

Volleyball Development Matrix

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A Special Thank You To Our Contributors

MAIN WRITERS

James Sneddon, Kyle Paquette, Jason Boivin, Michael Cook

SUPPORTING CONTRIBUTORS

Dawna Sales, Ian Halliday, Kerry MacDonald, Ed Drakich, Ryan MacDonald, Julien Boucher, Nicole Ban, Louis-Pierre Mainville, Josh Nichol, Ashlen Leonard, Richard Sylvester, Melissa Healy, Alain G. Marion, Emily Riley, Paul Gamble.

TRANSLATION

Keylingo

LAYOUT/DESIGN

paul@pauledwardsdesign.com

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Volleyball in Canada One Sport Three Disciplines





PHOTOS: FIVB/WorldParaVolley

About this Resource



Volleyball Canada's Development MATRIX is a document to help guide coaches and steer the National Coaching Certification Program (NCCP) content. It lays out specific benchmarks at each stage of athlete development for coaches to consider and apply to their programs. It builds upon the FRAMEWORK document:

A Roadmap for Volleyball in Canada - Long Term Development 3.0

This resource, the DEVELOPMENT MATRIX, provides the next layer of information for coaches. The MATRIX answers the following questions:

- What do I teach?
- When do I teach it?
- What does success look like?

The MATRIX is a part of the coach's toolbox to plan a practice. Below is a flow chart of resources and tools that guide our work with the players. Volleyball Canada and the Provincial/Territorial Associations have provided guidelines for the first three steps (Framework, Matrix, Periodized Plans). The coach can then reflect on these recommendations to determine how they could be applied to their practice plans.



The Matrix provides guidelines on WHAT to deliver and WHEN to best to meet the needs of developing players.

Training on HOW to apply the various items listed in the Matrix is delivered through the National Coaching

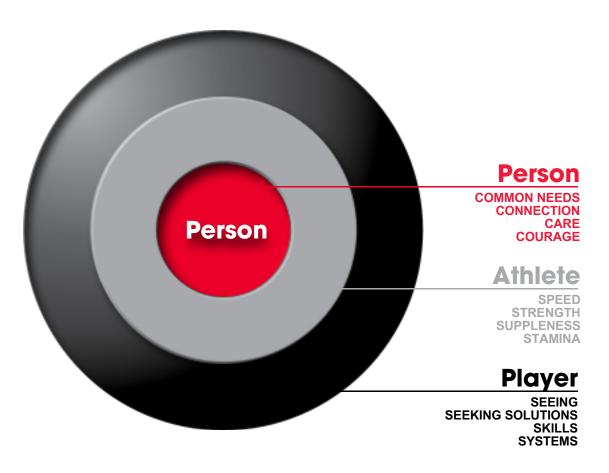
Certification Program (NCCP) and other coach education resources and opportunities.



Person Centred

A person-centred approach to the Volleyball Development Matrix recognizes that basic human needs are the essential building blocks of development. Coaches can often overlook these foundational objectives and assume they are taken care of elsewhere — or feel that the role of the coach is limited to developing skills and systems. This mindset can be detrimental to the person, the athlete, and the player. Volleyball Canada invites coaches to prioritize the COMMON NEEDS of the individual, their ability to CONNECT, to CARE, and to have COURAGE throughout the volleyball season and in their daily lives.



