders favoured this serve serve (n=126). Chi square test indicated significant differences in service technique***

***between blockers and defenders (p<0.001).***

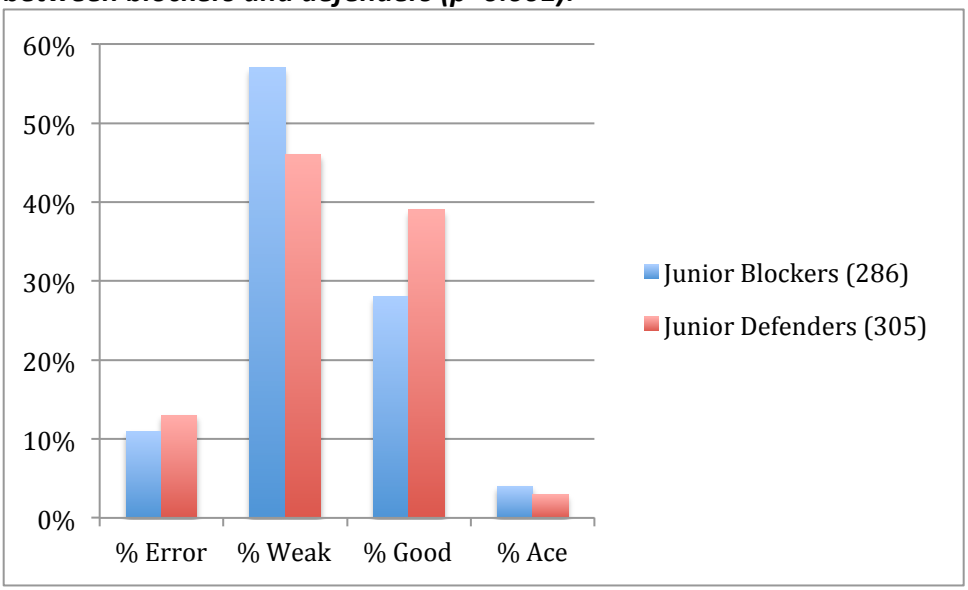



Figure 15 below compared serving results between male blockers and defenders. When both positions were compared to one another, blockers produced a higher percentage of poor serves, and a lower percentage of *good* serves. Aces and error percentages were rather similar. Quality analysis revealed significant differences between junior blockers and defenders, with defenders serving with a higher quality (p<*0.001).*

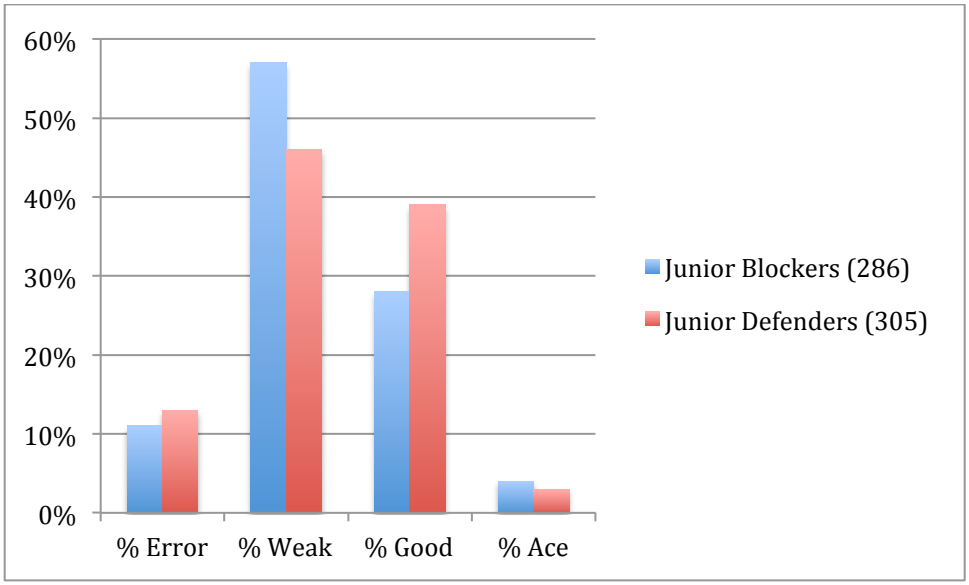



***Figure 15. Comparison of serving qualities between junior male blockers and defenders***

#### *3.1.3.2 Junior and Senior*

In terms of service technique, data from this study was compared to that of Koch & Tilp (2009a). Figure 16 below revealed similarities and differences between the technical choices of the junior and senior men. Data suggested that the percentage of *standing float* serves was similar, while senior athletes preferred the *jump spin* and the junior ones preferred the *jump float*. Chi square test showed significant differences for service techniques between the junior and senior athletes ($p<0.05$*).*

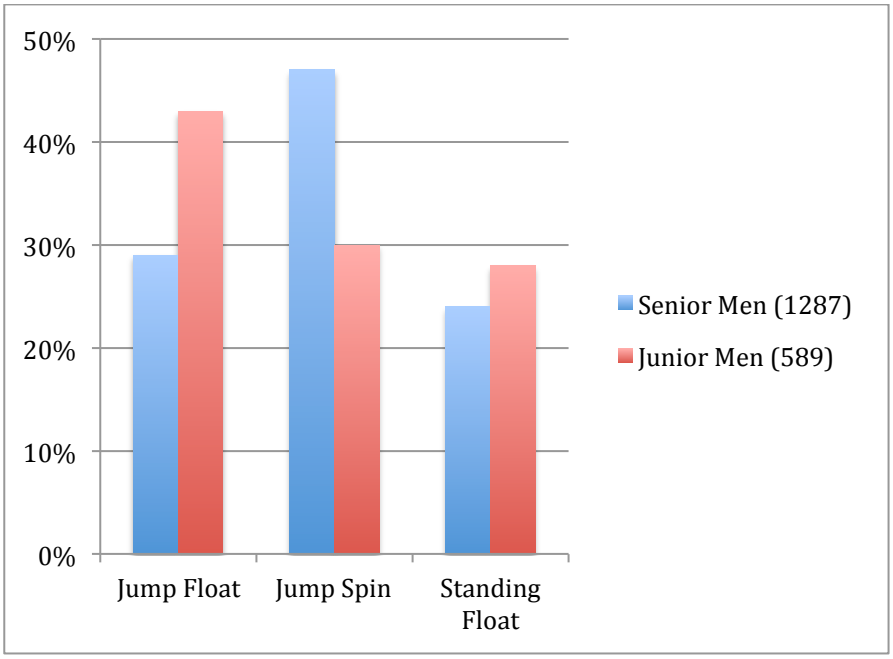



***Figure 16. Differences in serving technique between junior and senior men***

Data from this study could not be compared to other studies due to the discrepancies in measurable results. For example, Lopez-Martinez & Palao used 5 result criteria. From their study, they added criteria such as serves that limited the opposition's attack *and* serves categorized as '*no attack*'. In this study, a serve was considered *good* if two or more criteria were met, 1) Ball trajectory was low and/or fast, 2) The serve put the opposition under time crisis, 3) The serve forced movement out of the opposition. Therefore, it was impossible to make comparisons as different criteria existed between research papers.

### *3.1.4 Comparative Results and Discussion (Women)*

#### *3.1.4.1 Blockers, Defenders and Universal Athletes*

Figure 9 through Figure 14 described preferred serving techniques as well as results related to each serve for female blockers, defenders and universal athletes. From

this data statistical testing indicated that, like the junior men, significant differences existed in terms of service technique ($p$<0.001).

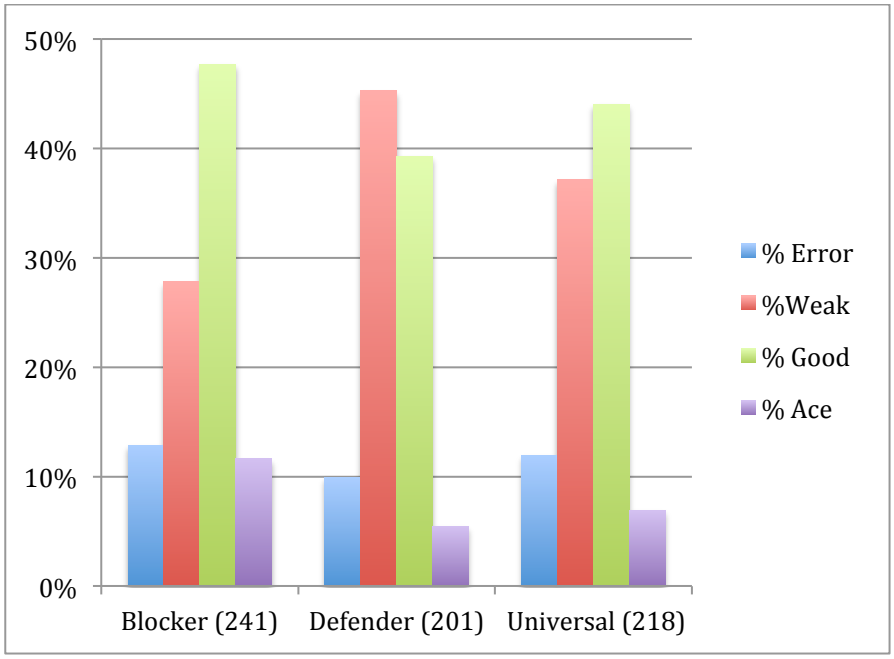



***Figure 17. Comparison of serving qualities between junior female blockers, defenders and universals***

When the results were compared, it appeared that blockers had the highest ratio of good-to-poor serves, yet committed the greatest percent of unforced errors. Defenders were the only athletes to have their good-to-poor service ratio under one. A significant difference in serving quality was found between the 3 different positions for junior female athletes *($p$<0.05).* Based on this data, it may be suggested that female blockers produced the best results when serving.

#### *3.1.4.2 Junior and Senior*

As with the men, comparisons of quality could not be made from junior to senior athletes. Nevertheless, technical differences could be analyzed. Senior women utilized the *jump spin* serve with significantly higher frequency than the junior

women, while the junior women preferred *jump float* serves. These differences proved significant ($p<0.001$).

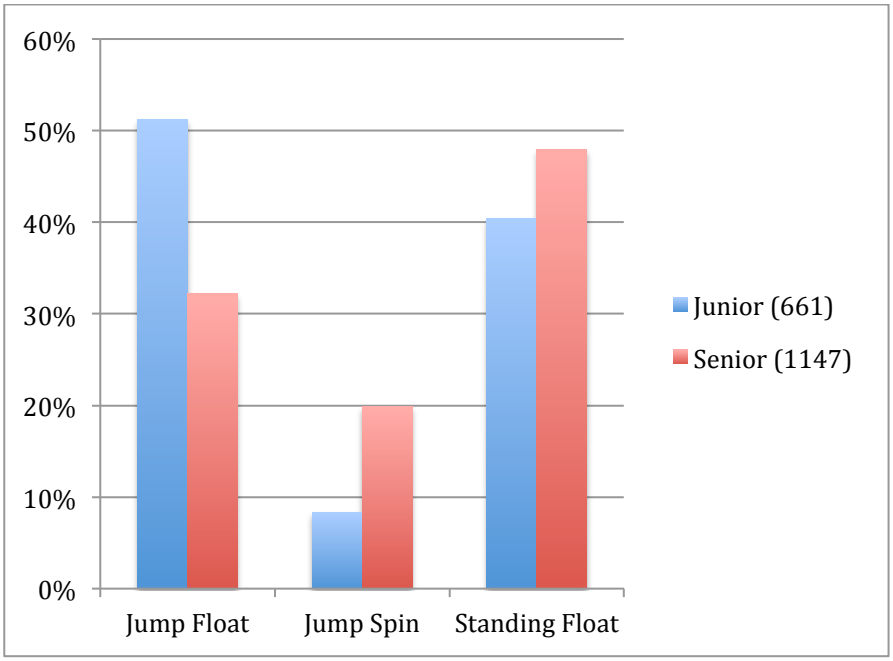



***Figure 18. Differences in serving technique between junior and senior women***

#### *3.1.4.3 Junior Males and Junior Females*

Show in Figure 19, both junior men and junior women used all three service techniques. Data suggested that both groups preferred the *jump float* to the other choices, while the *jump spin* accounted for less than 10% of the serves for junior women. Men on the other hand, had a more uniform service selection. Significant differences existed between the service techniques of junior male and female athletes *($p<0.001$).*

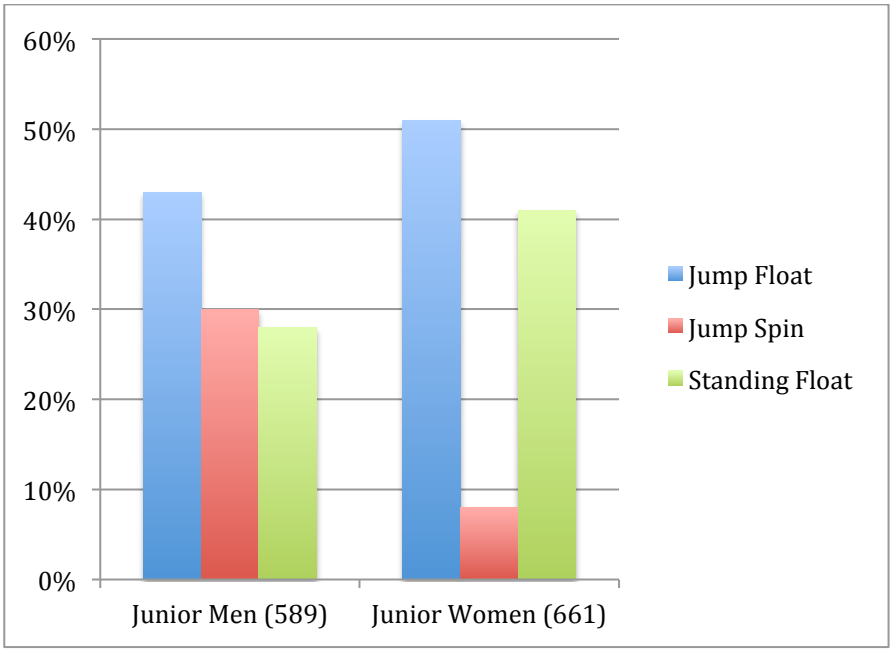



***Figure 19. Comparison of service techniques used my junior men and women***

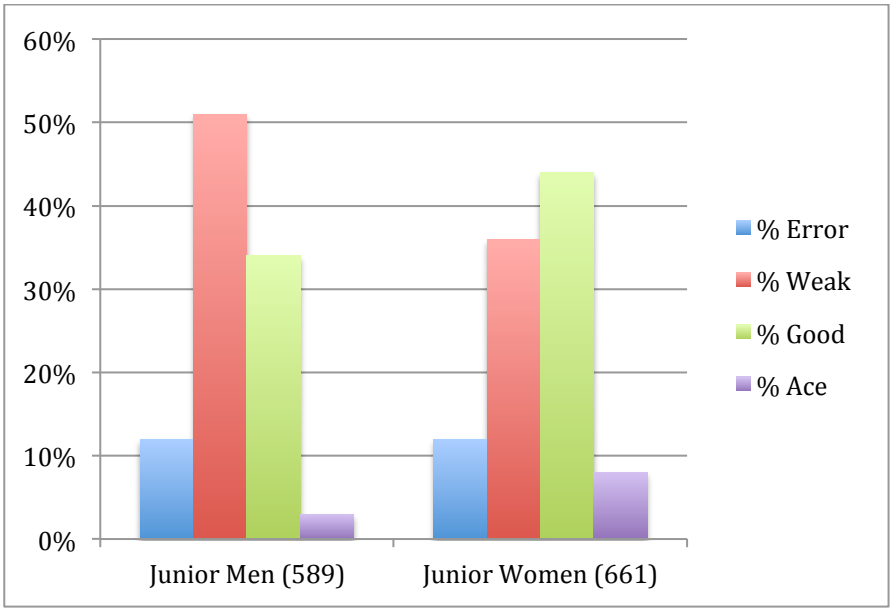



***Figure 20. Comparisons of junior men and women serve qualities***

In terms of overall service quality, significant differences also existed *(p*<0.001*).* It appeared that women had more aces and *good* serves, while maintaining a similar percent and number of errors.

## 3.2 Service Reception

### *3.2.1 Descriptive Results and Discussion (Men)*

A total of 503 passes were observed off of serves. Of those, nearly two-thirds resulted in a *good* criterion. Data suggests that when the ball was contacted in the midline reception quality increased, and when the ball was contacted outside the midline, reception quality decreased. Chi square tests showed a significant difference in quality when passing in the midline and outside the body ($p<0.001$). Based on this data, it seemed that forcing a team to pass outside their body added an element of difficulty in reception, reflected in the fact that athletes did not pass as well as when the ball was contacted away the midline.

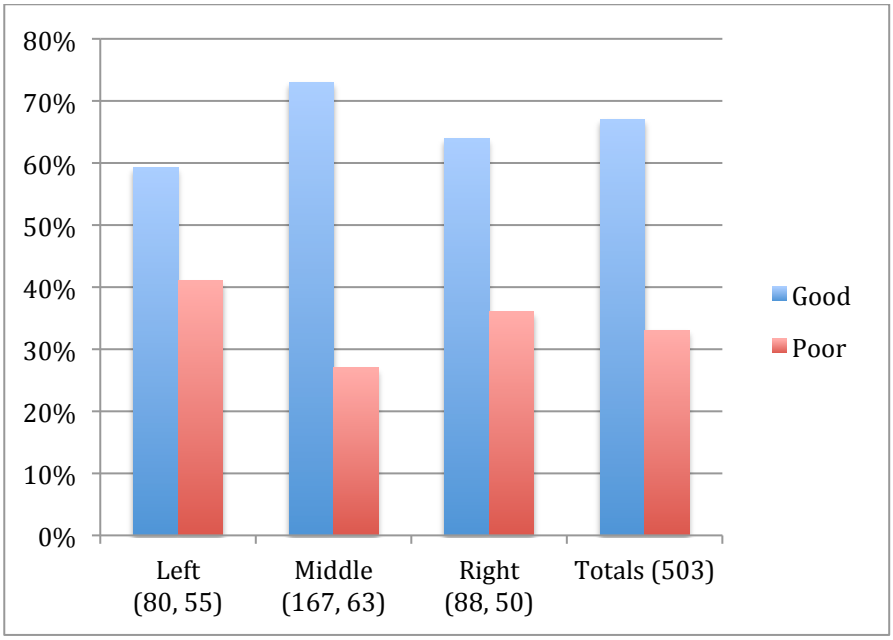



***Figure 21. Location of contact relative to the body and passing results for junior men***

#### *3.2.1.1 Blockers and Defenders*

A descriptive analysis was also conducted evaluating male blocker and defenders individually. Blockers were served 276 times. Seen in Figure 22 blockers received

more *jump float* serves than any other serve (54%), while 63% of all *jump float* serves passed by blockers recorded a *good* pass rating. However, this pass rating fell to 56% when passing *jump spin* serves. When passing a *standing float* serves, *good* pass rating increased to 71%. Finally, when a ball was contacted in the midline ball, 71% of all passes were considered *good*. This percentage dropped to 56% when the ball was contacted outside the midline. A significant difference was found between the quality of passing in the midlines and outside the body for blockers ($p<0.05$).

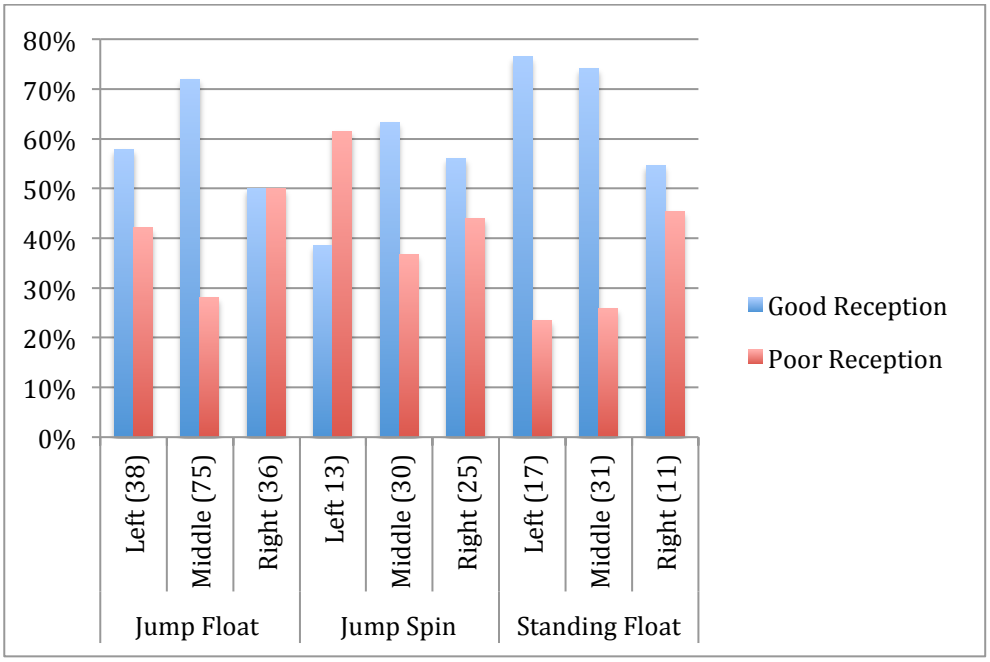



***Figure 22. Male blockers – reception results and contact locations relative to the body***

Defenders received a total of 227 serves. Again, data showed that defenders were more successful passing in the midline (76% *good* reception contacts) versus passing outside their body (68% *good* reception contacts). The serve that defenders appeared to have the most success passing was the *jump float* (72%), and the least success receiving was from the *jump spin* (68%). Statistical analysis revealed a significant difference in the pass quality *($p<0.05$).* Based on this data, it could be

considered that defenders pass with greater success when they receive the ball in the midline of their body, versus outside their midline.

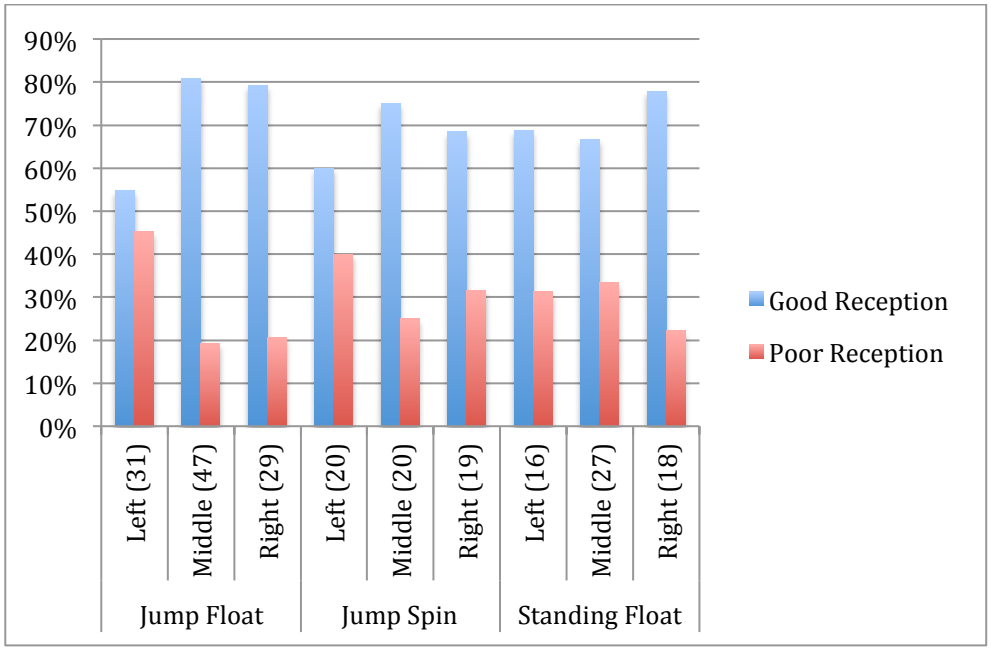



***Figure 23. Male defenders– reception results and contact locations relative to the body***

### *3.2.2 Descriptive Results and Discussion (Women)*

In total, women were observed receiving 532 times. Figure 24 shows that 43% of the receptions total were considered poor, while the other 57% were of *good* quality. Figure 24 also shows that junior women received the serve with highest successes when the ball was contacted in their midline. When the ball was received in the midline, junior women tallied 68% *good* receptions and when the ball was contacted outside the body that percentage dropped to 48%.