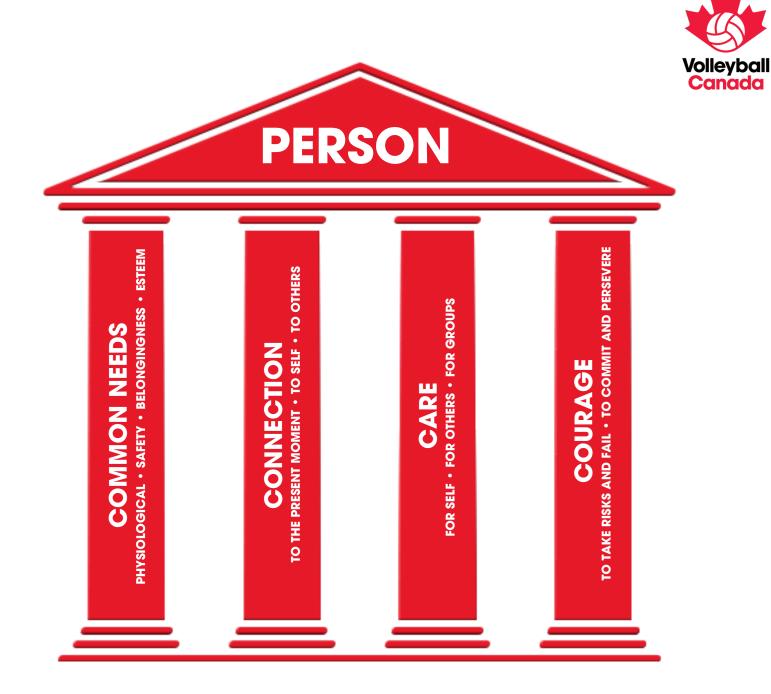


The PERSON Pillar

The PERSON pillar has 4 main dimensions.

Each dimension is divided into 2-4 elements.

The list of dimensions and elements are not meant to be exhaustive, but rather a prioritized list that captures the essential building blocks for participant wellbeing and fulfillment.



The information found within the PERSON pillar can be applied across all LTD stages.

ELEMENTS	DESIRED STATE	SKILLS OR ACTIONS NEEDED
COMMON NEEDS		
PHYSIOLOGICAL	Athletes have access to clean water, clean air, as well as adequate nutrition, hydration, and sleep.	Coaches advocate for these basic needs; they report potentially harmful situations to
SAFETY	Athletes have access to appropriate housing, physical/emotional/psychological safety, and health care.	competent authorities.
BELONGINGNESS	Athletes have meaningful and positive relationships with family members and friends.	Coaches provide for these needs within the
ESTEEM	Athletes demonstrate appropriate levels of prestige and feelings of accomplishment.	coaching context
CONNECTION		
TO THE PRESENT MOMENT	Athletes demonstrate mindfulness and the ability to focus on the task at hand and recognize when they are distracted from the present moment.	Mindfulness, Compartmentalization, Prioritization
TO SELF	Athletes demonstrate appropriate self-awareness, understanding of identity, and the ability to align their actions and decisions with their morals, values, and beliefs.	Self-awareness, Reflection, Self-assessment/monitoring
TO OTHERS	Athletes demonstrate interpersonal effectiveness to develop relationships in support of mutual fulfillment and performance objectives. The team is clear on its values. The individual athletes willingly adhere to the team values and derive a benefit in doing so.	Empathy, Communication, Vulnerability/ openness
CARE		
FOR SELF	Athletes demonstrate self-compassion and apply self-regulatory skills to manage varied conditions and stages of development in life and sport.	Self-compassion, Reflection, Planning
FOR OTHERS	Athletes demonstrate care and concern for others in support of the other person's well-being and pursuit of their performance objectives.	Leadership, Empathy, Acceptance/Forgiveness
FOR GROUPS	Athletes demonstrate a sense of care and respect for broader groups (i.e., team, club, province, country, and outside groups) and support these groups and/or advocate on their behalf.	Cultural awareness, Respect, Advocacy
COURAGE		
TO TAKE RISKS AND FAIL	Athletes demonstrate a willingness to fully engage in learning experiences that may involve uncertainty, perceived risks, and failure.	Managing arousal, emotions, and stress, Reframing
TO COMMIT AND PERSEVERE	Athletes demonstrate resilience and optimism in support of maintaining full engagement in situations of adversity and ease.	Ambition, Commitment, Optimism

The table below guides coaches in supporting the PERSON. The information is designed to help the coach identify where an athlete is relative to the 'desired state', and provides suggestions for reflection and reinforcement. Volleyball Canada has developed a Person Pillar Workbook - for Players. Coaches can incorporate the activities from the workbook into their season by assigning the activities throughout the year. Additional resources are under development to support coaches and athletes with activities and strategies to develop these important skills.