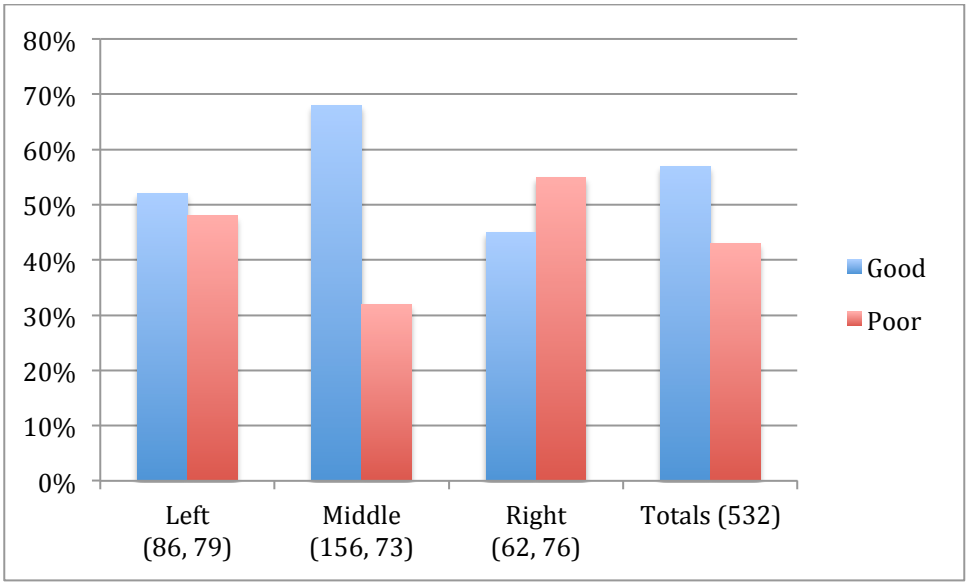



***Figure 24. Location of contact relative to the body and passing results for junior women***

#### *3.2.2.1 Blockers, Defenders and Universal Positions*

*It was important to note that the reception qualities of the jump spin serves may be misleading because the number of jump spin serves used by junior women was very small.*

Blockers passed a total of 148 times. Figure 25 below indicated that blockers were most effective passing a *standing float* (69% *good* passes) compared to a *jump float (*51% *good* passes) and *jump spin (*41% *good* passes). Overall female blockers still produced more *good* passes than *poor* passes. Lastly, in all categories, blockers were more efficient at passing in their midline versus outside their body, with the exception of the *jump spin*, though more data may be necessary to draw further conclusions. Though the data may show higher percentages of reception success when the ball was contacted in the midline, no significant differences were found when reception location and pass quality were observed *(p*=0.083*)*.

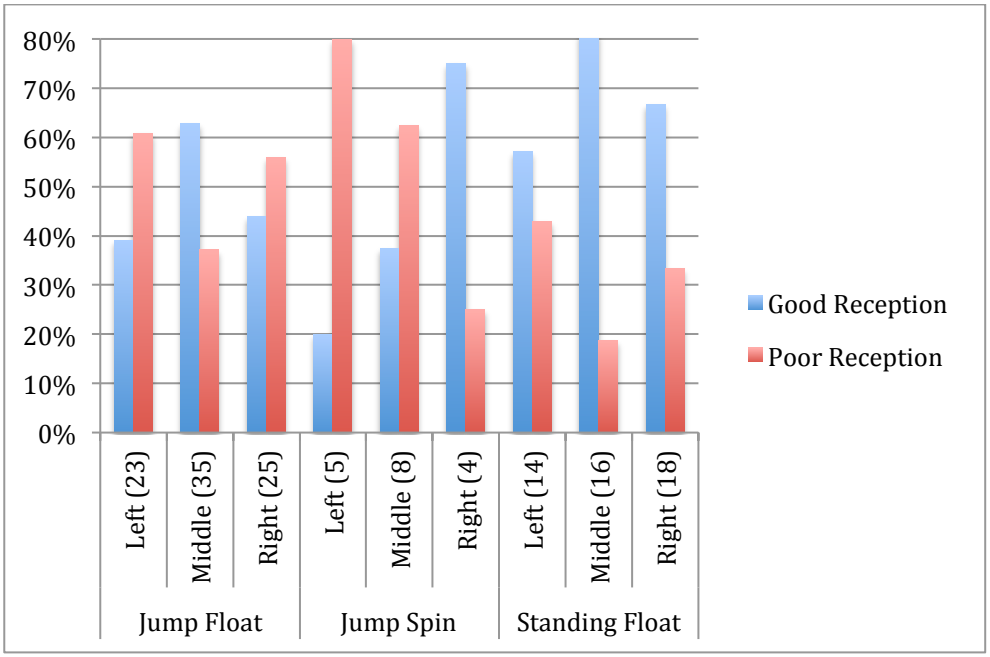



***Figure 25. Female blockers – reception results and contact locations relative to the body***

Similar to blockers', defenders' experienced the most success receiving serves in their midlines. Figure 26 shows reception quality for defenders. Overall, the percentage of *good* passes was above 70%. Once again, when the ball was served to the outside of their midline, passing success decreased. Chi square test for quality showed a significant difference in quality ($p<0.05$). It appeared as though defenders were more successful receiving the ball in their midline. In terms of success rates with serves, the data implied defenders experienced the greatest success receiving the *jump spin,* though a larger data set may be necessary to draw this conclusion With the *standing float,* defenders received the ball with a *good* quality rating in 66% of all instances, compared to 55% when receiving a *jump float*.

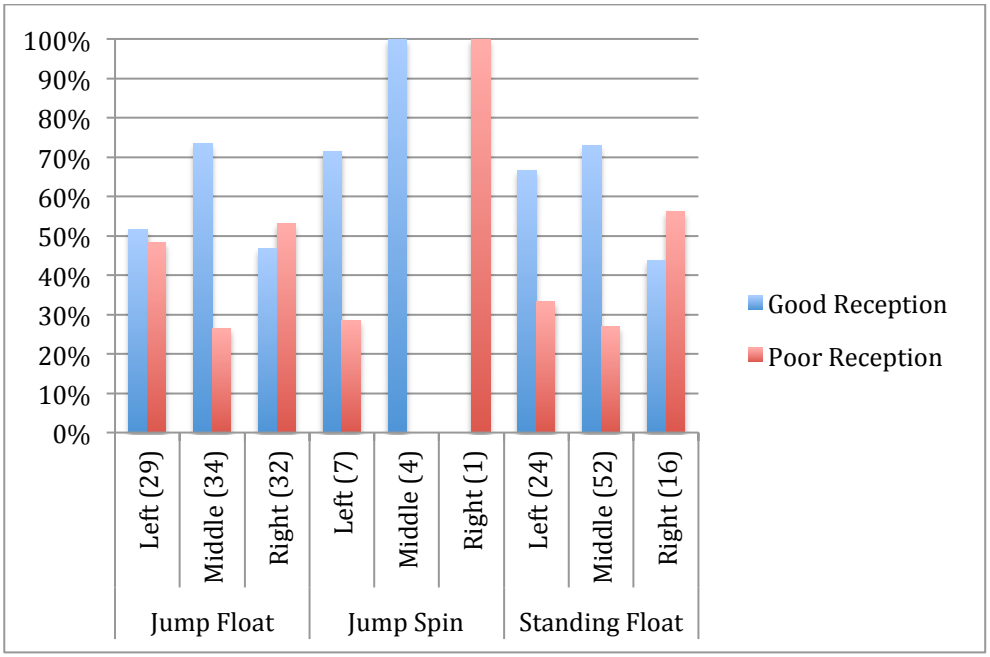



***Figure 26. Female defenders – reception results and contact locations relative to the body***

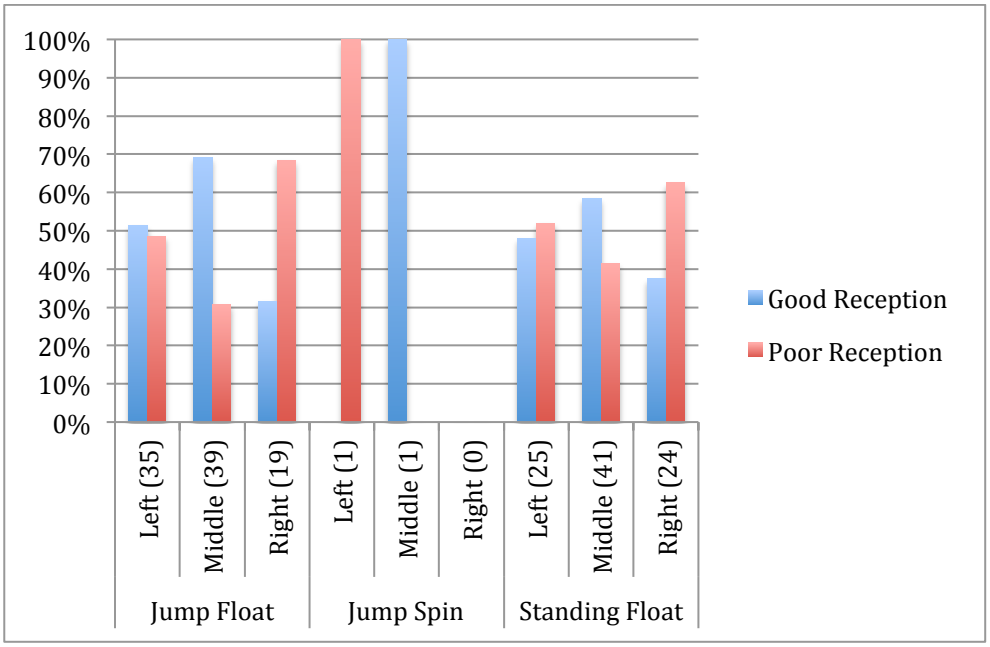



***Figure 27. Female universals athletes – reception results and contact locations relative to the body***

Results for female universal positions are shown in Figure 27. Since universal players only received a total two (2) receptions from *jump spin* serves, it may be difficult to make any conclusions and hence results and discussions were centered

on the *float* serves. When receiving the *jump float*, universal athletes experienced a higher percentage of success (55%) compared to receiving the *standing float* (50%). Overall universal athletes passed with a *good* quality in only 52% of all reception contacts. This percentage increased to 64% when passing in the midline, and dropped to below 50% when passing outside the body. Like defenders, a significant difference existed in quality when passing in the midline and outside the body ($p<0.05$*).*

### *3.2.3 COMPARATIVE RESULTS AND DISCUSSION (MEN)*

#### *3.2.3.1 Blockers and Defenders*

Male blockers and defenders both received with a high degree of success. Both athletes produced over 60% *good* receptions Furthermore significant differences for both blocker and defender were found in reception quality when the ball was received in the midline, versus outside the body. When compared, defenders appeared to be the better overall receivers (71% vs. 63%), as well as better receivers when passing the ball in their midline (76% vs. 71%) and outside their body (68% vs. 56%). No significant differences were found in overall pass quality between the male blockers and defenders ($p=0.063$). However, when the quality of receiving the serve *outside* the midline was compared, a significant difference was found *(*$p<0.05$*)*. The data therefore suggested that defenders are better receivers outside the body than blockers.

#### *3.2.3.2 Senior and Junior*

Koch & Tilp (2009a) observed a total of 1126 contacts and showed that 55% of senior men's receptions were executed perfectly. For junior men, data from this study showed that overall, 66% of junior men's receptions were considered *good*. Significant differences existed in reception quality between junior and senior men *(p*<0.001*)*. It would appear that the junior men were more successful in the element of reception that the seniors.

### *3.2.4 COMPARATIVE RESULTS AND DISCUSSION (WOMEN)*

#### *3.2.4.1 Blockers, Defenders, Universals*

All three athletes on the women's side received the ball in their midline, as well as outside their body. Figure 25 Figure 26 and Figure 27 shows reception quality based on serve technique, as well as the location on the body the ball was contacted and shows that overall, defenders appeared to have the highest percent of quality *good* receptions (63%), followed by blockers (55%), and then the universal athletes (52%). When the ball was received outside the midline, the quality for all three athletes decreased. Defenders received with 53% *good* quality, blockers with 49% and universal athletes with 43% success. In terms of overall pass quality, no significant differences were found between all three types of athletes *(p*=0.106*)*. Similarly, when the ball was contacted outside the midline, no significant differences were found in quality between all three athletes (*p*=0.344*)*.

#### *3.2.4.2 Senior and Junior*

According to their analysis done of beach volleyball athletes who played in 2005, Koch & Tilp (2009a) determined that senior female athletes have a success rate o 55% when receiving the ball. Data from this study implied junior females receive the serve with a success rate of 57%. A chi square test for quality determined no significant differences existed in reception quality between junior and senior beach volleyball athletes ($p$=0.139*).* It therefore appeared that both the junior and senior women received the serve with similar quality.

#### *3.2.4.3 Junior Men and Junior Women*

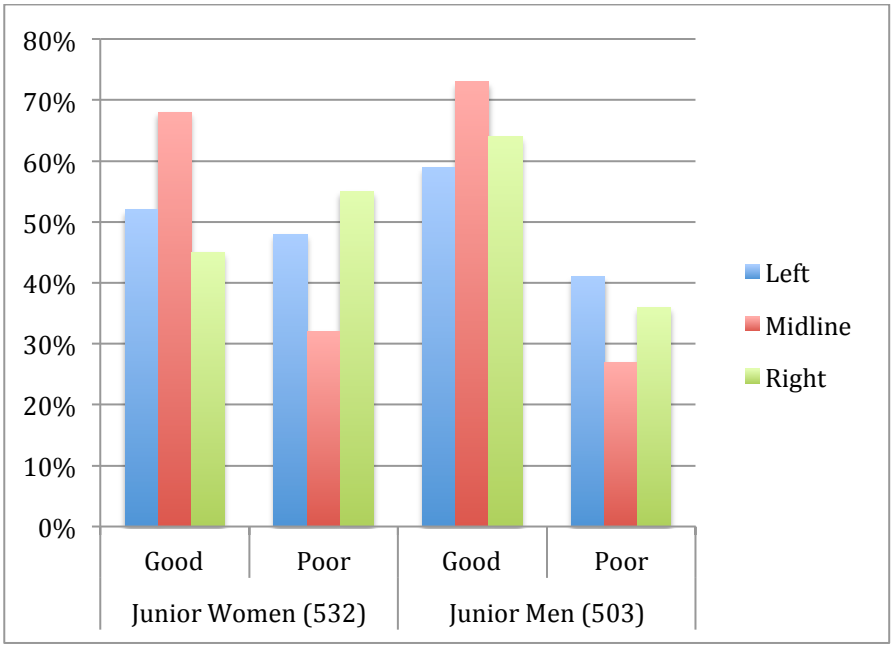



***Figure 28. Comparisons of reception results and reception locations for junior men and women***

Both junior men and women passed with higher efficiency when the ball was contacted in the midline, versus outside the body. This information was clearly revealed in Figure 28 below. When junior athletes receive the ball in their midline, more than 70% of all their contacts were considered *good*. When the reception

quality of junior men and junior women were compared, significant differences existed in passing quality ($p<0.001$). From this data it appeared that men were the more skilled passers.

## 3.3 Setting

### *3.3.1 Descriptive Results and Discussion (Men)*

A total of 719 setting contacts were observed for junior men. The quality of the second contact was very high as the overall percent of *good* sets totalled 75%. The *forearm* technique was used in 68% of all set attempts, compared to 32% use of the overhead technique.

***Table 3. Overall set quality and technique for junior men***

| Quality | | | *Technique* | | |
|---|---|---|---|---|---|
| **Good set** | 537 | 75% | **Forearm** | 486 | 68% |
| **Poor set** | 182 | 25% | **Overhead** | 233 | 32% |

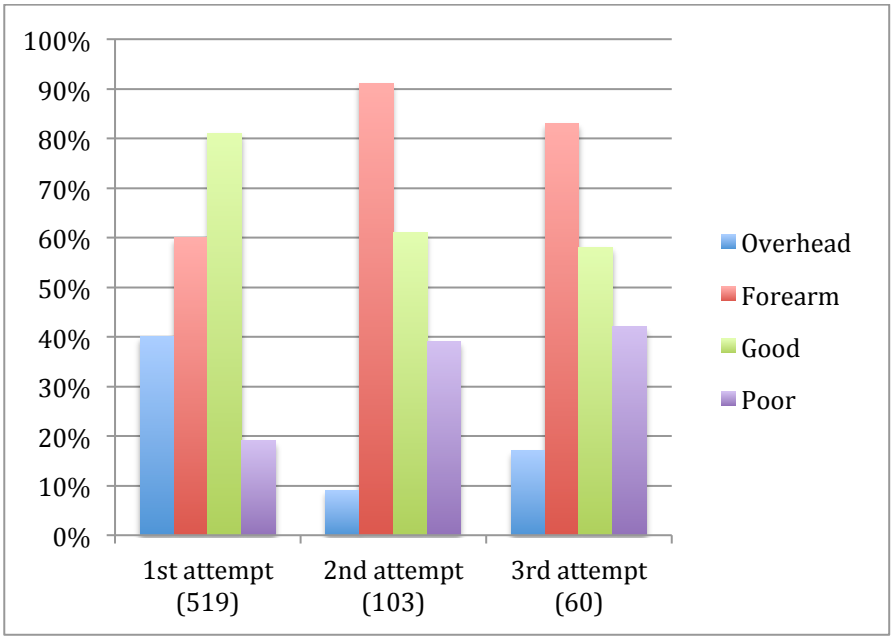



***Figure 29. Set techniques and qualities for junior men in relation to number of attempts in the rally***

In terms of techniques used by the junior men as rallies progressed, Figure 29 shows that the percent of *good* sets decreased after the first set contact. Set quality was highest after the first attempt (80%), decreased to 60% on the second attempt,

and again decreased to 58% on the third attempt. Also, the forearm technique was favoured in all three instances over the overhead technique. It was curious to see that the percent of use of the *overhead* technique decreased from the 1st rally to the 2nd rally, yet increased from the 2nd rally to 3rd rally.

#### *3.3.1.1 Blockers and Defenders*

Blockers had a total of 217 set attempts off of serve receive. 68% of the contacts involved the *forearm* technique, while the other 32% comprised the *overhead* technique. Figure 30 below shows the set quality of each technique after *good* and *poor* receptions, as well as the overall set quality for blockers off of serve receive.

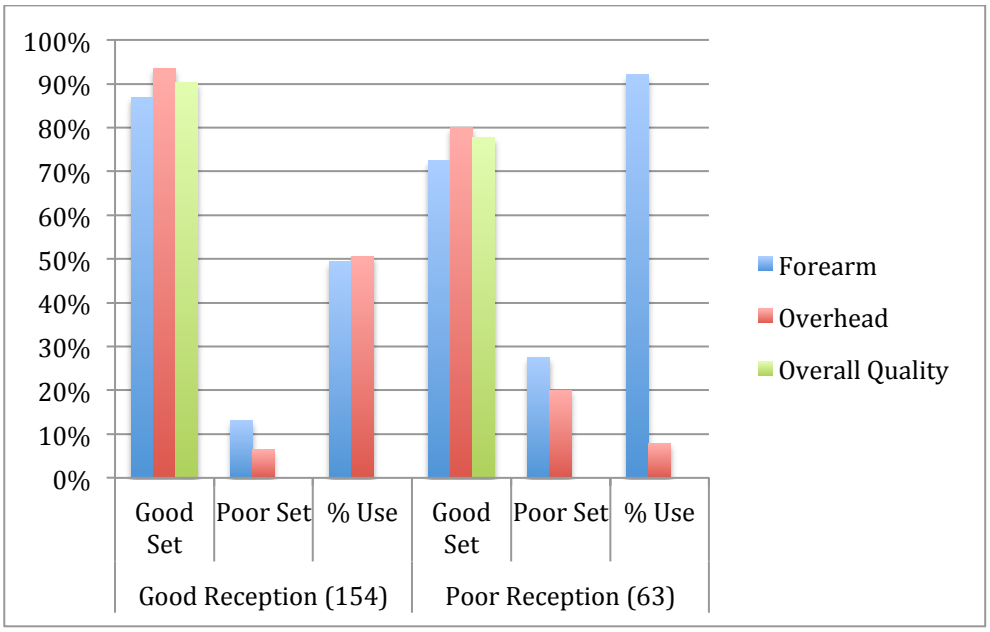



***Figure 30. Setting techniques and qualities from reception for junior male blockers***

Figure 30 shows that blockers produced a higher percent of overall *good* sets after a *good* reception, as well as used both the *overhead* and the *forearm* techniques in similar fashion. After a poor reception, it appeared that set quality remained high. The main difference appeared to be the fact that the *forearm* technique was

overwhelmingly favoured (over 90% use) after a poor reception. Significant differences existed between set quality after a *good* and *poor* reception ($p<0.05$). It appeared blockers were more successful setting after a *good* reception.

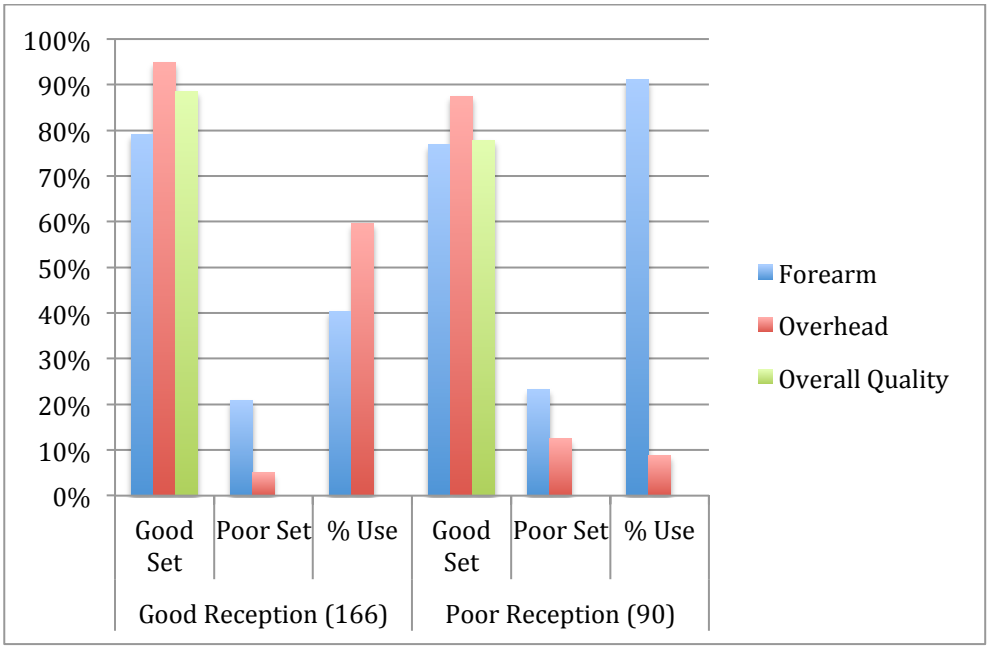



***Figure 31. Setting techniques and qualities from reception for junior male defenders***

Defenders were observed setting a total of 217 times off of serve receive. In terms of technique, the *forearm* technique was preferred to the o*verhead* technique (58% vs. 42%). Defenders also set with a very high quality regardless of the technique. 78% of the *forearm* and 94% of the *overhead* sets were considered *good*. Figure 31 further graphically represented the setting tendencies after *good* and poor receptions. Defenders preferred the *overhead* technique after *good* receptions (60%), while the use of the *forearm* technique was the dominant style after poor ones (over 90%). There was a significant difference between the set after a *good* reception and after a *poor* reception. As with blockers, defenders seemed to execute the set with a higher quality after a *good* reception, than after a *poor* one. ($p<0.05$).

### 3.3.2 *Descriptive Results and Discussion (Women)*

Junior women were observed setting the ball 787 times. Their overall set quality was over 75% *good* sets. Junior women avoided using the *overhead* technique as this technique accounted for a total of 6 attempts, or less than 1% of the total sets. Some have speculated the cause of this (Koch & Tilp 2009(a)), suggesting the strict enforcement and penalization of poor overhead sets, yet a concrete reason has yet to be determined. Table 4 below further describes overall setting characteristics for junior women.

***Table 4. Overall set quality and technique for junior women***

| Quality | | | *Technique* | | |
|---|---|---|---|---|---|
| **Good set** | 596 | 76% | **Forearm** | 781 | 99% |
| **Poor set** | 191 | 24% | **Overhead** | 6 | 1% |

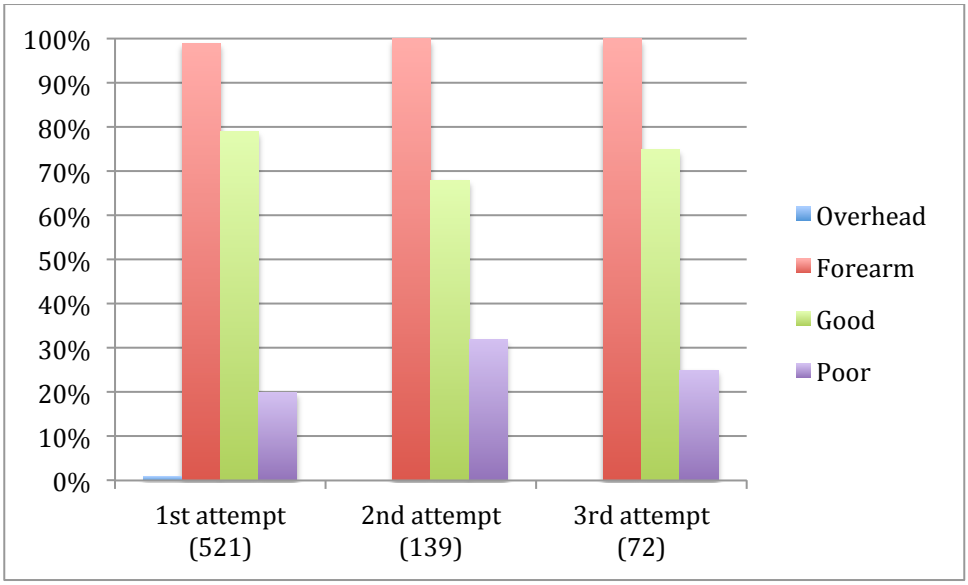



***Figure 32. Set techniques and qualities for junior women in relation to number of attempts in the rally***

Setting characteristics were also observed at different moments in the rally. Figure 32 above shows how the use of the *overhead* set was used only on the first set attempt in the rally, and was not used thereafter. Furthermore, the qualities of the

sets were highest after the first and third attempts, and lowest after the second. Generally, the second attempt was after an attack from the opposition rather than after service reception.

#### *3.3.2.1 Blockers Defenders and Universal Positions*

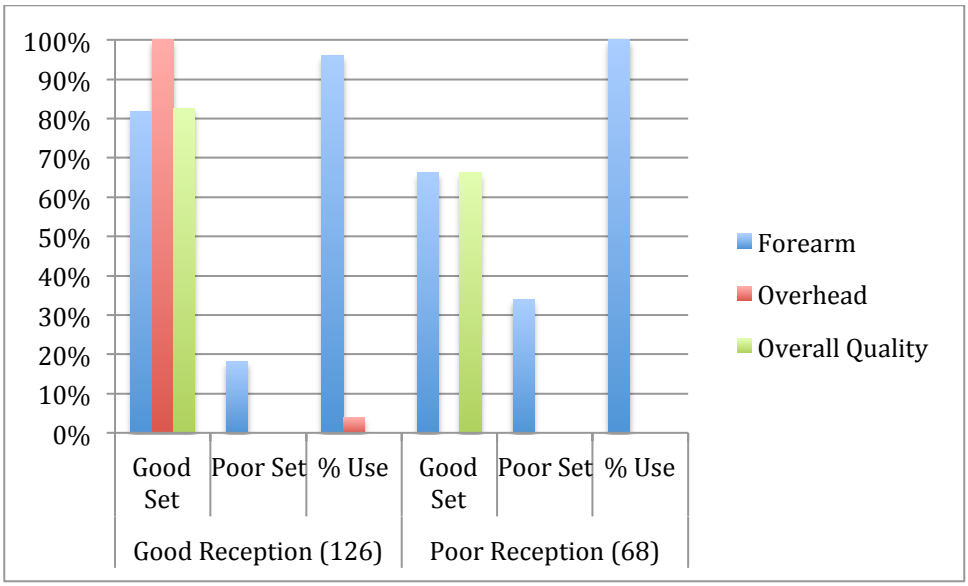



***Figure 33. Setting techniques and qualities from reception for junior female blockers***

Female blockers were observed setting on serve reception a total of 194 times. 75% of their sets were considered *good*, while 25% were considered *poor*. Technically, they only used the *overhead* technique on a *good* reception. However, this technique was only use 5 times (4%) of total attempts. The forearm set was again overwhelmingly favoured (97%), and was the only technique used after *poor* receptions. Chi square test showed a significant difference in quality between setting after a *good* and *poor* reception ($p<0.05$*).* Thus, it seems blockers set with a higher quality after a *good* reception.

For female defenders, they were observed setting off of serve receive a total of 143 times. They exclusively used the *forearm* technique since no *overhead* sets were

recorded. In terms of quality, 80% of their sets off of serve receive were considered *good*. This percentage increased to 88% on a *good* reception. After a *poor* reception, the quality decreased to 70%. Statistically, there was a significant difference between the quality of setting after a *good* reception and a *poor* one ($p<0.05$). It may be suggested that defenders were better at setting after a *good* reception compared to a poor one.

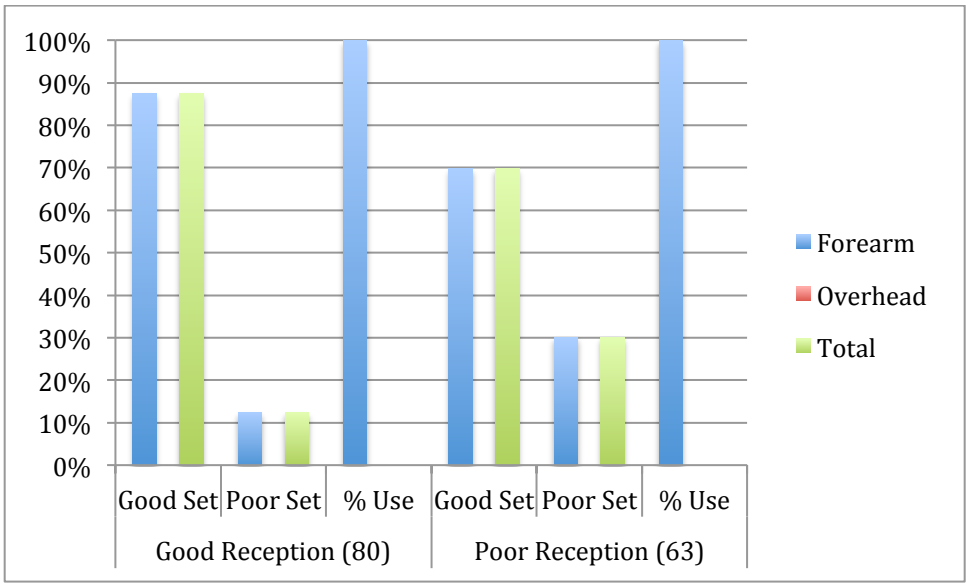



***Figure 34. Setting techniques and qualities from reception for junior female defenders***

Lastly, universal athletes set off serve receive 181 times. Like defenders, universals did not use the *overhead* set technique at all. 100% of their set contacts on serve receive were done with the *forearm* technique. They set with 80% *good* sets. This percentage increased to 86% after a *good* reception, and decreased to 76% after a *poor* reception. Again, a statistically significant difference was discovered between set quality after a *good* and *poor* reception. Universal athletes appeared to set with higher quality after a *good* reception ($p<0.05$). See Figure 35 below for details.

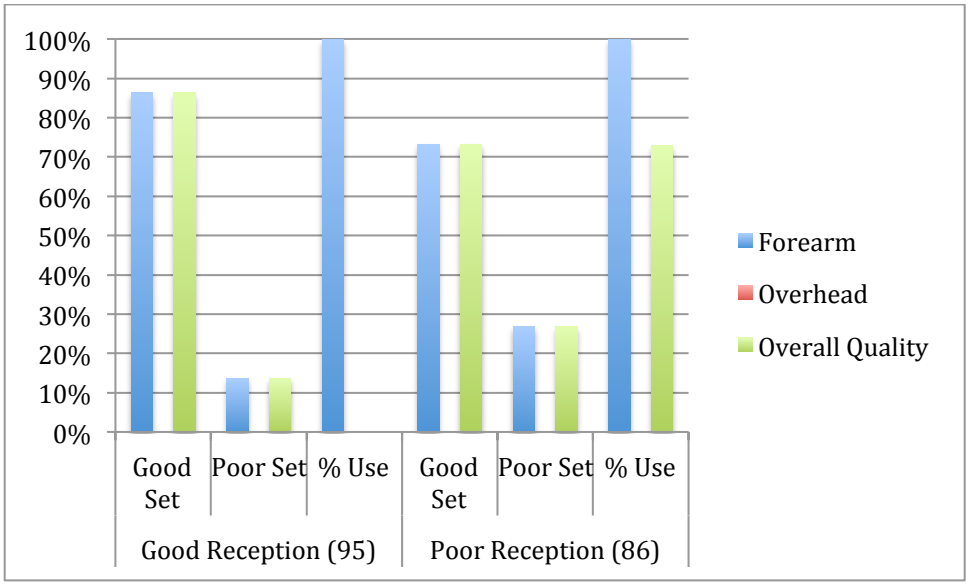



***Figure 35. Setting techniques and qualities from reception for junior female universals***

### *3.3.3 Comparative Results and Discussion (Men)*

#### *3.3.3.1 Blockers and Defenders*

Data showed that blockers and defenders used both setting techniques throughout the tournament. Both blockers and defenders set with a very high quality as 85% of all sets were considered *good*. It appeared as though blockers and defenders set with similar quality as chi square test showed no significant differences in overall set quality ($p$=0.882*).*

When set technique and quality after *good* and *poor* receptions were compared between both male positions, results showed that blockers and defenders again followed similar trends. On a *good* reception, both athletes favoured the *overhead* technique while on a *poor* reception both athletes overwhelmingly favoured the *forearm* technique. After a *good* or *poor* reception, no significant differences in quality were found ($p$=0.621*) (*$p$=0.498*)* respectfully.

#### *3.3.3.2 Junior and Senior*

Setting data from Koch & Tilp's (2009a) study of senior athletes was used and compared to data from the junior athletes in this study. Figure 36 shows how junior and senior men set with similar quality. Roughly 75% of all sets were considered *good* for both groups. Again, statistical tests for significance showed no differences in set quality between both groups ($p$=0.233*).* Differences were found in set technique ($p$<0.001). Data from Koch & Tilp (2009a) indicated senior men split the frequency of use of both techniques; *forearm* and *overhead* sets were used with the same regularity (675 *forearm* sets, and 681 *overhead* sets). This differed from the junior men, as they preferred the *forearm* technique (68%) to the *overhead* technique (32%).

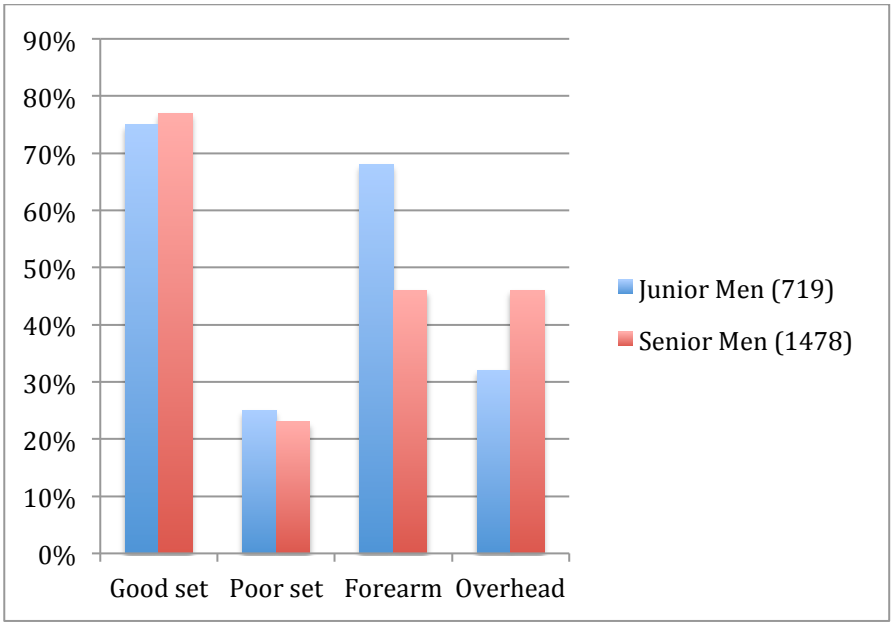



***Figure 36. Comparisons of set techniques and quality between junior and senior men***

### *3.3.4 COMPARATIVE RESULTS AND DISCUSSION (WOMEN)*

#### *3.3.4.1 Blockers Defenders and Universal Athletes*

All three female positions favoured the *forearm* technique to the *overhead* technique, while it was only the female blockers who actually attempted the *overhead* technique. Therefore, no apparent differences in set technique were found between junior women. For overall quality, defenders and universal athletes each had 80% *good* sets, while blockers had a slightly lower percentage at 76%. However, no significant differences were found between all three positions ($p$=0.606*).* When set quality was examined after reception quality, all three athletes set with significantly higher quality after a *good* reception than after a *poor* one. All three athletes set over 85% *good* sets after a *good* reception, while after a *poor* reception, blockers set with the lowest quality (66%) followed by defenders (70%) and universals (73%). Statistically, there was no difference in set qualities for all three positions, regardless of the pass quality ($p$<0.944*).*

#### *3.3.4.2 Junior and Senior*

Figure 37 below shows setting technique and quality of junior and senior female beach volleyball players. Statistically, there were no significant differences in set quality between the junior and senior athletes ($p$=0.359*).* While setting quality looked to be very similar, senior women seemed to use to the *overhead* set with more frequency. Senior athletes used the *overhead* set in 8% of all contacts, compared to less than one for the juniors. This represented a significant difference in quality for the women ($p$<0.05*).*

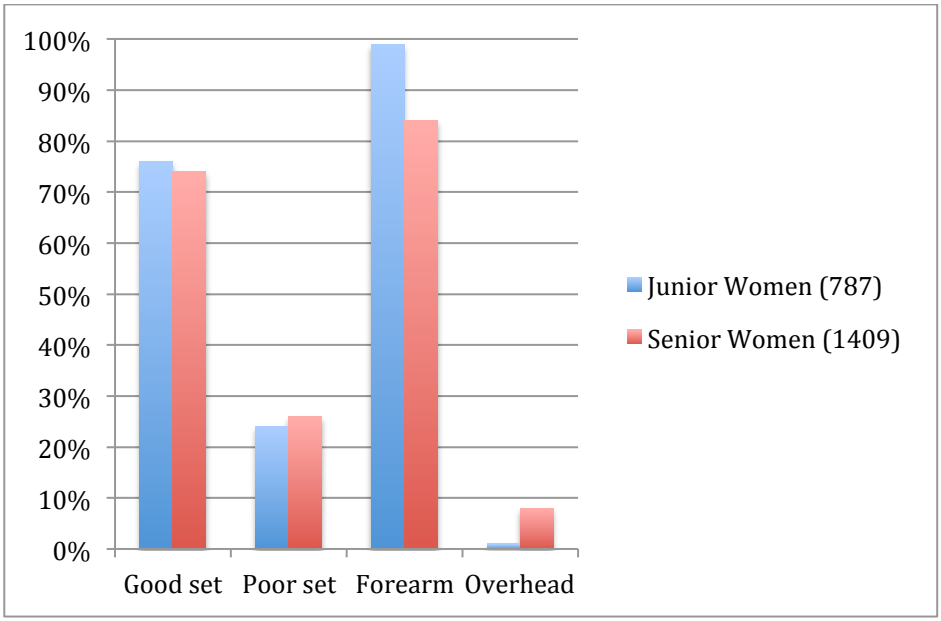



***Figure 37. Comparisons of set techniques and quality between junior and senior women***

#### *3.3.4.3 Junior Men and Junior Women*

Apparent in Figure 38 below, is the fact that men and women differed in set technique. Men used the *overhead* set in 32% of all instances, where as women used it in less than 1%. This represents a significant difference in set technique ($p<0.001$). Whereas technique differed, quality was similar for both men and women. 76% of sets for men and 74% of the sets for women were considered good. This did not represent a significant difference ($p=0.639$).

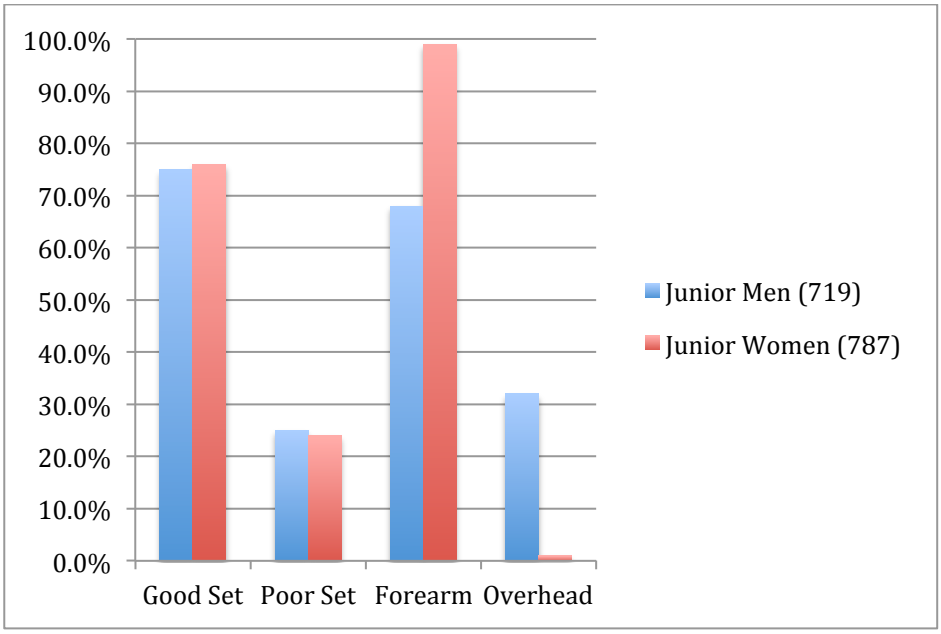



***Figure 38. Comparisons of set quality and technique between junior men and women***

## 3.4 Attacking

### *3.4.1 Descriptive Results and Discussion (Men)*

A total of 758 attack attempts were observed from junior men. Of those, all three attacks were used. The *spike* attack (53%) was favoured over the *shot* attack (40%) and the *pokey* attack (4%), and a 2nd ball attack occurred in only 3% of all attacks. Table 5 also shows attack results throughout the tournament. Junior men attacked with a 32% overall efficiency which was similar to findings from Koch & Tilp (2009a).

***Table 5. Attack techniques and results for Junior Men***

| **Attack Quality** | | |
|---|---|---|
| **Kills** | Errors | Continues |
| 380 | 138 | 240 (32%) |
| **Attack %** | **Error %** | **Efficiency** |
| 50% | 18% | 32% |

| **Technique** | **Total** | **Percent Used** |
|---|---|---|
| **Spike** | 403 | 53% |
| **Shot** | 300 | 40% |
| **Pokey** | 55 | 7% |
| **2nd ball** | 15 | 3% |

#### *3.4.1.1 Blockers and Defenders*

Blocker and defender attack techniques and results were also recorded. However, the data was only collected when attacking off of serve receive in order to analyze the tendencies of both positions on their first opportunity to attack. Blockers attempted 269 total attacks and preferred the use of the *spike* and *shot* techniques, and limited the use of the *spike* technique. In terms of quality, blockers were least efficient with the *shot,* and produced the highest kill percentage and efficiency with the *pokey*. A quality analysis using the chi square test revealed a significant difference between attack results and techniques ($p<0.05$). Thus, blockers had a higher efficiency with the *spike* when compared to the other techniques.

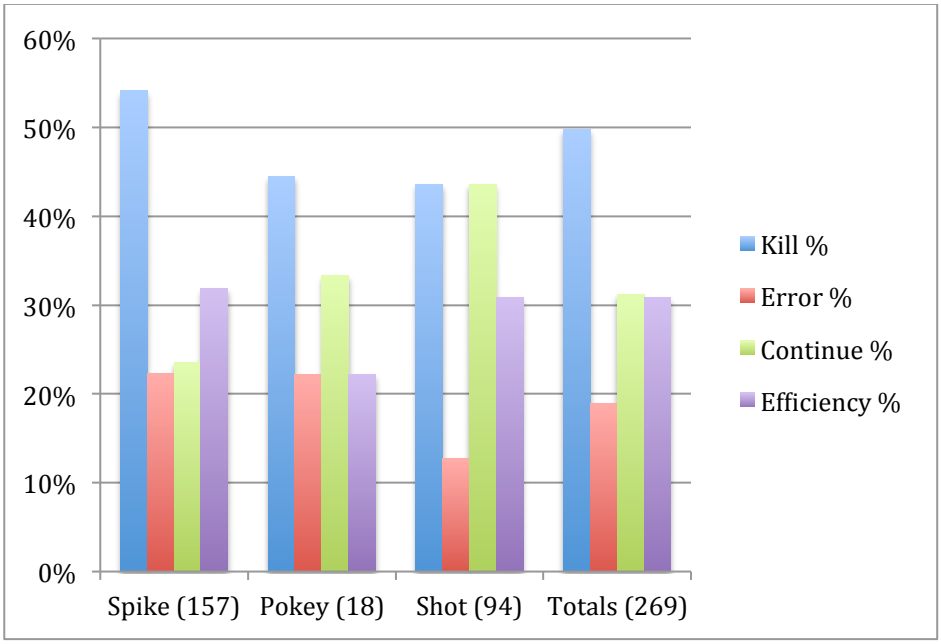



***Figure 39. Junior male blockers' attacking tendencies on serve receive***

Defenders attempted 211 attacks off of a serve and over half (53%) of those attacks were classified as *spike* attacks, while the *shot* attack (38%) and *pokey* attack (9%) contributed to the remainder. It was interesting to note that defenders overall efficiency remained above 35% despite the low *spike* attack efficiency (25%). Both the *pokey* and *shot* techniques produced very low error values and this allowed the overall efficiency of the defender to stay high. In terms of quality, the attack techniques showed significant differences ($p<0.05$). The defenders were most successful with *shot* technique.

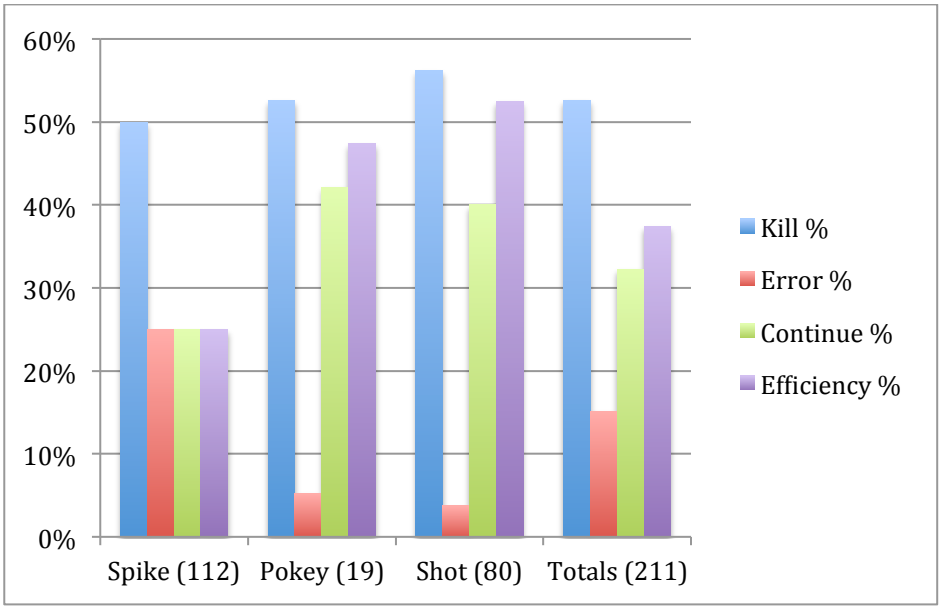



***Figure 40. Junior male defenders' attacking tendencies on serve receive***


***Figure 41. Male blockers' attack characteristics when attacking with a good quality set from serve reception.***

The quality of attack off of serve receive based on the pass quality, and with a good set was examined for both blockers and defenders and is shown in Figure 41. Only data with a *good* set quality was recorded due to the very low *n*-values associated with a poor set. For blockers, it seemed that regardless of the pass quality, if the set

was good, they attacked with a higher efficiency when compared to their overall results off of serve receive. Of note, blockers had a higher attack efficiency and a higher kill percentage off of serve receive after a *poor* pass. A chi square analysis revealed a significant difference of attack efficiency after a *good* and poor pass for blockers ($p<0.05$). A contributing factor to the increased kill percentage off of a poor pass may be the fact that defenders were very skilled at setting off of a *poor* pass (as previously seen in Figure 31). A more in-depth analysis of blocker attacking strategies and the opposition's defensive strategies may yield an explanation as to why blockers were more efficient attacking after a *poor* pass.

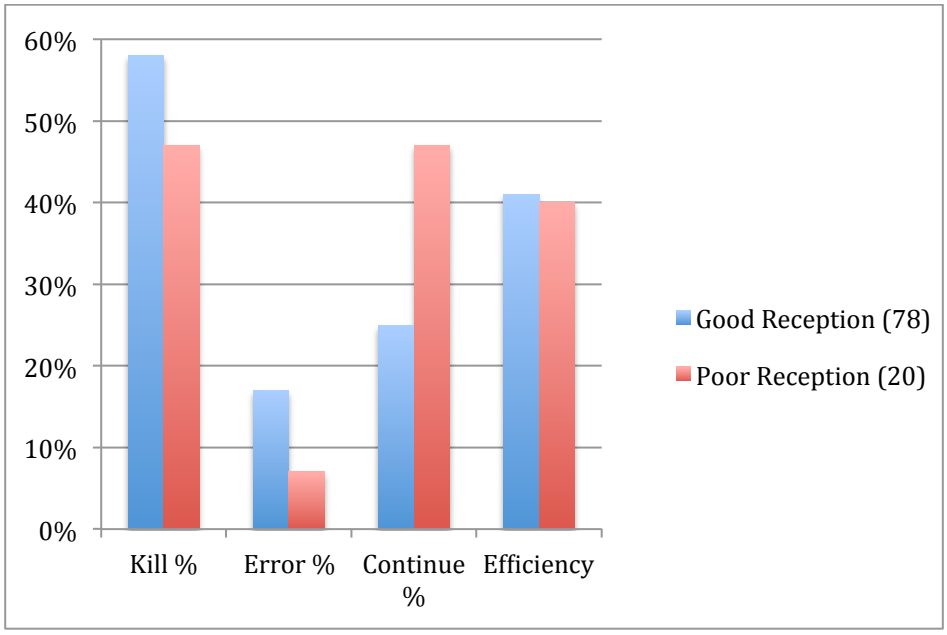



***Figure 42. Male defenders' attack characteristics when attacking with a good quality set from serve reception.***

Defenders maintained a high kill efficiency when the set quality was good, regardless of the reception quality. After a *good* reception, defenders had a higher kill percentage and efficiency, yet made more errors compared to a poor reception. On a *poor* reception, defenders had a lower kill percentage, and lower error

percentage, with similar attack efficiency when compared with a *good* reception. Furthermore, defenders had nearly double the percent of continuations after a *poor* reception. This may have indicated that defenders used a strategy to avoid making errors or avoided committing to high-risk high-reward attacks. More information would be necessary to draw this conclusion however. Statistical analysis showed a significant difference between the quality of attack on a good reception and a poor reception ($p<0.05$). Despite the increases in errors, defenders were more effective attacking after a good pass.

### 3.4.2 Descriptive Results and Discussion (Women)

Overall a total of 822 attacks were observed from junior women. The table below displayed the attacking preferences for women. Briefly, junior women favoured the *shot* attack (51%) to the *spike* attack (37%) and used the *pokey* (1%) the least. In terms of results, attack efficient was below 30% and their kill percentage was below 50%

***Table 6. Attack techniques and results for Junior Women***

| Kills | Errors | Continues |
|---|---|---|
| 382 | 138 | 302 (38%) |
| **Attack %** | **Error %** | **Efficiency** |
| 46% | 18% | 29% |

| Technique | Total | Percent Used |
|---|---|---|
| **Spike** | 308 | 37% |
| **Shot** | 423 | 51% |
| **Pokey** | 92 | 11% |
| **2nd ball** | 7 | 1% |

#### 3.4.2.1 Blockers, Defenders and Universal Athletes

Blockers, as with defenders and universals, were observed attacking off of serve receive only. In terms and frequency of attack techniques for female blockers, the

*shot* and *spike* attacks accounted for 92% of the total attacks, and the *pokey* for the remainder. Regardless of its' low use, the pokey accounted for the highest attack efficiency, followed by the *spike*, then the *shot.* In terms of quality distribution, a significant difference was found between the results of all three techniques *($p<0.05$)*. However, a significantly lower *n* value may indicate that blockers used the *pokey* technique sparingly. It would then be the *spike* technique that contributed to more success for junior female blockers.

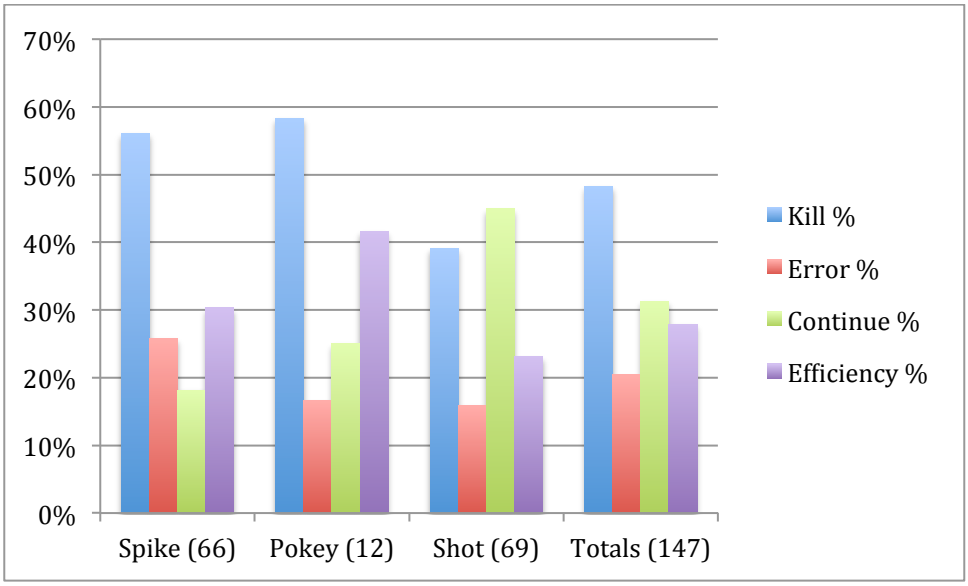



***Figure 43. Junior female blockers' attacking tendencies on serve receive***

Female defenders overwhelmingly favoured the shot technique as it was used in over 56% of all instances. The *spike* and *pokey* techniques accounted for 34% and 10% of the remainder, respectively. It was interesting to note that, as the preferred attack technique, the *shot* technique recorded the lowest kill percentage, lowest attack efficiency and contributed the highest number of error and continues. When the *spike* was used, defenders produced a higher kill percentage and efficiency, while minimizing their error and continue percentage. Further analysis may yield

results as to why the *shot* technique was utilized with the highest frequency when it was not as efficient as the *spike* or *pokey.* Still, a chi square test for independence revealed no significant differences between attack qualities in all three attack techniques *(p*=0.06*).*

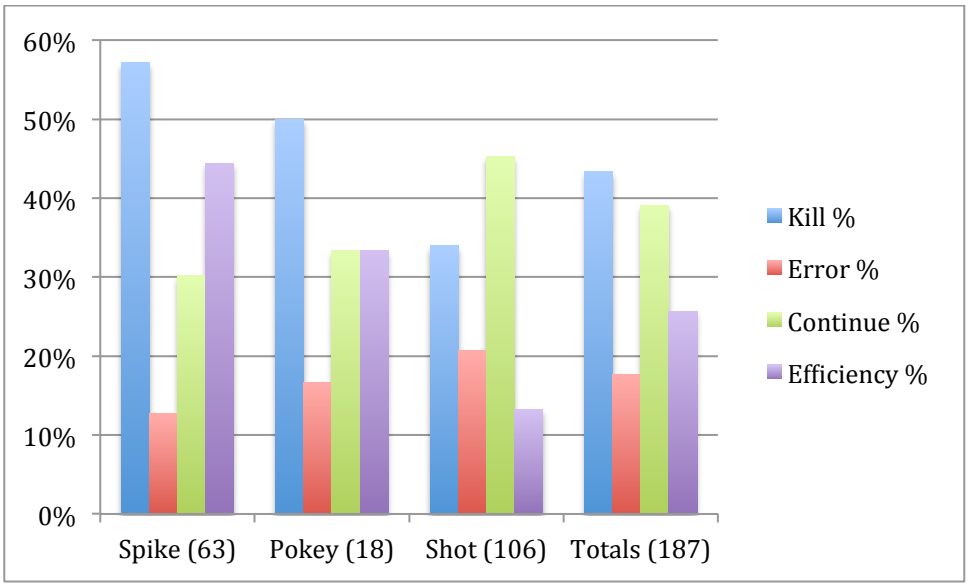



***Figure 44. Junior female defenders' attacking tendencies on serve receive***

Universal athletes produced a more uniform distribution with regards to attack efficiency, kill percentage, error percentage and continue percentage. Like blockers and defenders, universal athletes also preferred the *shot* attack, and minimized their use of the *pokey*. The *spike* and *shot* techniques were used in 90% of total attacks. In terms of results, universal athletes obtained the highest attack efficiency with the *spike* while the kill efficiencies associated with the *shot* and *pokey* attacks were below 20%. A chi square analysis however revealed no significant differences between the results of all three attack techniques (*p*=0.958*).*

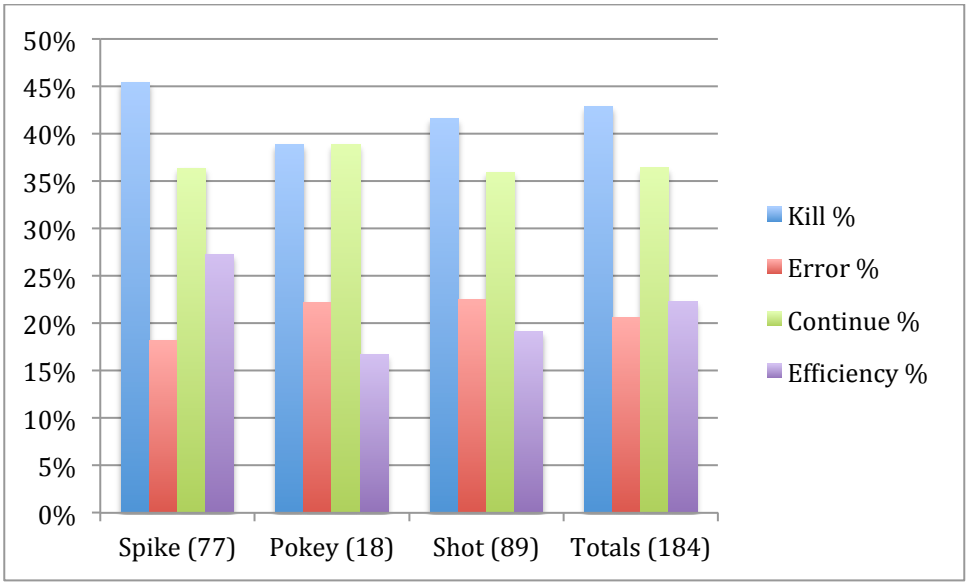



***Figure 45. Junior female universals' attacking tendencies on serve receive***

A descriptive analysis of attacking based on pass quality, with a good set was also performed for the junior women. When the set quality was good, regardless of the reception quality, female blockers were more efficient with their attacks, compared to overall attack efficiency on serve receive. It was interesting to note that error percentage was higher after a good reception, and attack efficiency and kill percentage were higher after a poor reception. Nevertheless, a chi square analysis revealed no significant difference between attack qualities after a *good* or *poor* reception *(p*=0.626*)*. One may speculate that for female blockers, the set quality may influence the outcome of the attack more so than the pass quality, though additional statistical analysis would be required to confirm this.

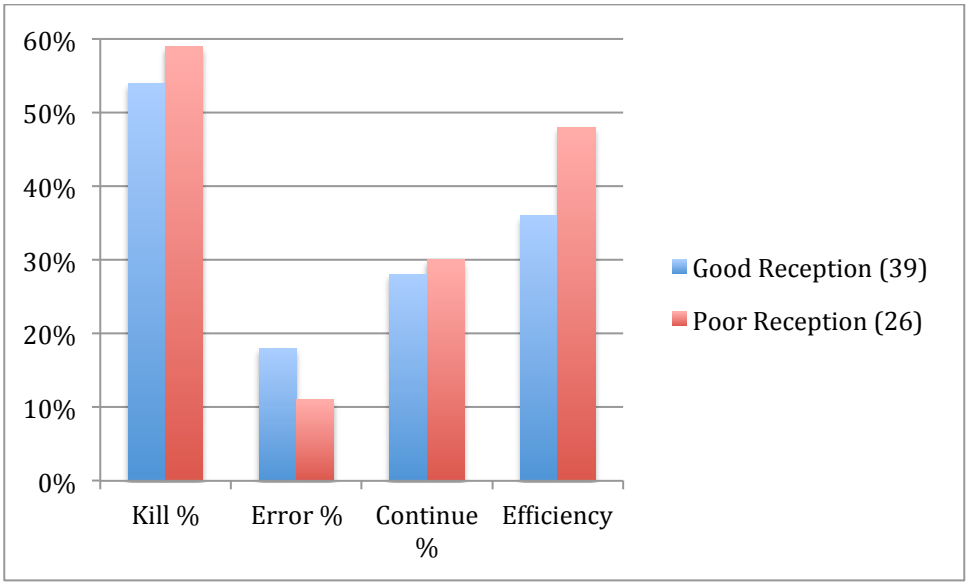



***Figure 46. Female blocker's attack characteristics when attacking with a good quality set from serve reception.***

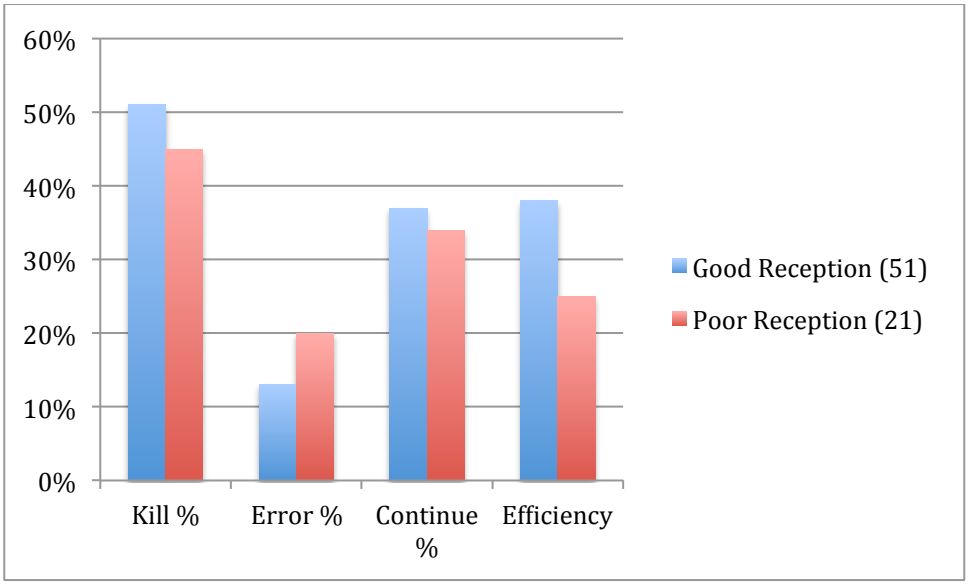



***Figure 47. Female defender's attack characteristics when attacking with a good quality set from serve reception.***

Defenders attacked with a better quality after a good reception, than a poor one (when the set quality was good). Perhaps the fact that blockers set with significantly less quality on a poor pass (Figure 33), contributed to a lower attack efficiency off a poor pass for defenders. However, there are many other variables that could be

explored, such as attack preparation, jump height, shot selection and even opposition defensive strategies, before reaching any firm conclusions.

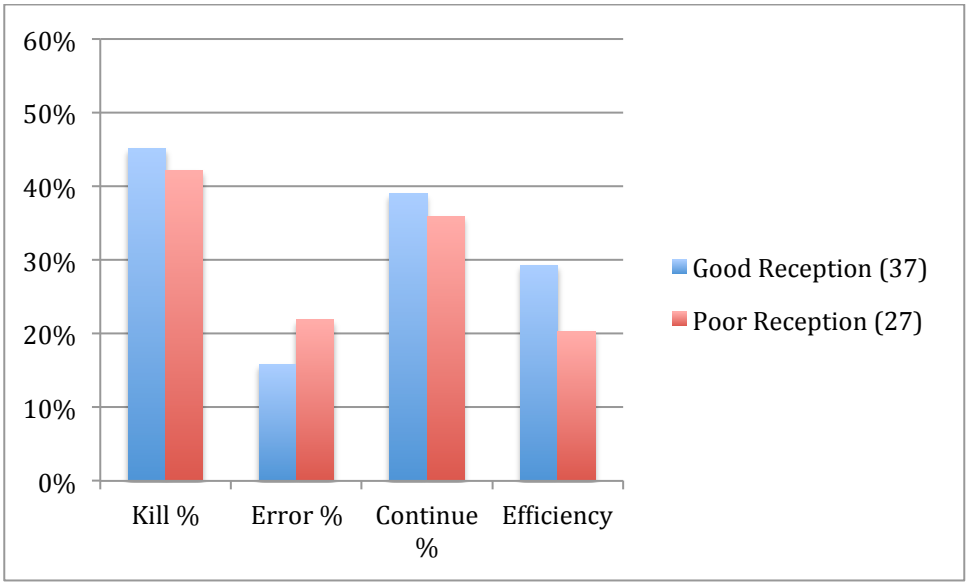



***Figure 48. Female universal athletes attack characteristics when attacking with a good quality set from serve reception.***

Similar to defenders, female universal athletes' kill percentage and attack efficiency were higher on a good reception, while error percentage was lower also after a good reception. Nevertheless, no significant differences were found in attack quality after a good or poor reception ($p$=0.06). Interestingly though, universal athletes attack efficiency remained lower compared to female blockers and defenders, regardless of the pass quality.

### 3.4.3 Comparative Results and Discussion (Men)

#### 3.4.3.1 Blockers and Defenders

Figure 39 and Figure 40 illustrated attack techniques and attack qualities produced by blockers and defenders. Off of serve receive, blockers and defenders utilized the various attack techniques with similar frequency. Both favoured the *spike* to the *shot* while the *pokey* was utilized in less than 10% of all attacks. In terms of attack

quality, defenders produced a higher attack efficiency compared to blockers (37% vs. 31%), however chi square tests showed no significant difference between the techniques used by defenders and blockers *(p*=0.502*),* or the execution of attacks *(p*=0.397*).* One may conclude that blockers and defenders attack choices were similar, as were the results they attained.

When attack data was recorded from pass quality and analyzed for both types of male athletes, a significant difference in attack quality was found after a *poor* reception *(p*<0.05*)* yet no significant difference in quality was discovered after a *good* reception (*p*=0.506*).* Interestingly, it appeared that blockers were more effective at attacking after a *poor* reception.

#### *3.4.3.2 Junior and Senior*

Figure 49 below compared the use of attack technique from this study, to the results of studies conducted on senior athletes. It appeared as though junior men attacked with similar style to the senior men with only slight variations. In both instances, junior men appeared to use the *shot* slightly more, and the *spike* slightly less than their senior counterparts. Furthermore, senior men were more active in using the 2nd ball attack compared to the junior men.

Quality wise, senior men attained 5% more kills than the juniors, and were also 3% more efficient. The juniors' created attacks that kept the ball in play more often (as noted by the higher continue percentage). There was a significant difference in attack quality between the junior and senior men *(p*<0.05*).* Based on their higher kill percentage and efficiency, senior men were better attackers than the juniors.

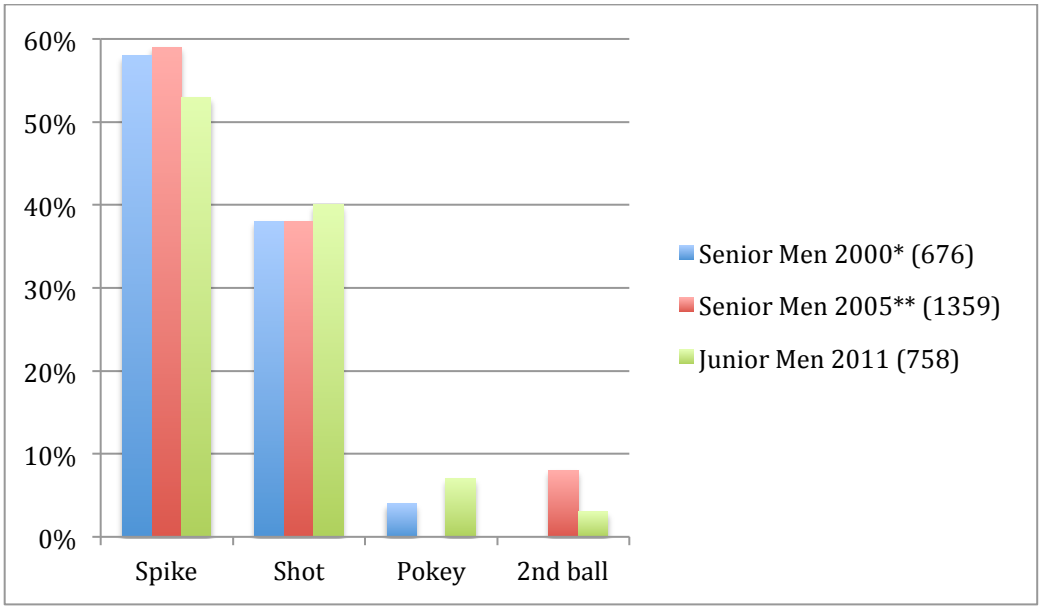



***Figure 49. Comparisons of attack techniques between junior and senior men***

**From Mesquita & Paolo (2004)*
*Data included wrist, cut and rainbow shots (amalgamated under 'shots')*
***From Koch & Tilp (2009a)*
*Data for Pokey frequency not available*

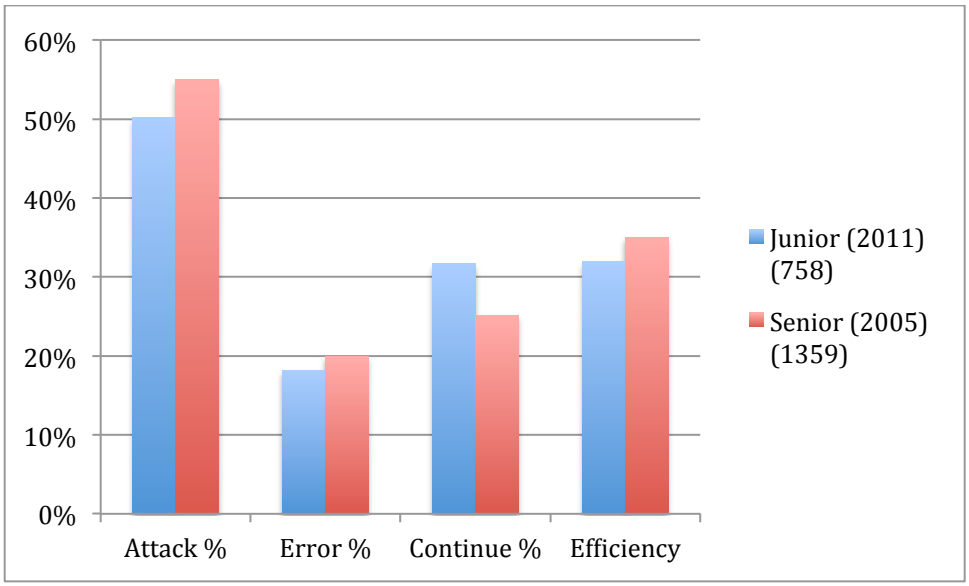



***Figure 50. Comparisons of attack percentages and kill efficiency for junior and senior men***

### *3.4.4 COMPARATIVE RESULTS (WOMEN)*

#### *3.4.4.1 Blocker, Defenders and Universal Athletes*

All three female groups favoured the *shot* technique over the *spike* technique when attacking off of serve receive. Blockers again possessed the highest kill percentage (48%) and attack efficiency (28%) while defenders had a higher attack efficiency (26%) than universal athletes (22%), yet they shared the same kill percentage (43%). Though it appears that blockers attacked with the highest efficiency, no significant differences were found between the attack qualities of all three athletes on serve receive ($p$=0.636).

When female athletes attacking qualities were compared after reception, with a good quality set, blockers were the only athletes to have higher attack efficiency and kill percentage off a *poor* reception. Defenders were more efficient off a *good* reception, as was indicated by a higher kill percentage, and lower error percentage. Lastly, it was universal athletes that again had the lowest efficiency and kill percentage of all three. No significant differences were found between attack qualities off of a *good* reception ($p$=0.568*),* or *poor* reception ($p$=0.212). Nevertheless, higher attack efficiency means that the difference between kills and errors was very high, where as a lower attack efficiency translates into fewer kills and more errors. Though no significant differences were found, on a *poor* reception, female blockers attack efficiency almost doubled those of defenders, and was nearly 60% higher than universal athletes. For more information, consult Figure 46, Figure 47 and Figure 48 above.

#### *3.4.4.2 Junior and Senior*

Figure 51 below compared attack techniques used by junior and senior women. It appeared that while the senior women utilized the *shot* and *spike* in similar fashion, the junior women overwhelmingly preferred the *shot*. Note no data was available to compare the frequency of the *pokey* attack. When attack quality was compared between seniors and juniors, differences were again found. Senior women topped all point scoring categories (kill percentage, and attack efficiency), produced a lower continuation percentage, and shared a similar error percentage (17%). With this said, the *p*-value (0.933*)* indicated that no significant differences existed between junior and senior athletes in terms of attack quality.

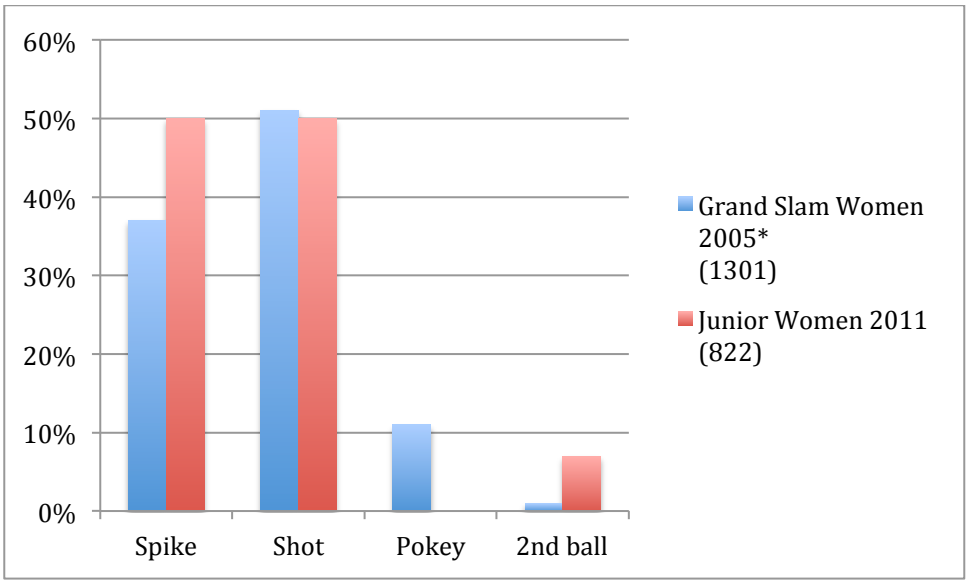



***Figure 51. Comparisons of attack techniques between junior and senior women***

**From Koch & Tilp (2009a)*
*Data for Pokey frequency not available*

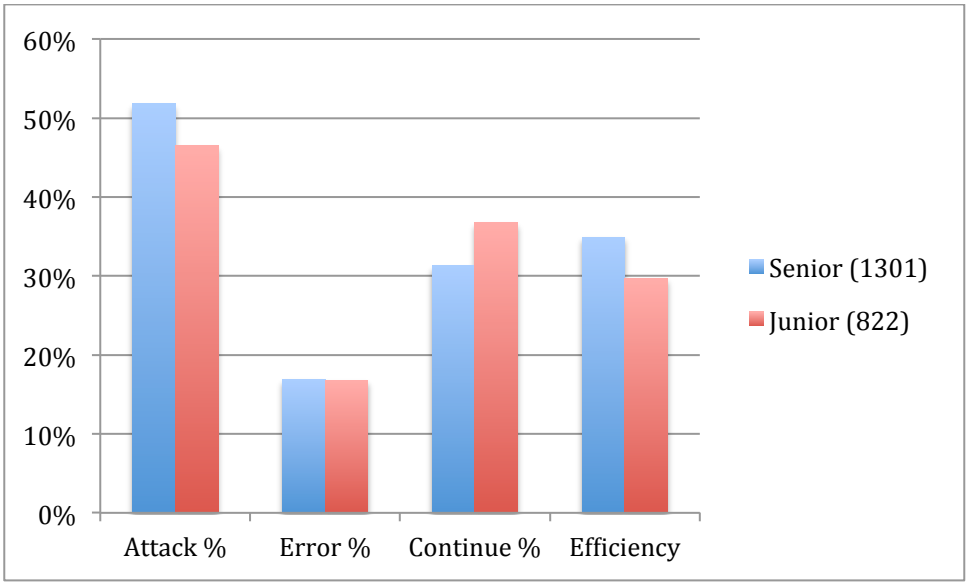



***Figure 52. Comparisons of attack percentages and kill efficiency for junior and senior men***

#### *3.4.4.3 Junior Males and Junior Females*

Data from this study revealed that males and females play with different attack techniques, and their attack quality also differs. Whereas men favoured the use of the *spike* technique, females preferred the *shot* technique. Both men and women limited their use of the *pokey* (7% and 11%) as well as their attempts of attacking directly off a reception (2nd ball attacks, 3% and 1% respectively). Chi square analysis revealed a significant difference between attack styles used by men and women *($p$<0.05)*, therefore men preferred the *spike* attack compared to the women who preferred the *shot* attack. The final comparison between junior males and females with regards to attacking was to analyze the quality of their attacks. The data has shown that men were more efficient (32% vs. 30%), had a higher kill efficiency (50% vs. 46%) and committed more errors than their female counterparts however, no significant differences were found in terms of attack quality *($p$=0.895).*

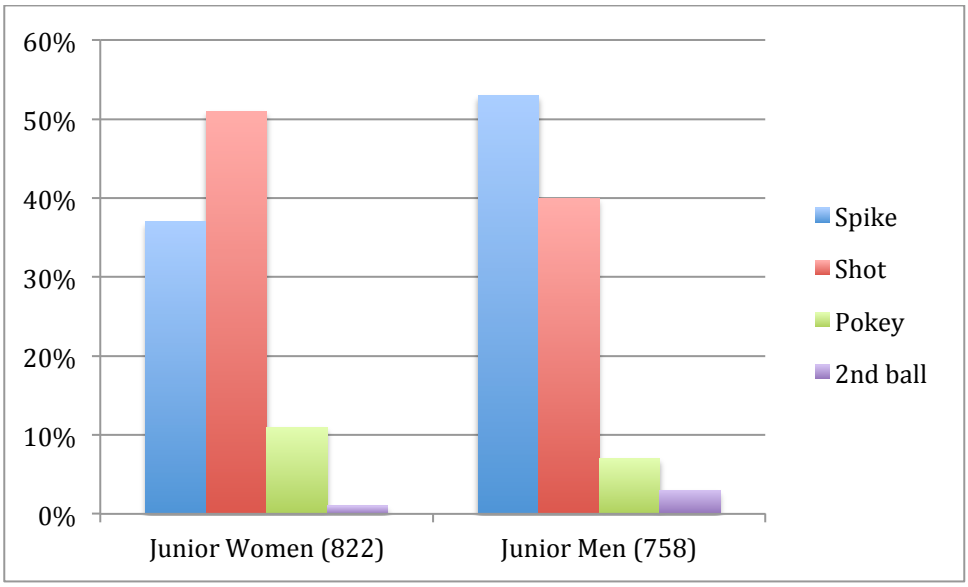



***Figure 53. Comparisons of attack techniques between junior men and junior women***

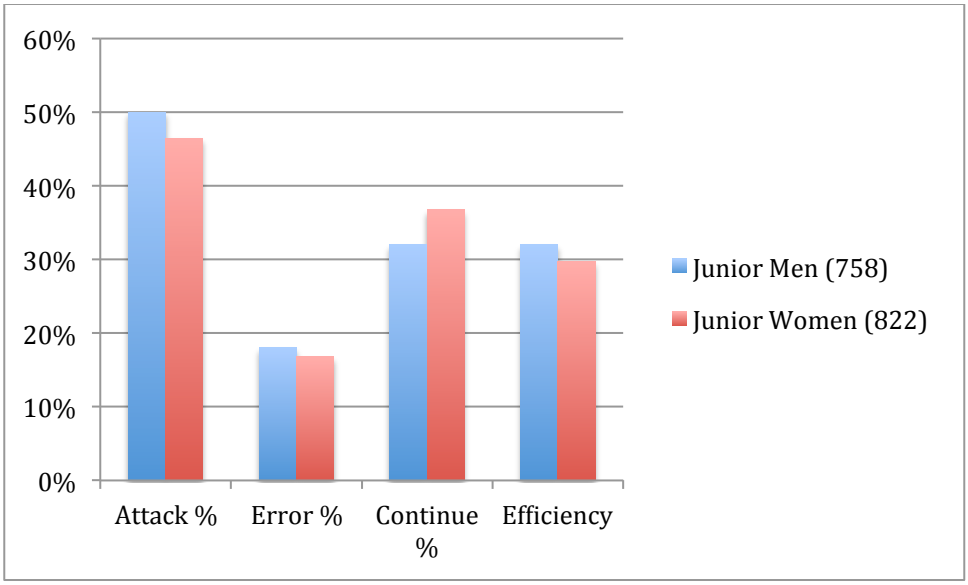



***Figure 54. Comparisons of attack qualities between junior males and junior females.***

## 3.5 Blocking

*No information was gathered in the element of blocking by fulltime defenders since they did not block. Information was only gathered from blockers and universal athletes.*

### *3.5.1 Descriptive Results and Discussion (men)*

A total of 716 block attempts were observed. A block attempt included a block peel (running from the net to establish a dig position) and a block jump. Contact with the block was only recorded in 33% of all attempts. When contact did occur, the following results were recorded; s*lam* (27%), *tool* (18%) and *block touch/continuation* (55%). Lastly, if the blocker touched the net, it was recorded as a net fault (5%). Blockers' favoured staying at the net in an attempt to intercept the ball versus peeling away from the net in an attempt to dig the attack. Similar to Mesquita & Teixeira (2004) roughly 85% of all attempts involved a jump at the net, while only 15% of attempts were peels. No data was recorded of defenders' attempting to block.

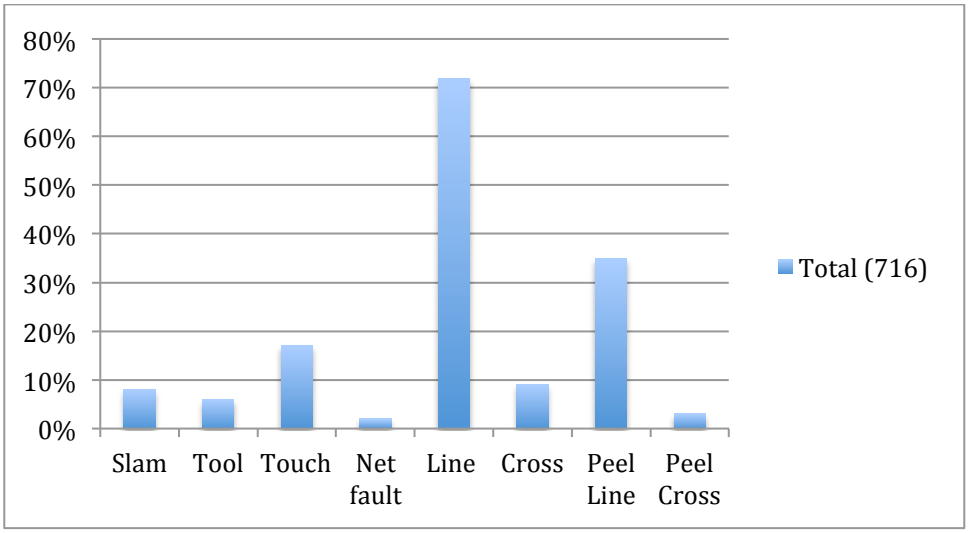



***Figure 55. Block techniques and results for junior men.***

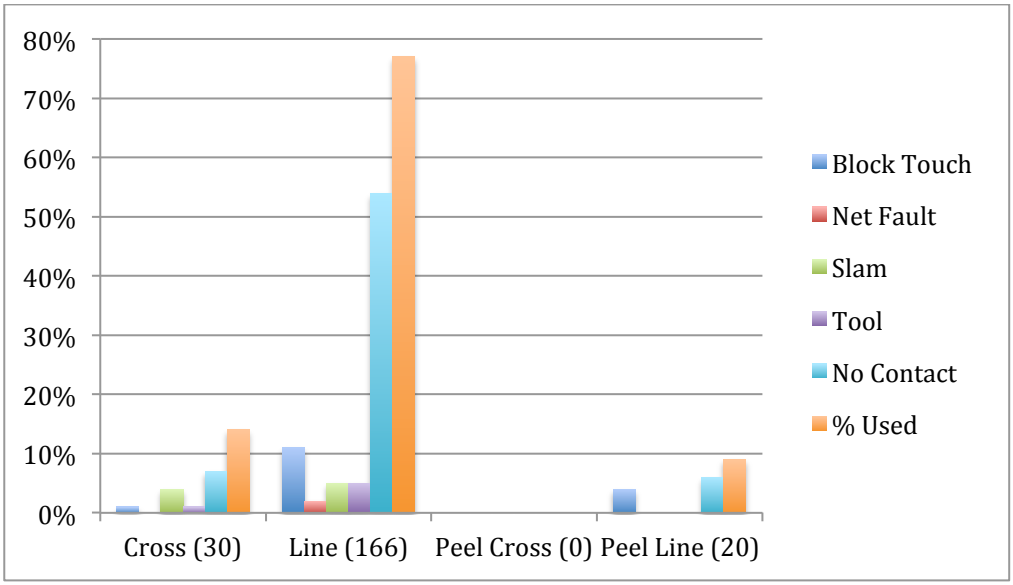



***Figure 56. Blocking position: men's blocking tendencies when blocker serves***

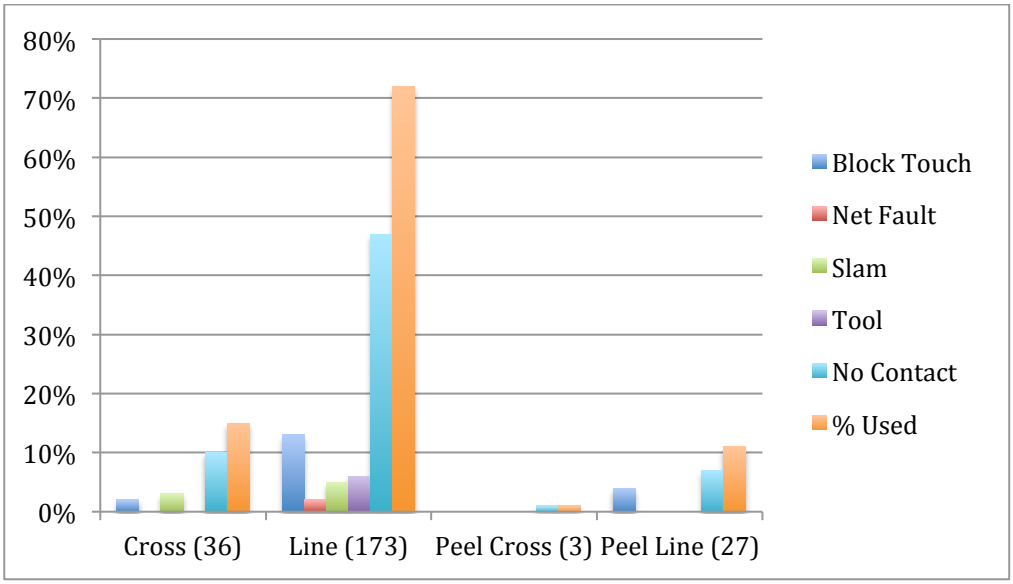



***Figure 57. Blocking athlete: men's blocking tendencies when defender serves***

Data was also collected on blocking quality and techniques when blockers were serving, and when they were at the net and their partner was serving. Of note, when defenders served, blockers scored more blocks (8% vs. 4%) and more block touches (20% vs. 16%). However, chi-square tests showed no significant difference between blocking tactics when serving and when the partner serves (p=0.38), and with

quality of execution (p=0.757). Nevertheless, there are imposed physical demands that may influence technique when a blocker must run to the net after serving.

### 3.5.2 *Descriptive Results and Discussion (Women)*

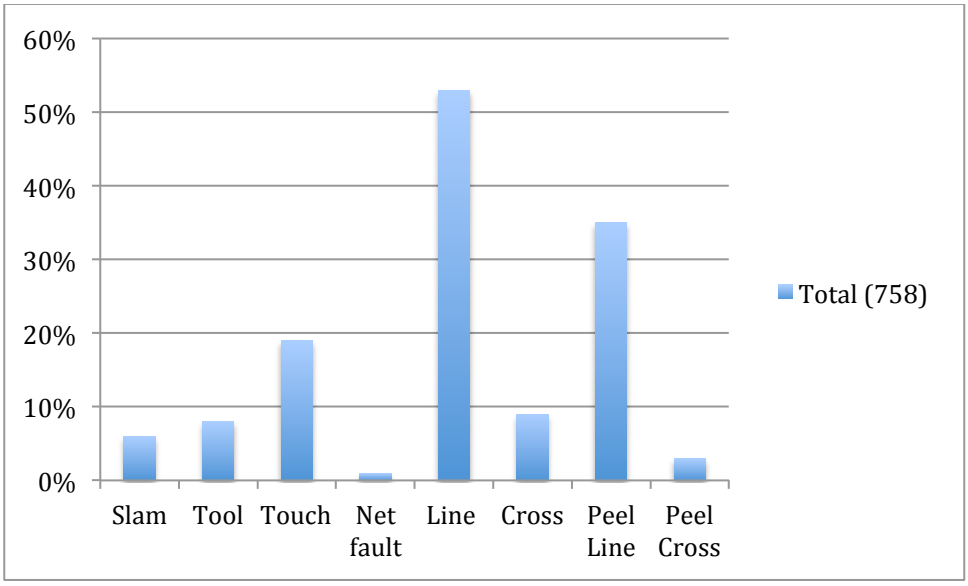



***Figure 58. Overall block technique and quality for junior women***

758 block attempts were observed. Though female athletes at the net only made contact with the ball in 34% of all attempts, each jump or peel was recorded. In terms of technique, over half of the total attempts involved a line block, the line peel accounted for 34% of the blocks, and the cross court block and cross court peel accounted for 9% and 3%% of blocks respectfully. Of the 34% of balls contacted by the block, 19% involved a touch (ball kept in play), 8% were points for the opposition (tool), 6% were direct points (slam), and less than 1% involved a net touch.

#### 3.5.2.1 *Blockers and Universal Athletes*

Blockers were observed while their team served, and attempted a total of 327 times. Figure 59 below shows tendencies and block quality. Of note, blockers did not

commit a single net touch. They favoured line-blocking actions (jump and peel) versus cross-court block actions. Lastly, they contacted the ball in 30% of all attempts.

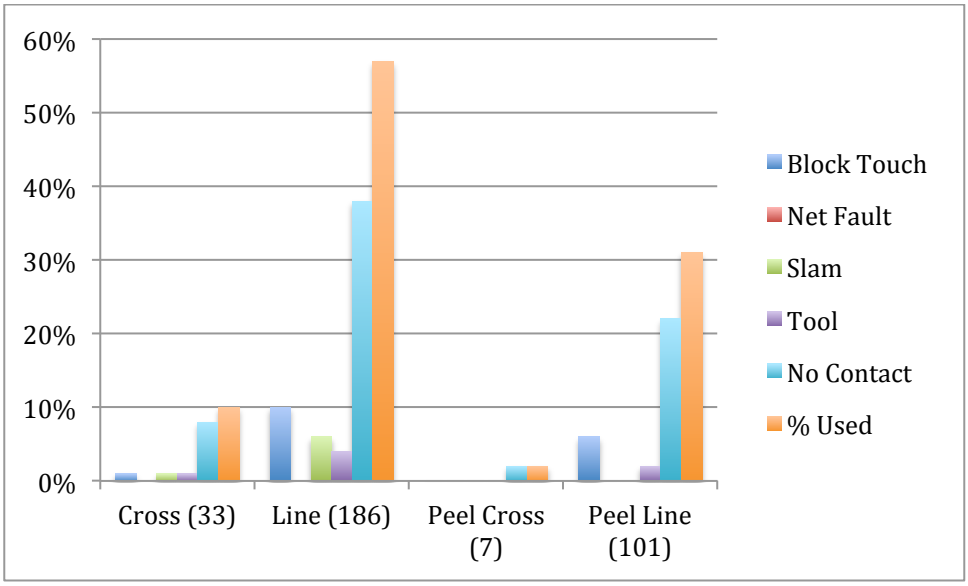



***Figure 59. Female blocker: blocking tendencies when team serves***

Universal athletes were observed blocking 132 times while their team served. Figure 60 below indicated that universals preferred line block actions to cross-court ones and 69% of the total attempts did not involve a contact. Interestingly however, the cross court block, while used significantly less than the line block, resulted in similar outcomes in the slam category. Perhaps junior female blockers could be encouraged to use the cross court block as a more consistent tactic.

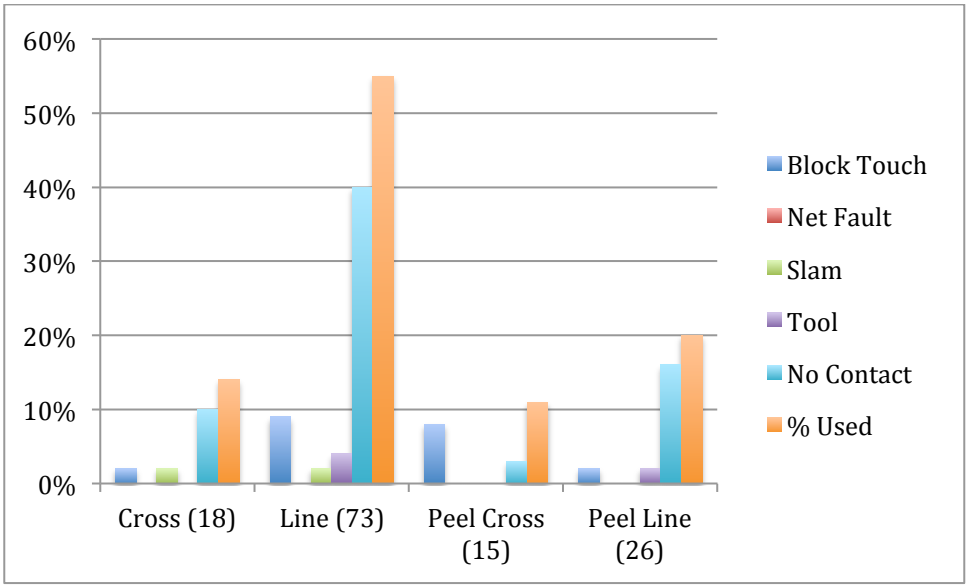



***Figure 60. Female universal: blocking tendencies when team serves***

Data for female blockers (position) was compared between when they had to run up to the net and serve, and when they were already positioned at the net when their defender partner served. It was speculated that differences in technique and/or block quality would exist because the time it takes to run up to the net after a serve. Figure 61 detailed the blocking techniques when the blocker had to serve and run up to the net. *Line* block actions were again used the most and represented 89% of the total block actions, while the use of the *line* jump block represented 100% of the total slams and 66% of the total tools. Lastly, female blockers did not record a single net fault when running to the net. When this data was compared to data in Figure 62 (when blockers were already stationed at the net), blocker recorded 6% fewer touches, while they scored 4% more slams and 2% less tools. However, no significant differences were found in technique ($p$=0.289*)* or in quality *(*$p$=0.475). Data therefore suggested there was no difference in quality or technique when the athlete was already at the net, versus serving from the baseline.

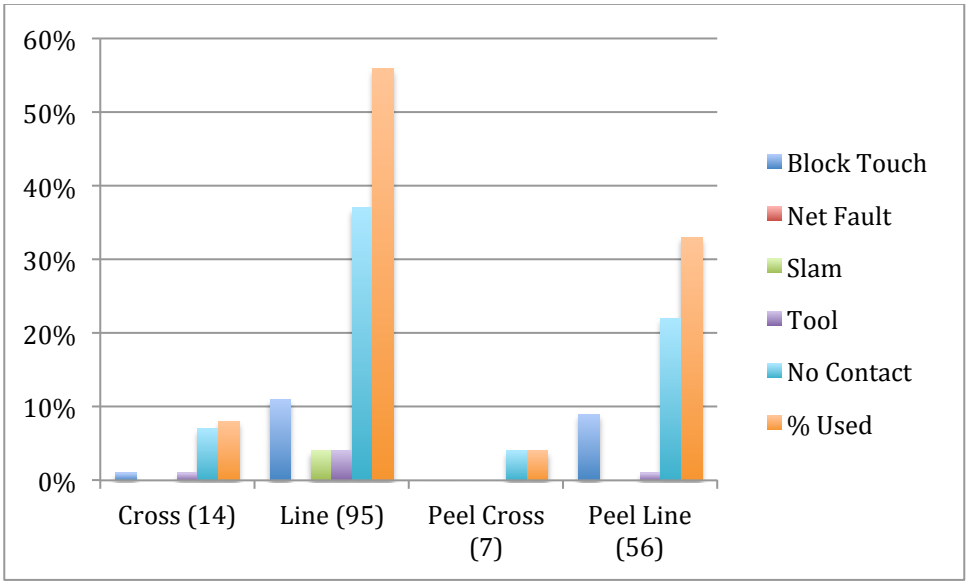



***Figure 61. Blocking athletes: women's blocking tendencies when blocker serves***

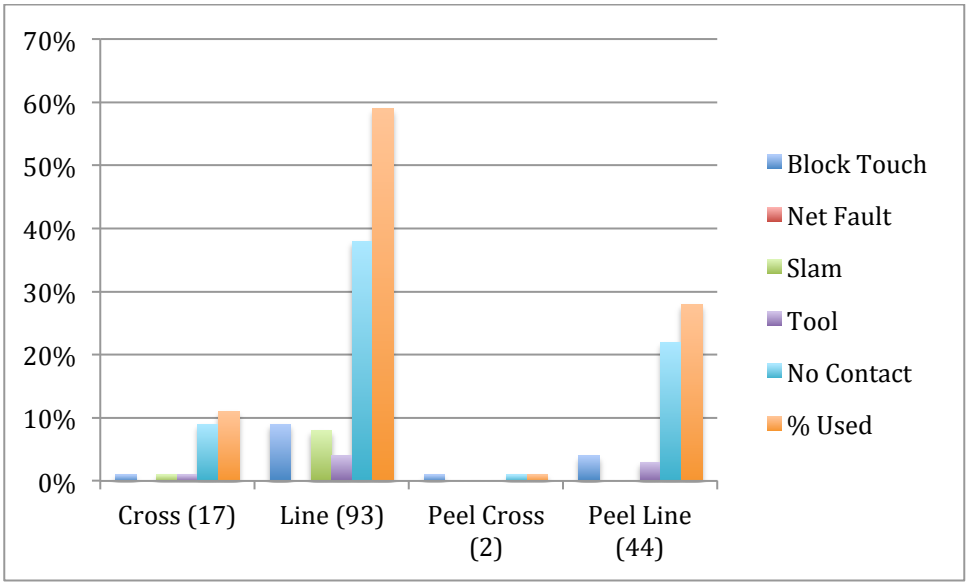



***Figure 62. Blocking athletes: women's' blocking tendencies when defender serves***

### *3.5.3 Comparative Discussion and Results (Men and Women)*

Comparisons were only made between female blockers and universal athletes, because male blockers did not have another group to compare with. For women, universal athletes scored less *slam* blocks (4%) than blockers (6%) while the preferred block technique for blockers and universal athletes was the *line* block (58% and 55%) followed by the *line peel* block (20% and 31%). Statistically, there were no significant differences between the techniques used by blockers and universal athletes ($p$=0.543*)*, as well as no significant differences between the qualities of the block between both athletes ($p$=0.551).

#### *3.5.3.1 Senior and Junior*

Since different systems of observations were used in different studies, it was not possible to compare junior men and women to senior men and women. In order to do so, multiple categories would have had to be amalgamated that may of lead to incorrect conclusions. However, from Koch & Tilp (2009a), men scored 9% blocks and 7% blocking errors (not defined), and 84% of correct blocks did not lead to a point. These percentages are similar to the junior men, 8% of blocks were slams, and 6% were tools, while 2% were net faults.

For women, there was no mention of blocking results, but technically, the study found that senior women used the *peel* block in 27% of all instances. This value was higher for the junior women, as they used the *peel block* in 38% of all instances.

#### *3.5.3.2 Junior Men and Junior Women*

Both the junior men and women favoured line block actions. However, men preferred to stay at the net and intercept the ball, while women used the peel techniques more frequently. Statistically, there was a significant difference in block techniques used by men and women ($p<0.001$). In terms of quality, men scored a higher percent of slam blocks than women, while women were tooled more than men. Chi square test for significance showed a difference between block quality of men and women ($p<0.05$).

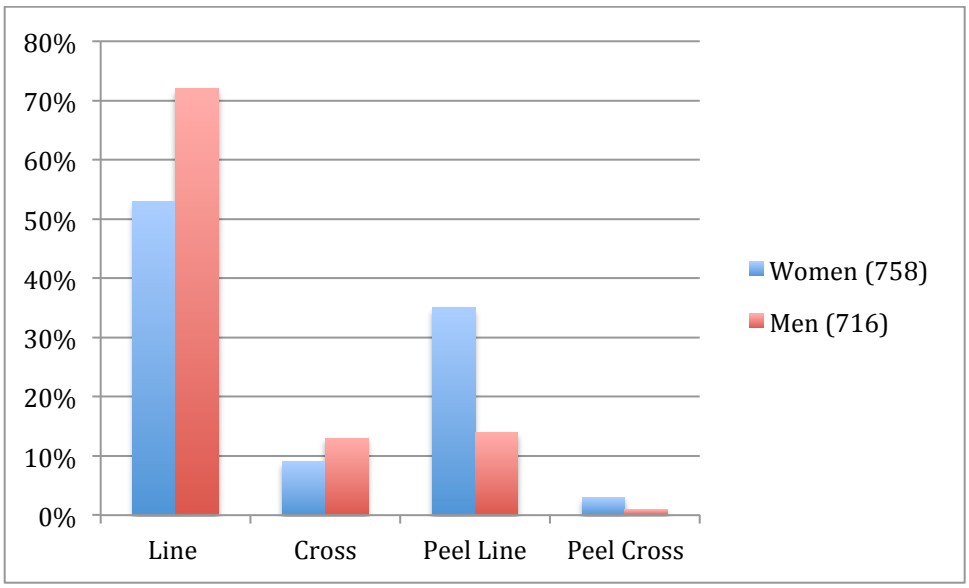



***Figure 63 Comparisons of blocking techniques between junior men and women***

## 3.6 Defence

### *3.6.1 Descriptive Results and Discussion (Men)*

Defensive contacts were counted as the contact after an attack (with the exception of a block touch). Though almost every rally that contained an attack may have included a dig contact, only contacts that continued the rally were observed. A total of 202 defensive contacts were observed. Of those, 37% resulted in a good criterion, while the other 63% resulted in a poor criterion. Similar to Koch & Tilp (2009a), a distinction was made between a dig (1) in motion, (2) ready position (near the body) and (3) after moving. Most defensive contacts that were *good* occurred when the contact occurred in the ready position (42%) compared to moving to the ball (in motion), 27% and after moving (30%). Overall, junior men produced 62% poor digs and 37% good digs.

***Table 7. Overall defensive quality and technique for junior men***

| Technique | | Quality | |
|---|---|---|---|
| **After Moving** | 27% | **Good Dig** | 38% |
| **In Motion** | 29% | **Poor Dig** | 62% |
| **In Ready Position** | 44% | Total | 202 |

#### *3.6.1.1 Blockers and Defenders*

While serving, defenders followed a similar quality trend to the overall results. 37% of their digs were good and 63% of the digs were poor. Defenders dug the *spike* shot in 48% of all instances (compared to 38% *shots* and only 8% *pokey* attacks). Lastly, Figure 64 below shows that defenders had the most successes with the *pokey* and *other* attacks, and the least success digging the *spike*.

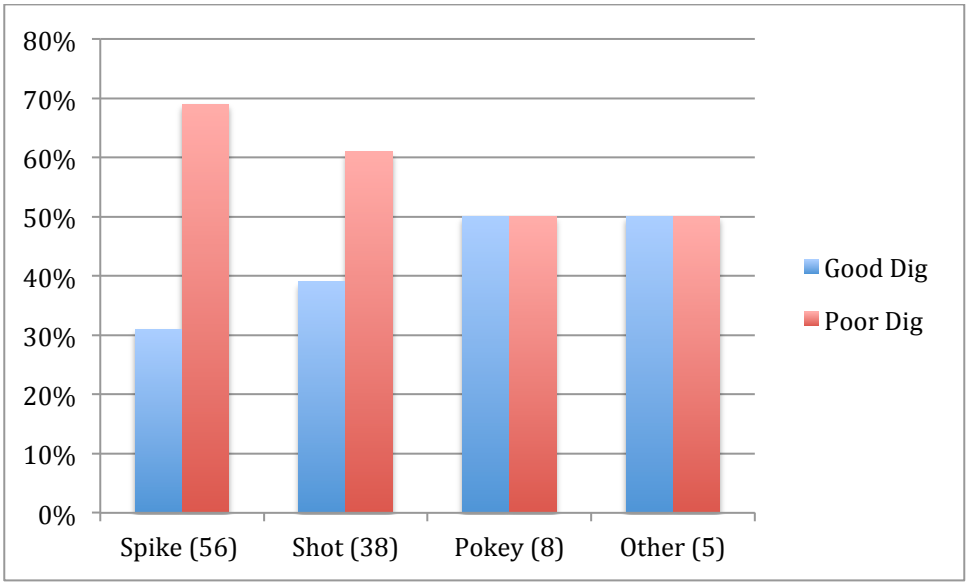



***Figure 64. Attack technique and dig quality for male defenders***

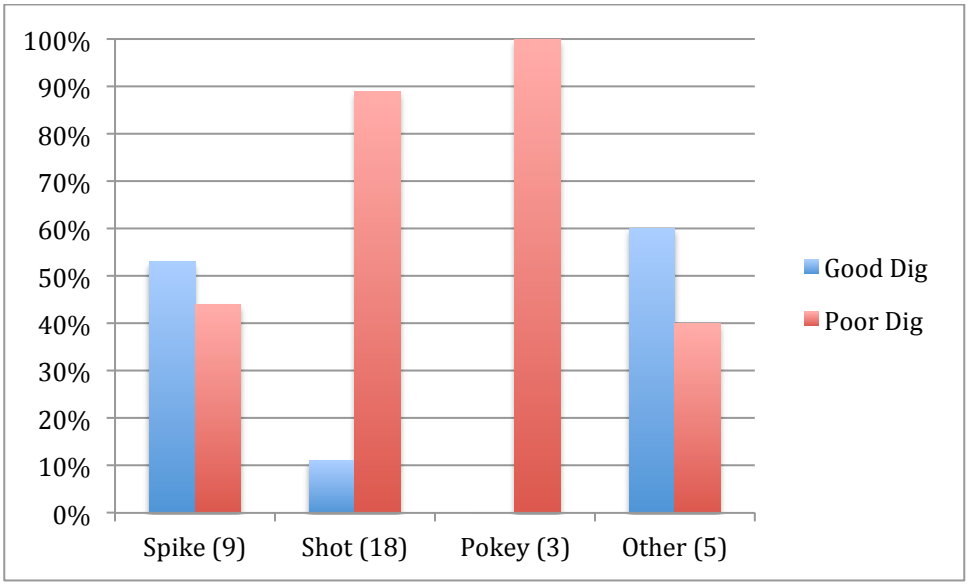



***Figure 65. Attack technique and dig quality for male blockers***

Male blockers were observed digging less than their defensive partners. In total, they contacted the ball 35 times while in a defensive position and dug the *spike* attack (37%) less often than the *shot* attack (53%) and *pokey* attacks (9%). In contrast to defenders, Figure 65 above shows that blockers had the least success with the *pokey* and *shot,* and the most successes with the *spike*.

### 3.6.2 *Descriptive Results and Discussion (Women)*

A total of 345 defensive contacts were observed. Only those that continued the rally were counted (balls deflected off the defender that resulted in a direct point were counted as a *kill* for the attacker. Junior women tallied 56% *good* digs and 44% poor digs overall. They contacted more digs *in the ready position* (36%) than any other position.

***Table 8. Overall defensive quality and results for junior women***

| Technique | | | Quality | | |
|---|---|---|---|---|---|
| **After Moving** | 108 | 31% | **Good Dig** | 193 | 56% |
| **In Motion** | 109 | 31% | **Poor Dig** | 152 | 44% |
| **In Ready Position** | 128 | 36% | **Total** | | **345** |

#### 3.6.2.1 *Blockers, Defenders and Universal Athletes*

In terms of quality, Figure 66 shows that female blockers produced the highest quality digs when faced with the *pokey,* while the *spike* and *shot* produced the lowest successful dig contacts.

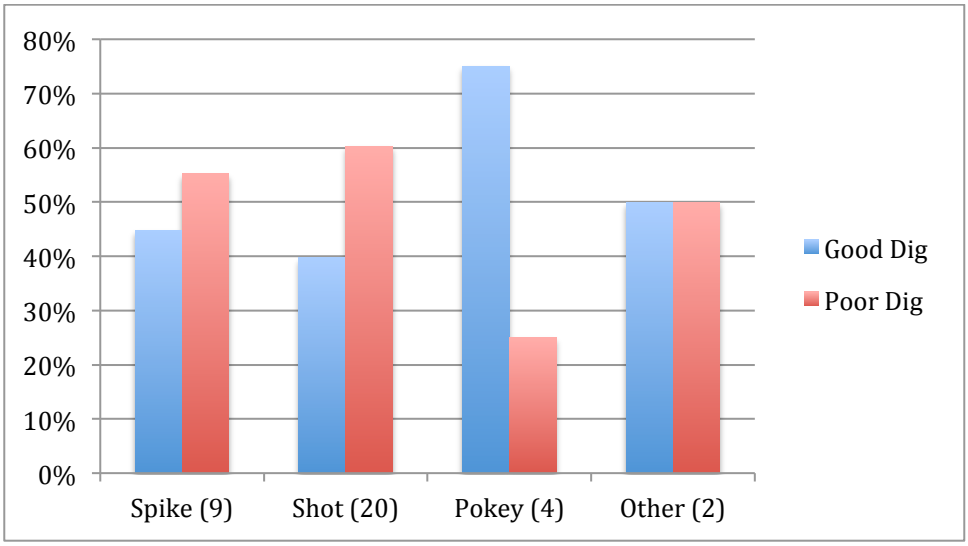



***Figure 66. Attack technique and dig quality for female blockers***

Defenders accounted for over 50% of the total overall dig contacts for women. Their highest dig quality occurred when they defended the *shot* attacks, and this category was the only one that produced more good digs than poor digs.

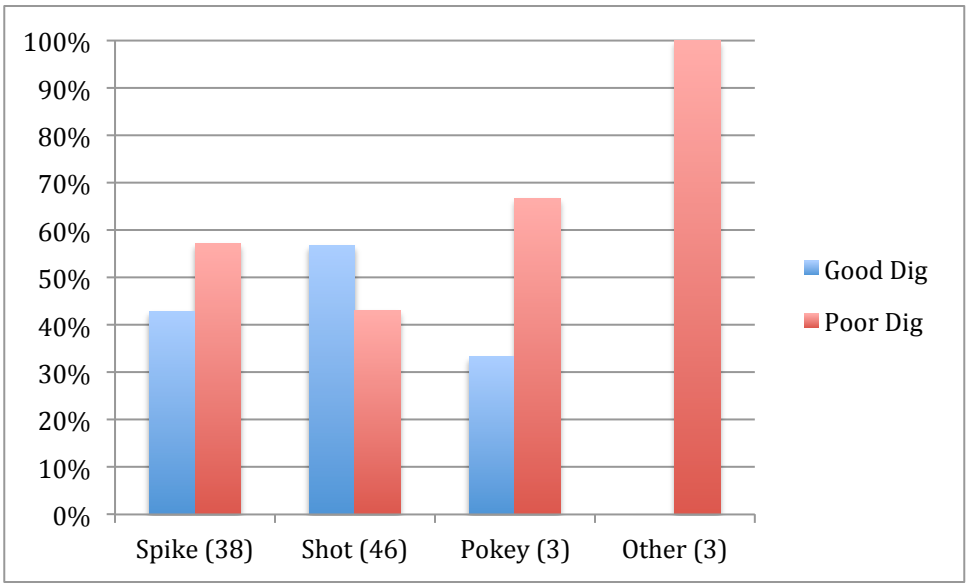



***Figure 67. Attack technique and dig quality for female defenders***

Universal athletes tallied 59% good digs. The only attack that they faced where they produced a higher percentage of poor digs than *good* digs was when defending the *spike* attack. The *shot, pokey,* and other attack techniques were all defended with a higher percentage of good *digs* than poor *digs*. Figure 68 below shows the female universal defensive qualities.

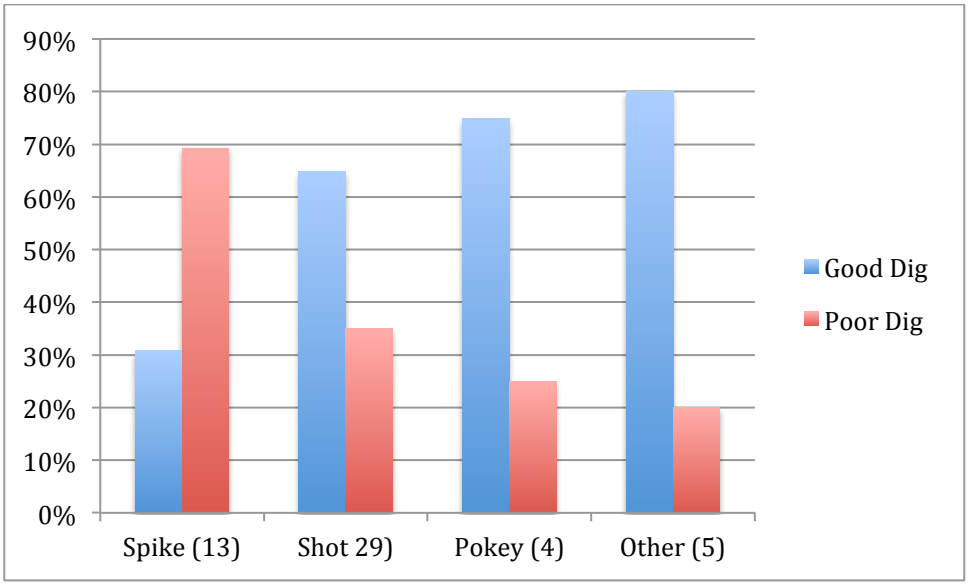



***Figure 68. Attack technique and dig quality for female universals***

### *3.6.3 Comparative Results and Discussion (Men)*

#### *3.6.3.1 Blockers and Defenders*

Male blockers only tallied one third of the digs that defenders did (35 vs. 98). 28% of blockers' digs were considered *good*, while 36% of defenders' digs were considered good. Despite the discrepancy in total digs contacted, there were no significant differences in dig quality between these two positions ($p$=0.395*).*

### *3.6.4 Comparative Results and Discussion (Women)*

#### *3.6.4.1 Blockers, Defenders and Universal Athletes*

When observed defending after the serve, female defenders posted the highest number of digs (90), compared to universals (51) and blockers (32). This would stand to reason as defenders had the opportunity to create a defensive contact on every rally, whereas blockers could only create a defensive contact if they peeled from the net. Universal athletes had an opportunity for a defensive contact only

when they served, or if blocking, peeled from the net. Overall, universal athlete produced the highest percent of *good* digs compared to all females, with defenders in second and blockers last. However chi square tests showed no significant differences in dig quality between all three positions ($p$=0.236*)*.

#### *3.6.4.2 Junior Males and Junior Females*

When defending after the serve, the data suggests that women were more effective defenders. The total dig contacts and dig quality was higher for women. Junior men tallied 133 digs, with 41 good digs (31%) and 92 poor digs *(69%)*, while junior women tallied 173 digs, with 85 good digs (49%) and 88 poor digs (51%). Chi square test for significance confirmed that women are more effective defenders in terms of quality than men ($p$<0.05).

# 4 Summary and Conclusions

While this was a descriptive study, it was the intent of the researcher to provide an initial base comparison between blocker, defenders, and universal athletes and where possible well give examples of how the junior athletes may differ from the senior ones. Furthermore, it was also the goal of this research to describe multiple factors in the playing skills used by junior athletes, as well as describes how previous skill execution in one rally may impact subsequent skill executions.

## 4.1 Blockers, Defenders and Universal Players

### *4.1.1 SERVE*

- Results indicated that male blockers and defenders used different service techniques ($p<0.001$). Data showed that male blockers' preferred the *jump float* while male defenders' prefer the *jump spin*. Furthermore, male defender's appeared to serve with higher quality than blockers ($p<0.05$).
- Significant differences in technique were noted between all three positions on the female side ($p<0.001$). Blockers and defenders preferred the use of the *jump float* serve, while universals used both *jump* and *standing float* serves with similar frequency. Significant differences in quality also existed between all three positions ($p<0.05$). It was interesting to note that female blockers attained the highest successes while serving in the female group, while it was the male defenders who were the more successful servers.

### 4.1.2 *SERVE RECEPTION*

- Male blockers and defenders showed significant decreases in service reception when midline reception contacts were compared to outside midline contacts ($p<0.05$). When a direct comparison was made between blockers and defenders, no significant differences were found when the ball was contacted in the midline yet when quality was examine for receptions contacted outside the body, it appeared that defenders had greater successes ($p<0.05$).
- While junior male blockers and defenders showed a discernable difference in reception quality when the ball was contacted outside the midline, compared to the midline, no significant differences were found between all three junior female positions *($p$=0.106)*. Female blockers showed no significant differences in midline and outside body passing, where as defenders and universal athletes did. Lastly, when all three positions were compared receiving when the ball was contact outside the midline, no significant differences were found in quality between all three athletes ($p$=0.344*)*.

### 4.1.3 *SETTING*

- Male blockers and defenders used both the *forearm* and the *overhead* set techniques. For male blockers, after a poor reception, the use of the forearm technique was dominant (90%), compared to 68% after a good reception. Furthermore, significant differences existed between set quality after a *good* and *poor* reception ($p<0.05$*)*. It appeared blockers were more successful setting after a *good* reception. Like blockers, defenders also favoured the

*forearm* technique after a poor pass (over 90%) compared to a good reception. Data from the study showed no significant differences between male blockers and defenders in setting technique and quality (page 59).

- Intriguingly, junior women used the overhead set technique less than 1% of the time. After a *good* reception, all three positions set with high quality as 85% of sets were considered good. After a poor set, this quality dropped for all positions. Blockers fell to 66% *good* sets, defenders to 70% and universals to 73%. Nevertheless, no significant differences were found between set qualities for all three athletes regardless of the reception quality.

### 4.1.4 ATTACKING

- While no significant differences were found between male blockers and defenders in terms of quality or technique, when attack data was limited to those attacks after a poor reception a significant difference in attack quality ($p<0.05$) was found. From this analysis, blockers emerged as the more effective attackers. Finally, it must be noted that defenders had very low kill efficiency when the *spike* attack was used (25%), yet their overall efficiency remained comparable to that of blockers mainly because of a very high efficiency when using the *pokey* and *shot* attacks.
- Junior women favoured the *shot* technique over the use of the *spike* technique. Female blockers split the use of the *spike (*44%*)* and *shot (*46%*),* while defenders and universals favoured the *shot* (58% and 48%). In terms of kill percentage and attack efficiency, blockers possessed the highest kill percentage (48%) and attack efficiency (28%) while defenders had a higher

attack efficiency (26%) than universal athletes (22%), yet they shared the same kill percentage (43%). Nevertheless, no significant differences in attack technique or qualities were found.

### *4.1.5 BLOCKING*

- Due to the nature of the game, no comparisons were made between blockers and defenders for both genders, as the defender was not observed blocking after the serve. Beach volleyball stakeholders have speculated that blockers are more efficient at their skill when they are at the net and do not have to run up after serving. Data from this study showed no significant differences in block quality for junior male blockers or junior female blockers and universal athletes when they had to run up to the net after serving versus when they started at the net when their partner served. With this said, there are physiological demands from running up to the net that may place an extra burden on the blocker. However, an analysis of this nature was beyond the scope of this research.
- Comparing the female blocker with the female universal athlete, both athletes overwhelmingly preferred line block actions (either a peel or jump). It would be interesting to observe the quality of blocker (and universal athletes) with a greater *n*-value for cross-court block actions. No significant differences existed between block technique and block quality for both types of female athletes.

#### *4.1.6 DEFENSE*

- Unlike blocking, comparisons could be made between all three positions. For junior men, defenders had more dig contacts than blockers. This was understandably so, as blockers were attempting to intercept the ball at the net. Nevertheless when blockers peeled away from the net it was possible for them to tally a dig contact. Blockers tallied more digs after a *shot*, while defenders contacted more digs after a *spike*. With this said, the quality of digs did not differ between male blockers and defenders.
- For women, all three groups (blockers, defenders and universal athletes) tallied the higher number of digs after the opposition attacked with a *shot*. It was again the defender that tallied the highest number of digs. When compared, no significant differences were found between all three female positional players

## 4.2 Junior and Senior Comparisons

Where possible, data gained from the U21 athletes was compared with other studies in which senior athletes were observed. Some skill were not possible to compare due to different observation criteria (namely blocking). A standardized method and procedure would be needed for a more rigorous comparison between junior and senior athletes.

### *4.2.1 MALES*

**Serve**

- Compared to the seniors, the junior men used the *jump float* more, while the seniors preferred the use of the *jump spin*. It is understood that the *jump serve* has a high degree of risk associated with it as(18% of jump serves ended with a point for the oppositions at the senior level Koch & Tilp 2009a). They speculated that the senior men needed to use the *jump spin* due to the high degree of reception success. It is possible that junior men applied a different serving strategy to minimize the risk with their serves. Overall the *jump float* produced the lowest percent of errors for the junior men. Perhaps men need to *jump spin* serve to succeed at the senior level.

**Reception**

- In the element of reception, only quality comparisons were made. Junior men emerged as the more successful receivers As beach volleyball is a cyclical sport and previous actions can effect the next actions, it may be important to note that senior men were tasked with receiving a *jump spin* (a *high risk serve* (Koch & Tilp 2009a), more so that the junior men. It was therefore possible that the service technique and quality had an effect on these results.

**Set**

- Junior and senior men used both techniques. However, the senior men evenly spilt the use of the *forearm* and *overhead* technique, while over two-thirds of the set attempts by the juniors comprised the use of the *forearm* technique. Again, the *overhead* technique involved a higher degree of risk due to the

technical requirements and strict enforcement of the overhead contact rule. Junior men appeared to use this *technique* sparingly (but use it none the less), while the senior men showed an ability to incorporate it into their standard play.

**Attack**

- Results indicated that junior athletes attempted the *shot* attack slightly more than the seniors. Nevertheless, the preferential attack technique for both groups was the *spike* (over 55%). Thus, no significant differences in attack technique were observed. A significant difference in quality existed between junior and senior men. Senior men were more efficient, had a higher kill percentage and committed more errors. Since senior men committed more errors, yet lead in all offensive categories, it is possible that they take more risk with their attacks. They scored more often off their attacks, but also committed more errors. Junior men may need to increase the risk of their attack to succeed at the senior level.

**Block and Defense**

- Data was unavailable for comparisons to be made.

### *4.2.2 FEMALES*

**Serve**

- Junior and senior women both use two types of serves with similar frequency. The junior women split between the use of the *standing* and *jump float* serves, while the senior women split the use of the *jump spin* and *jump float* serves. The risk associated with the *standing float* and *jump float* appeared to be

minimal (10% errors) while the *jump spin* produced 38% errors. Senior were better at minimizing errors with the *jump spin* (18% errors). It appears that junior women need to increase the use of the *jump spin* while decreasing the number of errors committed with this technique to be able to use it on the senior tour.

**Reception**

- After receiving the serve, unlike the men, no significant differences in quality were observed. Even when faced with different serving technique, both women's groups received with similar quality (roughly 55% good passes).

**Set**

- Similar to the reception skill, no differences in quality were discovered between junior and senior women. A significant difference did exist in setting technique. While the both groups favoured the *forearm* technique, it was the senior women attempted the *overhead* with greater frequency. The *overhead* set was only used in 8% of set opportunities for senior women, and less and 1% for junior women. Researchers, coaches and volleyball enthusiasts have speculated about the causes for virtual abandonment this technique in the women's game, but no scientific research has been conducted.

**Attack**

- Senior women preferred both the *spike* and *shot* technique (50% each), while the junior overwhelmingly used the *shot* attack. As data was unavailable for the *pokey* attack frequency for senior women, no fair comparison between attack techniques could be made. However, quality results indicated that

both senior and junior women share similar results. As with the senior men, senior women lead in all offensive attack categories (attack percentage and efficiency), both groups produced similar error percentages while junior women had a higher continue percentage. It would appear, like on the men's side, that the senior athletes attack with a higher degree of risk. Nevertheless, there was no statistical difference in terms of attack quality between junior and senior women.

**Block and Defense**

- Data was unavailable for comparisons to be made.

## 4.3 Coaching

### *4.3.1 Contributions to Coaching Research*

With the affordability of more complex video capture devices and analysis software, this technology now provides a myriad of options to a coach. Video cameras and analysis software can aid in technique error detection and correction, be used as a feedback tool for athletes and coaches, as well as used for scouting the opposition. To take full advantage of those opportunities, high performance coaches will need to organize their coaching practices in a more scientific and systematic way. Creating large volumes of data through video capture can only be useful to the coach if there is a specific purpose or what a researcher would refer to as a research question. The experienced gained through this research project has particularly illustrated the potential for improving coaching practice through the analysis of performance data, but it has also made it acutely aware of the need to capture, organize and analyze

data within a purposeful and systematic framework. For example if the purpose is simply to describe what has occurred in a match (or practice) such as offensive tendencies, attack averages, block percentages, then the data organization and analysis can be quite basic. If the purpose is to examine the tendencies of a particular player at particular times of the match (or after the execution of a particular skill), then data entry must include more variables, which must be organized prior to the project. Since beach volleyball is an interacting sport, the researcher wanted to examine how previous skills in the rally may have influenced the outcomes of other skills.

It was important to note that the data must be organized in such a fashion that allowed the software to filter it properly. Thus, when using pivot tables, it is imperative that the coach/researcher know exactly what information they need to gather to answer the research question/coaching quandary. An example of this organization and analysis can be seen in the appendices.

The titles of heading and the data input criteria were not limited to numerical values. Thus, as an example, if an error was committed it was possible (and at times more practical) to write '*error'* versus inputting a numerical value. For ease of use, the implementation of a standardized criterion was followed. Secondly, in order to avoid confusion, it was important to keep unique headings for all sections. Every skill had a 'results' heading and it therefore was important to distinguish between 'serve result', 'reception result' etc.… versus leaving the heading as 'result'.

The entire database contained similar headings for all of the skills (serve, reception, set, attack, block, defense), yet not all criteria were the same. This did not pose any issues with the filtering capabilities of the table.

## 4.4 Recommendations for Future Research

This study was the first to examine the differences between blockers, defender and universals at the junior level. It is also one of the few that examined beach volleyball techniques and tactics as they are used at the junior level for both men and women. Some questions have ben answered by this research, but there are specific areas of investigation that could further aid the volleyball community in understanding how elite junior athletes play the game of beach volleyball:

- An in-depth analysis of the limited use of the overhead set technique by women. Specifically, what are, if any, the benefits/risks of increasingly the use of the *overhead* set by junior women?
- Studies looking at the relationship between multiple variables could be done. For example, is there a relationship between the location of ball reception relative to the midline and the quality of the resulting attack?
- It would be interesting to explore the use of '*play sets'.* Are junior athletes running a variation of sets (high, fast, distance) and if so, has this added element increased attack efficiency?
- A definitive study of team composition could bring forth recommendations to coaches and athletes. It would be worth noting how a team comprised of blocker/defender differed from the universal model. The exploration of team

composition should not be limited to technical and tactical, but perhaps researchers could explore the psychological dynamic between members of both teams.

- Since this study excluded the data collected from universal athletes on the men's side, a more in-depth analysis (perhaps over an FIVB season) could bring forth new data pertaining to team composition for men. The same study could also add value to the women's' side by collecting more data that could inform the composition of beach volleyball teams for women.

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# 6 Appendix

## 6.1 2009-2012 FIVB Athlete Agreement

Fédération Internationale de Volleyball, Château Les Tourelles,
Avenue Edouard Sandoz 2-4, 1006 Lausanne, Switzerland
**Fax: +41 (21) 345 3548 e-mail: beach@fivb.org**

**WT-01 2009-2012 BEACH VOLLEYBALL NF-ATHLETE'S COMMITMENT**

*Only one original copy of the ATHLETE'S commitment must be sent via email to the FIVB Beach Volleyball Dept. in Lausanne at least 30 days before the start of the Event(s) concerned. This document may be accepted via fax but it will need to be sent to the FIVB in original.*

**Ms./Mrs./Mr. (The ATHLETE) _____**

**ATHLETE ID#_____**

**voluntarily signs this commitment undertaking the obligations herein on the _____ day of_____**

**20____ jointly with the National Volleyball Federation (NF) of _____**

**and both, the "NF" & the "ATHLETE" state the following:**

The ATHLETE joins the National Federation (NF) and FIVB's aim to develop Beach Volleyball as a major world media and entertainment sport through world class planning and organisation of competitions, marketing and promotional activities in the respect of the FIVB Constitution, Code of Conduct, FIVB-organiser agreements, the Beach Volleyball Handbook and the Rules of the Game.

The ATHLETE understands that the right to play in FIVB EVENTS is a privilege, as well as to work with the FIVB for the enhancement of Beach Volleyball, and exert his/hers rights respecting the FIVB and its Licensees in the terms of this commitment, and acknowledges that he/she has read and commits to comply with the FIVB current regulations and obligations, particularly but not limited to those governing his/her participation at FIVB EVENTS as follows.

**1. RESPONSIBILITIES STEMMING FROM PARTICIPATION**

1.1 The ATHLETE is free to enter or not FIVB Official Beach Volleyball events and should not be constrained by any organisation to do so or not. In the case of entering, every ATHLETE must respect and abide by the FIVB Regulations, which breach of may lead to the loss of eligibility to take part in any Official national and international Beach Volleyball and Volleyball competitions including, without limitation to, Continental events, World Tour, World Championships and other FIVB competitions as well as to the Olympic Games.

1.2 The ATHLETE taking part in tournaments not authorised by the FIVB, or playing in a foreign country without a previous written invitation from the local National Association and authorisation from their respective National Federation commits a serious breach of the FIVB regulations and may be sanctioned with the loss of eligibility as mentioned in the previous paragraph, without any other formality.

1.3 The ATHLETE violating any of the above regulations or other reiterated violations might cause the FIVB to impose heavy fines against the ATHLETES involved.

1.4 The ATHLETE is expected neither to claim nor to request any payment other than prize money and/or FIVB Bonus Pool money.

1.5 Each ATHLETE is responsible for being informed of the starting time of all matches and of being present and ready to play on time. The ATHLETE should also make himself / herself available for local promotions whenever requested by the promoter and/or the host NF if such promotions do not interfere with their preparation or scheduled matches.

1.6 Upon signing the agreement to enter FIVB Beach Volleyball Events a ATHLETE undertakes:

a) The obligation to submit himself/herself to anti-doping Controls conducted in accordance with the FIVB and WADA regulations.

Player's Commitment 1-8 NF's Commitment

_____ _____

b) The obligation to obtain from his/her NF or NOC, the list of forbidden substances/products enlisted in the FIVB and WADA Doping Regulations and to accept the disciplinary measures taken by the FIVB.
c) An athlete can appeal any decisions made after the FIVB anti doping hearing panel, to the International Court for Arbitration in Sports recognised by the IOC, the FIVB and the NOCs and, furthermore, waive any right to appeal to a civil court regarding this issue.

**2. GENERAL CONDITIONS TO ENTER FIVB BEACH VOLLEYBALL TOURNAMENTS**

The ATHLETE acknowledges:

2.1 Only when they have been previously registered by their NF, the ATHLETES are granted the right to participate in the men's or women's FIVB Swatch World Championships, FIVB Swatch World Tour EVENTS and other FIVB competitions based on entry points for the Contract Years as stipulated in this agreement and/or in the competition regulations issued by the FIVB.

2.2 The obligation to present a annual medical certificate by sending to the FIVB the WT/10 form (- 30 days prior the start of a competition) attesting they are in good health to participate in Beach Volleyball competitions, assuming total responsibility for any health problems that they might face during any FIVB Beach Volleyball Official event and acknowledging the risk of injuries due to the game itself.

2.3 To present an FIVB Anti-Doping Certificate 30 days prior to the participation in an FIVB Swatch World Tour and/ or Swatch World Championships, after having successfully completed FIVB's Anti-Doping education program "We play it clean!" online: http://www.fivb.org/RealWinner/

2.4 That, they may earn a compensation for their participation by way of prize money and/or Bonus Pool to be fixed by the FIVB on the basis of their performance.

2.5 The FIVB guarantees that the ATHLETE will be paid his/her earnings within a reasonable time limit, but never later than 30 days after the last event of each month including all events earnings in that month if and when obtaining the right to such earnings the ATHLETE will give to the FIVB in due time his/her bank account coordinates and personal data through the dedicated extranet.

2.6 The FIVB shall pay the Bonus Pool in their full amounts to the eligible athletes who will play in all tournaments except for 4 events in the season concerned (i.e. 2009 or 2010 or 2011 or 2012). Eligible ATHLETES missing the mandatory participation in the World Championships, in the majority of Grand Slam and remaining Open events not reaching the minimum events participation requirements lose all Bonus Pool unless the athlete already entered in the provisional and confirmed list requests an exception proving with medical certificate his or her injury for maximum 2 events as per clause 2.6.

2.7 The injured ATHLETE can only miss two events (resulting in total 4 + 2 events due to the injury) during the entire season. In case of "force majeure" a medical certificate must be sent to the FIVB by the corresponding National Federation. An ATHLETE through the National Federation must declare 15 days after the event concerned his/her injury to the FIVB and send to the FIVB the appropriate Medical Certificate. Upon declaration, an approximate time frame must be stipulated in order to determine the 2 events he/she will miss. Late requests which are sent to the FIVB after 15 days from the date of the injury will not be taken into consideration by the FIVB.

2.8 In the situation where the playing partner is affected, the FIVB will make a decision on a case by case basis for his/her eligibility for Bonus Pool.

2.9 Moreover an athlete can be eligible for his/her Bonus Pool in case he/she enter in the event but his/her pair will not have enough entry points to be included in the confirmed list of participants of the FIVB Swatch World Championships and in certain FIVB Swatch World Tour events due to the limitation of the maximum number of teams participation featured in the event's regulations, and the team was physically present at the Preliminary Enquiry and/or Technical Meeting of the respective tournament.

2.10 In case an eligible athlete who did not participate in either the FIVB Swatch World Championships, in the majority of the Grand Slam Events, the FIVB will have the right to withhold financial benefits provided by the FIVB hereunder such as the Bonus Pool.

2.11 After three (3) attempts to contact the ATHLETE in case of an unsuccessful payment of the Prize Money/ Bonus Pool, the FIVB Finance Department sends an official letter (to NF and the ATHLETE) to inform of the money transfer to the respective NF. It will be then the NF responsibility to wire the amount to the ATHLETE.

2.12 Having the right to authorise his/her NF or a personal representative to receive all payments **on his/her behalf.**

2.13 Whoever will be authorized to receive the payments must provide FIVB with a certified statement featuring the name of the account holder, the name and full address of him/herself, name and full address of his/her bank, Bank IBAN account and Swift Code, otherwise the FIVB do not accept any responsibility related to payments delay.

2.14 That he/she is not expecting to be paid any other money or offered any value in kind, other than expenses which will not be conditioned upon his/her performance in the tournament.

2.15 The ATHLETE if in the Main Draw acknowledges the obligation to provide to the Promoter concerned, by the deadline stated in the Events Regulations, his/her travel itinerary. Main draw ATHLETES sending in due time the WT/31 form will be eligible free of charge for all local transportation to/from the airport and to/from the hotel paid by the EVENT organizers. ATHLETES participating to the Qualification Tournament and coaches may be required to pay a flat fee to be granted local transportation.

2.16 Their NF to register him/her to take part in FIVB Beach Volleyball events and that he/ she is an affiliated member of their NF and for this reason the NF agrees and assumes the responsibility and the rights to represent the ATHLETE`S interests, within the FIVB, in the terms of this agreement and in full respect of the FIVB Constitution, Code of Conduct, General Regulations and decisions and provide the ATHLETES all information concerning those FIVB legal instruments.

2.17 To abide to the FIVB-IOC approved Olympic Qualification System / Procedures for the 2012 Olympic Games which will be implemented by the FIVB in accordance with the FIVB Board of Administration and IOC decision.

2.18 In case that, due to 'Force Majeure' or to unforeseen circumstances an EVENT is cancelled, the FIVB will inform by email and through the FIVB Website its Sponsors and National Federations to inform the ATHLETES as soon as it is known. Should vital topics in the Master Plan not be respected by a Promoter, the FIVB is required to inform 45 days before the start of the event all participating NFs about the risk of a cancellation. Should the cancellation be confirmed 21 days before an event, neither the FIVB nor the Promoter will be held accountable for reimbursing the parties concerned the penalty fees of any airplane tickets issued. .

2.19 The ATHLETE acknowledges and agrees that he/she shall take part in FIVB events pursuant to the terms of this Agreement. The FIVB has implemented the policy of "freedom to choose". Notwithstanding anything to the contrary in this Agreement, the FIVB agrees and acknowledges that the ATHLETE is free to participate in connection with his or her Continental National Tour and to the other FIVB events that under no circumstances the FIVB shall sanction, fine, penalize the ATHLETE for his or her participation on such National Tour. The ATHLETE is aware that he/she shall secure the authorization of his/her National Volleyball Federation before taking part in any eventual FIVB homologated National Tours abroad as per FIVB regulations.

2.20 Any further details concerning the FIVB event's regulation will be featured in the annual Beach Volleyball Handbook.

3. **ATHLETE'S ACCESSORIES, ENDORSEMENT RIGHTS and ATHLETE'S COMMITMENT ON THE PLAYING UNIFORMS**

The ATHLETE acknowledges that during the competitions he/she has the right to use or wear accessories and uniforms as stated in the latest edition of the Beach Volleyball Handbook.

**4. ATHLETE'S COMMITMENT ON THE PLAYING UNIFORMS:**

4.1 Whenever required, the ATHLETE will submit his/her own playing shorts/bottoms to the FIVB technical supervisor to verify that they are in line with the uniform standards approved by the FIVB Board of Administration, FIVB World Congress and the rules set out in the Handbook, that they are of the same colour and style as his/her partner, that the space reserved for the FIVB Swatch World Tour or FIVB Swatch World Championships is left free (min 10cm2). The uniform standards will apply to every Event in the same way, so approval will not be different per Event. Verification will take place no later then the Technical Meeting before the Main Draw of each event.

4.2 Accessories shall be approved by the FIVB Technical Supervisor during the Preliminary inquiry before each EVENT including temporary tattoos or medical braces and once approved, it will not be

allowed to include any new sponsors' logo/name on shorts/bottoms, hats, caps, bags, arm pads, head bands, etc., nor to conclude new agreements with companies willing to sign a last minute deal during the EVENT unless specifically authorized in writing by the FIVB and the promoter of the EVENT.

4.3 During all FIVB International EVENTS the ATHLETE agrees not to wear a patch or logo of any other organization except his/her country flag, his/her NF logo, the FIVB and/or the FIVB Swatch World Tour/World Championships title and his/her respective name/nickname which are mandatory for the main draw teams.

**5. ATHLETE'S COMMITMENT RELATED TO PARTICIPATION:**

The ATHLETE shall take part in the following EVENTS and respect the conditions herein below in order to have the right to be paid a share of the Bonus Pool:

5.1 To take part in all FIVB Swatch World Tour and FIVB Swatch World Championships tournaments in a season (i.e. 2009 or 2010 or 2011 or 2012) except for 4 events of to be eligible for the full Bonus Pool (except in cases of injury, illness or "force majeure" with a mandatory participation in the FIVB Swatch World Championships in 2011 and the obligation to take part to other FIVB events, FIVB Swatch World Tour as stated in this agreement and eventually updated in the latest edition of the Beach Volleyball Handbook. In case an athlete who will not participate in either the FIVB Swatch World Championships in 2011 and the remaining World Tour events to reach his/her Bonus Pool eligibility for the entire season, the FIVB will have the right to withhold financial benefits such as the Bonus Pool.

5.2 The injured ATHLETE can only miss two events (resulting in total 4 + 2 events due to the injury) during the entire season (as per point 2.6 above)

5.3 To attend the compulsory Preliminary Inquiry and Technical Meeting scheduled the day before the qualification tournament and the Main Draw.

5.4 Not participate in any non-sanctioned FIVB international EVENTS without prior confirmation given by the FIVB and the National Federation. In order to qualify for approval, the National Federation shall notify FIVB, in writing, at least (30) days before the EVENT. The FIVB's decision whether to authorize an ATHLETE to play in a non-sanctioned FIVB EVENT shall be final.

5.5 An ATHLETE taking part in tournaments not authorized by the FIVB, or playing in a foreign country without a previous written invitation from the local National Federation commits a serious breach of the FIVB regulations and may be sanctioned and subject to fines, suspension and/or expulsion as detailed in the Handbook and in the Code of Conduct.

5.6 The ATHLETE respects the hospitality of the Promoter by not abusing the Promoter's rights.

5.7 The ATHLETE states that he/she is subject to their National Federation's regulations.

5.8 The ATHLETE agrees to represent himself/herself and the sport to the highest standards at all times showing good behaviour, fair play and loyalty to the sport and its members and governing bodies, Sponsors and/or Promoters as per the rules set out in the Handbook. Failure to implement the above and comply with these rules may result in fines and/or instant dismissal from the sport.

5.9 In addition to complying with the rules of the Handbook, the ATHLETE shall at all times observe and comply with all written and issued requirements of the FIVB.

5.10 The ATHLETE agrees to abide by the Code of Conduct and Constitution set by the FIVB.

**6. FIVB & FIVB'S SPONSORS/SUPPLIERS RIGHTS:**

The ATHLETE hereby acknowledges and pledges to honour the following exclusive rights of the FIVB and its sponsors/suppliers:

6.1 The right to reproduce in computer assisted and computer related games embodied in or on any devise or medium in the form of software, firmware and/or hardware which may be utilised directly or indirectly for the reproduction of visual images with or without sound of the FIVB Swatch World Tour, or FIVB Swatch World Championships, or other FIVB competitions matches real or simulated but always with reference to the Beach Volleyball FIVB Swatch World Tour, or FIVB Swatch World Championships or other FIVB competitions.

6.2 The right to licence assign or transfer the rights and licences mentioned herein at their sole discretion to any third party.

6.3 The right to make use of and show, at its discretion, any motion pictures, video games, magazines including live, taped or filmed television footage or photos of the ATHLETE taken during FIVB Official events without compensation, and hereby waives any right to such compensation for the ATHLETE, his/her heirs and assignees.

6.4 The ATHLETE hereby grants and acknowledges that the FIVB owns all exclusive rights to use and promote The ATHLETE name or likeness, photograph, video footage, voice, biography during this contract agreement for the FIVB, Sponsors and Promoters in connection with the FIVB Swatch World Tour. FIVB acknowledges that they will only use this all exclusive right in connection with the FIVB Swatch World Tour, FIVB Swatch World Championships as well as other FIVB competitions as set out in the terms of this contract.

6.5 The ATHLETE grants non exclusive licenses rights in perpetuity to the FIVB to photograph, record, tape, display, publish, promote and broadcast of themselves at any FIVB EVENT (i.e. visual, flyer, etc.).

6.6 The ATHLETE agrees not to grant or authorize any third party for the purposing of endorsing their product rights such as TV footage, photographs etc. with the FIVB logo without written consent from the FIVB in advance.

6.7 The ATHLETE agrees that FIVB owns all media rights including photographs, video, digital television at any FIVB EVENT and have exclusive rights to exploit his/her likeness within the worldwide territory for the use promotional purposes in perpetuity throughout the contract period.

6.8 The ATHLETE agrees that FIVB will inform their Sponsors upon request of any restrictions applicable to the ATHLETE and in the event that the Sponsors misuse this information in an unreasonable way The ATHLETE shall have the right to redeem any compensation from the Sponsors directly

**7. FIVB RIGHTS FOR PROMOTIONAL PURPOSES**

The ATHLETE and the NF vow to support FIVB Promotional efforts as follows:

7.1 The FIVB has the right to use in perpetuity and on a worldwide territory by any and all means the ATHLETE'S identification in connection with photos, films, videos computer games in connection or related exclusively to one tournament or to the ensemble of official EVENTS.

7.2 FIVB's sponsors and their respective advertising agencies and each television or other distribution station, system or service scheduled to distribute the EVENT shall have the right to grant others the right to reproduce, print, publish, or disseminate in any medium, the name and likeness and voice of each person appearing in or connected with the EVENT and biographical material concerning such person, the name of the EVENT site for purpose of trade or for advertising purposes.

7.3 The ATHLETE understands that they are granted access to the FIVB video archive and photographs upon request for technical production and shipment costs only. This request must be sent by email to the FIVB Beach Volleyball department to the following email address: beach@fivb.org (fax: +41 21 345 3548).

7.4 The ATHLETE acknowledges that the FIVB has the right to reproduce in computer assisted and computer related games embodied in or on any devise or medium in the form of software and/or hardware which may be utilized directly or indirectly for the reproduction of visual images with or without sound of the FIVB Swatch World Tour and/or the FIVB Swatch World Championships matches real or simulated.

7.5 The ATHLETE acknowledges that the FIVB has the right in perpetuity and on a worldwide territory by any and all means to make use of and show, at its discretion, any motion pictures, video games, magazines including live, taped or filmed television footage, such as highlight shows or photos of the ATHLETE taken during FIVB Official EVENTS without compensation, and hereby waives any right to such compensation for the ATHLETE or his/her heirs and assignees.

7.6 To be present for the award ceremony at each of the EVENTS in which they finalize among the top 3 teams wearing their uniform tops as provided by the Promoters/FIVB for the photography and media session.

7.7 To participate without excuse neither pretext, upon the FIVB request, in a minimum of one hour per day at all played Beach Volleyball EVENTS during the contract year in the following promotional activities: VIP Package, FIVB highlight shows when organized in advance by the TV Production company, autograph sessions, participation in VIP EVENTS (night & day), practice sessions, exhibitions, Beach Volleyball clinics, PR activities, media EVENTS, TV interviews, sponsorship interviews and other promotional activities reasonably required by the PROMOTER and FIVB.

The ATHLETE must be available for TV interviews during EVENTS or with press photographers when requested in front of the FIVB official backdrop as required.

The FIVB will respect the ATHLETE'S need to train, play, eat, sleep and prepare for coming games during the event when requesting the ATHLETE'S participation.

7.8 To make him/herself available for clean head shots (with no promotional clothing) to be used for the ATHLETE'S identity photograph on the FIVB website and photo cards (should they be required.) This photograph will be taken on the first day of the Technical Meeting by a photographer on site.

7.9 To do his/her utmost to be available for professional interviews or promotion events by the FIVB or FIVB Sponsors at any time in any part of the world (in such requests the FIVB travel expenses and accommodation will be paid) and will use reasonable efforts to organize his/her schedule accordingly.

7.10 The ATHLETE hereby grants to the FIVB and to its Licensees the right and license to use the ATHLETE'S identification, but, notwithstanding anything to the contrary in this Agreement, it is expressly understood and agreed herein that the FIVB and its Licensees will not use the ATHLETE'S identification for advertisement or promotion (especially on the packaging of its products) in such a way that an individual ATHLETE should appear to be endorsing any product or service. Such appearance will have to be negotiated by a separate contract with the ATHLETE.

7.11 The FIVB, its Sponsors and Licensees agree that the ATHLETE has the right to authorize sponsors to use the ATHLETE'S identification during the contract period. All monetary value gained by the ATHLETE through the Sponsor will remain in the ATHLETE'S possession.

7.12 The ATHLETE shall verify his/her data on the FIVB website and personally update the data throughout the season, as the data is the main source of information for the media and the FIVB administration purposes.

**8. GROUP LICENSING RIGHTS**

8.1 Subject to individual endorsement limitations set forth in Section 7.5 the ATHLETE hereby grants FIVB the right to use the licensed ATHLETE'S identity throughout the Contract in connection with selling or using all products and/or services used by three or more FIVB ATHLETES in order to promote, market or exploit the FIVB and FIVB Events, the sport or any telecast or broadcast of such Events unless such right was previously granted by ATHLETE to a third party in which case, pursuant to this provision, it shall not be granted.

8.2 FIVB will in good faith consult with the ATHLETE regarding specific uses of their ATHLETE'S identity, name or likeness with three or more ATHLETES in connection with licensing rights, if any, and agrees that it shall not grant any licensee the right to utilize one of these ATHLETE'S identity in such a way that the ATHLETE would seem to have granted an individual endorsement of a product or service. Any usage pursuant to this provision cannot feature the ATHLETE in a manner in which the ATHLETE is readily and specifically identifiable unless specifically agreed to by ATHLETE in a separate license agreement with the exceptions of the rights granted by the ATHLETE to the FIVB in clauses 6, 7 and 8 of this agreement.

**9. WAIVER**

The ATHLETES hereby releases and waives all claims he/she has or may have against FIVB and FIVB associated Sponsors and Promoters during the SWATCH FIVB World Tour/World Championships and other FIVB competitions in connection with any misconduct within the field of play at the EVENTS during the season.

9. **NOTICES**

All notices, statements, consents, approvals, documents and other communications to be given hereunder shall be given by one party to the other either by personal delivery or by certified mail or by telegram and followed by a signed faxed version and e-mail within in five (5) working days and shall be addressed as follows.

To FIVB:
Fédération Internationale de Volleyball,
Château Les Tourelles,Avenue Edouard Sandoz 2-4
1006 Lausanne, Switzerland

Tel.: + 41 21 345 35 35
Fax: + 41 21 345 35 48
Email: Beach@fivb.org
Attn: FIVB Beach Volleyball Department

10. **INDEMNIFICATION**

The ATHLETE agrees, at his/her sole cost and expense, to indemnify and hold FIVB and NF employees and members harmless from and against any and all claims, demands, causes of action, obligations, liabilities, losses, penalties, and expenses incurred by or on behalf of an FIVB or NF Indemnities as a result of any material breach of any warranties, representations or agreements herein made by the ATHLETE including the use and exploitation by FIVB of any rights granted by the ATHLETE.

**11. TERM/TERMINATION**

11.1 This Commitment shall commence on the date hereof and shall automatically expire on the 31st of December 2012 unless previously terminated pursuant to the terms hereof. It is agreed that the rights of exploitation of the likeness of the ATHLETE featured in this commitment will be extended beyond the terms in perpetuity on the world wide territory.

11.2 In the event of FIVB having conclusive evidence that the ATHLETE does not abide by the terms contained in this commitment or should the ATHLETE be charged with an illegal act or criminal charge involving substance use or any other immoral case, the FIVB has full authority to cancel the ATHLETE'S participation.

11.3 In the event that an ATHLETE IS CHARGED of breaching this commitment the ATHLETE will have 7 working days, from written notice given by FIVB through the National Federation, to respond to those charges should the breach be of a nature that can be explained or have a specific reason

The ATHLETE and the NF declares to have read, understood and hereby decided to sign this commitment ratifying all the terms of its content. This commitment shall be acknowledged receipt by the FIVB Beach Volleyball Department.

ATHLETE'S NAME (in Capital letters) _____

ATHLETE'S ADDRESS

Street_____

_____

Postal Code_____City_____Country_____

ATHLETE'S Bank
Name_____

ATHLETE'S Bank
Address_____

Street_____

_____

Postal Code_____City_____Country_____

Beneficiary Name at the bank_____

ATHLETE'S Bank
Account_____

IBAN Account * _____Swift Code_____

E-Mail
address:_____

Web site:

_____

Player's Commitment 7-8 NF's Commitment

_____ _____

CITY & COUNTRY _____

TELEPHONE NO _____ FAX NO_____

MOBILE TEL. NUMBER_____

PLACE & DATE: _____

* IBAN Account: Mandatory information for European Athletes.

ATHLETE'S SIGNATURE:

NF PRESIDENT'S SIGNATURE AND STAMP

_____ _____

1 February 2011

## 6.2 Weather Data for 2011 U21 World Championships for Beach Volleyball

Hourly Data Report for September 2, 2011

| Time | Temp °C | Dew Point Temp °C | Rel Hum % | Wind Dir 10s deg | Wind Spd km/h | Visibility km | Stn Press kPa | Weather |
|---|---|---|---|---|---|---|---|---|
| 0:00 | 15.2 | 14.1 | 93 | 13 | 9 | 24.1 | M | Mostly Cloudy |
| 1:00 | 14.8 | 13.5 | 92 | 13 | 7 | 24.1 | M | Mainly Clear |
| 2:00 | 12.7 | 12.6 | 99 | 8 | 11 | 24.1 | 100.55 | Mainly Clear |
| 3:00 | 12.1 | 10.5 | 90 | 6 | 7 | 24.1 | 100.52 | Clear |
| 4:00 | 12.4 | 12.4 | 100 | 8 | 9 | 6.4 | 100.5 | Fog |
| 5:00 | 12 | 11.9 | 99 | 6 | 7 | 9.7 | 100.5 | Fog |
| 6:00 | 12.3 | 12.3 | 100 | 9 | 7 | 24.1 | 100.51 | Mainly Clear |
| 7:00 | 12.5 | 12.5 | 100 | 34 | 6 | 24.1 | 100.54 | Mostly Cloudy |
| 8:00 | 13.1 | 13.1 | 100 | 35 | 7 | 24.1 | 100.57 | Cloudy |
| 9:00 | 17.4 | 13.8 | 79 | 8 | 13 | 24.1 | 100.56 | Mainly Clear |
| 10:00 | 18.5 | 13.5 | 73 | 11 | 19 | 24.1 | 100.53 | Mainly Clear |
| 11:00 | 19 | 13 | 68 | 7 | 11 | 24.1 | 100.49 | Mainly Clear |
| 12:00 | 19.9 | 13.2 | 65 | 8 | 7 | 24.1 | 100.44 | Mainly Clear |
| 13:00 | 21.9 | 12.9 | 57 | 7 | 13 | 24.1 | 100.34 | Mainly Clear |
| 14:00 | 20.9 | 12.5 | 59 | 11 | 9 | 24.1 | 100.25 | Mainly Clear |
| 15:00 | 20.2 | 14 | 68 | 12 | 19 | 24.1 | 100.2 | Mainly Clear |
| 16:00 | 19.9 | 13.9 | 68 | 13 | 19 | 24.1 | 100.17 | Mainly Clear |
| 17:00 | 19 | 13.3 | 70 | 14 | 19 | 24.1 | 100.14 | Mainly Clear |
| 18:00 | 17.8 | 13.7 | 77 | 13 | 19 | 24.1 | 100.12 | Clear |
| 19:00 | 15.9 | 13.8 | 87 | 15 | 9 | 24.1 | 100.12 | Clear |
| 20:00 | 14.5 | 13.6 | 94 | 14 | 9 | 24.1 | 100.11 | Clear |
| 21:00 | 14.2 | 13.5 | 96 | 14 | 11 | 24.1 | 100.05 | Clear |
| 22:00 | 14 | 13.6 | 97 | 13 | 9 | 24.1 | 100.03 | Mainly Clear |
| 23:00 | 13.5 | 13.5 | 100 |  | 0 | 4.8 | 99.96 | Fog |

Hourly Data Report for September 3, 2011

| Time | Temp °C | Dew Point Temp °C | Rel Hum % | Wind Dir 10s deg | Wind Spd km/h | Visibility km | Stn Press kPa | Weather |
|---|---|---|---|---|---|---|---|---|
| 0:00 | 13.8 | 13.8 | 100 | 12 | 7 | 0.2 | 99.89 | Fog |
| 1:00 | 13.8 | 13.8 | 100 | 21 | 4 | 0.2 | 99.81 | Fog |
| 2:00 | 13.5 | 13.5 | 100 | 34 | 6 | 0.4 | 99.82 | Fog |
| 3:00 | 13.5 | 13.5 | 100 | 31 | 7 | 0.2 | 99.77 | Fog |
| 4:00 | 13.1 | 13.1 | 100 | 36 | 7 | 0.2 | 99.77 | Fog |
| 5:00 | 12.6 | 12.6 | 100 | 34 | 7 | 0.2 | 99.74 | Fog |
| 6:00 | 12.4 | 12.4 | 100 | 4 | 6 | 0.2 | 99.68 | Fog |
| 7:00 | 12.6 | 12.6 | 100 |  | 0 | 0.2 | 99.68 | Fog |
| 8:00 | 13.7 | 13.7 | 100 | 31 | 15 | 0.2 | 99.69 | Fog |
| 9:00 | 14.2 | 14.2 | 100 | 30 | 11 | 0.2 | 99.69 | Fog |
| 10:00 | 14.7 | 14.7 | 100 | 29 | 6 | 24.1 | 99.63 | Mainly Clear |
| 11:00 | 19.4 | 15.2 | 77 | 26 | 4 | 24.1 | 99.56 | Mainly Clear |
| 12:00 | 21.2 | 15.4 | 69 | 33 | 15 | 24.1 | 99.52 | Mainly Clear |
| 13:00 | 23.1 | 14.5 | 58 | 31 | 11 | 24.1 | 99.47 | Mainly Clear |
| 14:00 | 23.9 | 14.1 | 54 | 25 | 7 | 24.1 | 99.39 | Mainly Clear |
| 15:00 | 25.3 | 13.6 | 48 | 26 | 13 | 24.1 | 99.37 | Mainly Clear |
| 16:00 | 23.3 | 16.6 | 66 | 14 | 11 | 24.1 | 99.39 | Mainly Clear |
| 17:00 | 22.6 | 15.5 | 64 | 22 | 22 | 24.1 | 99.43 | Mainly Clear |
| 18:00 | 19.9 | 14.8 | 72 | 23 | 19 | 24.1 | 99.46 | Mainly Clear |
| 19:00 | 18 | 15.1 | 83 | 21 | 17 | 24.1 | 99.47 | Mainly Clear |
| 20:00 | 17.3 | 14.8 | 85 | 24 | 9 | 24.1 | 99.53 | Mostly Cloudy |
| 21:00 | 17.5 | 15.3 | 87 | 24 | 9 | 24.1 | 99.57 | Cloudy |
| 22:00 | 17.9 | 15.3 | 85 | 24 | 11 | 24.1 | 99.57 | Cloudy |
| 23:00 | 18.2 | 15.2 | 83 | 23 | 13 | 24.1 | 99.57 | Cloudy |

Hourly Data Report for September 4, 2011

| Time | Temp °C | Dew Point Temp °C | Rel Hum % | Wind Dir 10s deg | Wind Spd km/h | Visibility km | Stn Press kPa | Weather |
|---|---|---|---|---|---|---|---|---|
| 0:00 | 18.1 | 14.6 | 80 | 26 | 13 | 24.1 | 99.54 | Cloudy |
| 1:00 | 17.8 | 14.7 | 82 | 27 | 9 | 24.1 | 99.53 | Cloudy |
| 2:00 | 17.1 | 15 | 87 | 27 | 11 | 24.1 | 99.57 | Cloudy |
| 3:00 | 17.3 | 15.1 | 87 | 27 | 9 | 24.1 | 99.59 | Cloudy |
| 4:00 | 17.2 | 15.3 | 89 | 26 | 9 | 24.1 | 99.63 | Cloudy |
| 5:00 | 17 | 15.4 | 90 | 24 | 7 | 24.1 | 99.66 | Cloudy |
| 6:00 | 17 | 15.5 | 91 | 23 | 7 | 24.1 | 99.72 | Cloudy |
| 7:00 | 17.1 | 15.8 | 92 | 22 | 7 | 16.1 | 99.75 | Cloudy |
| 8:00 | 17.7 | 16.2 | 91 | 23 | 6 | 16.1 | 99.79 | Cloudy |
| 9:00 | 18.3 | 16.6 | 90 | 25 | 6 | 24.1 | 99.82 | Cloudy |
| 10:00 | 20 | 17.4 | 85 | 23 | 6 | 24.1 | 99.84 | Cloudy |
| 11:00 | 22.3 | 18.3 | 78 | 21 | 7 | 24.1 | 99.82 | Mostly Cloudy |
| 12:00 | 23 | 18.7 | 77 | 21 | 11 | 24.1 | 99.8 | Mostly Cloudy |
| 13:00 | 23.3 | 18.6 | 75 | 21 | 19 | 24.1 | 99.74 | Mostly Cloudy |
| 14:00 | 24.2 | 18.9 | 72 | 20 | 19 | 24.1 | 99.72 | Mostly Cloudy |
| 15:00 | 24.5 | 19.2 | 72 | 21 | 22 | 24.1 | 99.69 | Mainly Clear |
| 16:00 | 24.3 | 18.3 | 69 | 19 | 24 | 24.1 | 99.67 | Mainly Clear |
| 17:00 | 22.9 | 17.5 | 72 | 19 | 17 | 24.1 | 99.69 | Clear |
| 18:00 | 20.5 | 16.9 | 80 | 17 | 19 | 24.1 | 99.69 | Clear |
| 19:00 | 18.5 | 16.6 | 89 | 18 | 17 | 24.1 | 99.7 | Mostly Cloudy |
| 20:00 | 17.6 | 16.2 | 92 | 18 | 15 | 24.1 | 99.75 | Mostly Cloudy |
| 21:00 | 17.8 | 16.1 | 90 | 18 | 19 | 24.1 | 99.74 | Cloudy |
| 22:00 | 18 | 15.3 | 84 | 18 | 19 | 24.1 | 99.7 | Cloudy |
| 23:00 | 17 | 15.2 | 89 | 17 | 20 | 24.1 | 99.62 | Clear |

## 6.3 Example for four rallies of the flow of data analysis and entry into the spread sheet

# Serve

| Score | Position | Start Location | End Location | Type | Result (Serve) |
|---|---|---|---|---|---|
| *0-0* | *Universal* | *9* | *9* | *SF* | *Poor* |
| *0-1* | *Defender* | *9* | *Net* | *JF* | *Error* |
| *1-1* | *Universal* | *9* | *8* | *SF* | *Good* |
| *2-1* | *Blocker* | *9* | *6* | *SF* | *Good* |

# Reception

| Score | Position | Contact Position | Side | Result (Pass) | |
|---|---|---|---|---|---|
| *0-0* | *Blocker* | *Midline* | *Midline* | *Good* | |
| *0-1* | ***Rally ended with missed serve*** | | | | |
| *1-1* | *Blocker* | *Outside* | *Right* | *Good* | |
| *2-1* | *Blocker* | *Outside* | *Left* | *Poor* | |

# Set

| Score | Position | Set Technique | Result (Set) | | |
|---|---|---|---|---|---|
| *0-0* | *Defender* | *Forearm* | *Good* | | |
| *0-1* | ***Rally ended with missed serve*** | | | | |
| *1-1* | *Blocker* | *Forearm* | *Good* | | |
| *2-1* | *Universal* | *Forearm* | *Good* | | |

## Attack

| Score | Position | 2nd ball attack | Technique (Attack) | Result (Attack) | |
|---|---|---|---|---|---|
| *0-0* | *Blocker* | *No* | *Spike* | *+* | |
| *0-1* | ***Rally ended with missed serve*** | | | | |
| *1-1* | *Defender* | *No* | *Shot* | *+* | |
| *2-1* | *Universal* | *No* | *Shot* | | |

## Block

| Score | Position | Technique (Block) | Contact/Result (Block) | | |
|---|---|---|---|---|---|
| *0-0* | *Universal* | *Line* | *No* | | |
| *0-1* | ***Rally ended with missed serve*** | | | | |
| *1-1* | *Universal* | *Line* | *No* | | |
| *2-1* | *Blocker* | *Peel Line* | *No* | | |

## Defense

| Score | Position | Technique (Defense) | Result (Defense) | | |
|---|---|---|---|---|---|
| *0-0* | ***Rally ended with kill*** | | | | |
| *0-1* | ***Rally ended with missed serve*** | | | | |
| *1-1* | ***Rally ended with kill*** | | | | |
| *2-1* | *Defender* | *Moving* | *Poor* | | |

## Set

| Score | Position | Technique (Set) | Result (Set) | | |
|---|---|---|---|---|---|
| *0-0* | ***Rally ended with kill*** | | | | |
| *0-1* | ***Rally ended with missed serve*** | | | | |
| *1-1* | ***Rally ended with kill*** | | | | |
| *2-1* | *Universal* | *Forearm* | *Poor* | | |

## Attack

| Score | Position | 2nd ball attack | Technique (Attack) | Result (Attack) | |
|---|---|---|---|---|---|
| *0-0* | ***Rally ended with kill*** | | | | |
| *0-1* | ***Rally ended with missed serve*** | | | | |
| *1-1* | ***Rally ended with kill*** | | | | |
| *2-1* | *Universal* | *No* | *Shot* | *Error* | |

## Block

| Score | Position | Technique (Block) | Contact/Result (Block) | | |
|---|---|---|---|---|---|
| *0-0* | ***Rally ended with kill*** | | | | |
| *0-1* | ***Rally ended with missed serve*** | | | | |
| *1-1* | ***Rally ended with kill*** | | | | |
| *2-1* | *Blocker* | *Cross* | *Slam* | | |