ELEMENTS	DESIRED STATE	INDICATORS OF DESIRED STATE	INDICATORS OF UNDESIRED STATE	REFLECTION QUESTIONS FOR COACHES	REINFORCING COMMENTS FOR COACHES	
PHYSIOLOGICAL	Athletes have access to clean water, clean air, nutrition, hydration, and sleep.	Athlete appears to be healthy and well-rested. Athlete often shows up to practice with high-quality snacks and a water bottle.	Athlete seems undernourished and regularly behaves in a lethargic manner. Athlete rarely brings any snacks or a water bottle to practice. Note: Be aware of communities that have boil water advisories.	No reflection questions are needed here. Rather, the coach takes steps to	No reinforcing comments are needed here. Rather, the coach takes steps	
SAFETY	Athletes have access to appropriate housing, physical/emotional/ psychological safety, and health care.	Athlete appears to have access to appropriate housing, physical/emotional/psychological safety, and shows no signs of psychological or physical abuse.	You become aware that an athlete does not have access to appropriate housing, physical/ emotional/psychological safety. Athlete expresses not wanting to go home after practice because of safety issues. Athlete presents signs of physical abuse (ie. bruises, injuries)	provide for the person's needs, or seeks professional help.	to provide for the person's needs, or seeks professional help.	
BELONGINGNESS	Athletes have meaningful and positive relationships with family members and friends.	Athlete's family, if available, shows a supportive interest in their sport participation (ex.: Rides to and from practice, attendance at games) Athlete appears to have kind and supportive friends on the team and/or outside of the team.	Athlete seems uncomfortable when parents are watching a game. Athlete doesn't seem to have many friends on the team and/ or outside of the team. Athlete's friends seem unsupportive and unkind.	I've noticed that [insert indicator]. Are you noticing something similar? Note: Just because	I've noticed that [insert indicator]. This is great! Keep it up. I noticed you've	
ESTEEM	Athletes demonstrate appropriate levels of prestige and feelings of accomplishment.	Athlete seems comfortable maintaining eye contact and communicating with others (asking questions, talking to teammates, expressing needs). Note: Certain athletes who are neurodiverse may struggle to maintain eye contact and communicate. Athlete seems to believe they can achieve their goals. Athlete appears comfortable with other athletes' success.	Excessively low levels: Athlete struggles with eye contact and communication (asking questions, talking to teammates, expressing needs). Note: Certain athletes who are neurodiverse may struggle to maintain eye contact and communicate. Athlete doesn't seem to believe they can achieve their goals. Excessively high levels: Athlete is always speaking, appears to over-prioritize their importance, appears to lack full effort in the practice environment.	you see something doesn't make it true or real. What are some of the reasons why this might be happening? What can we do to improve in this area?	been making efforts to [insert indicator]. Great work today! I've seen you [insert indicator] and it is having a great impact on your/the team's success/ improvement. Way to go!	

ELEMENTS	DESIRED STATE	INDICATORS OF DESIRED STATE	INDICATORS OF UNDESIRED STATE	REFLECTION QUESTIONS FOR COACHES	REINFORCING COMMENTS FOR COACHES
CONNECTION					
TO THE PRESENT MOMENT	Athletes demonstrate mindfulness and the ability to focus on the task at hand and recognize when they are distracted from the present moment. Skills needed: Mindfulness, compartment-alization, prioritization	Athlete appears to consistently maintain their attention on court/in the game between every point. Note: Some athletes who are neurodiverse* may struggle with this aspect. Athlete appears to refocus and reset after a missed play. The team appears to be focused on their preparation for practice.	Athlete's attention appears to drift away from the court/game between points (ex: looking to friends, family, coaching staff between points). <i>Note: Some athletes who are neurodiverse may struggle with this aspect.</i> Athlete seems focused on a missed play while the next point starts. The team is talking about their evening plans as they warmup for practice.		
TO SELF	Athletes demonstrate appropriate self-awareness, understanding of identity**, and the ability to align their actions and decisions with their morals, values, and beliefs. Skills: Self- awareness, reflection, self- assessment	Athlete's identity appears to extend beyond being an athlete. For example, they have healthy interests in other relationships, pursuits, etc. Athlete appears to be primarily internally driven by motivators such as enjoyment, pursuit of mastery, connection to others. When athlete's fail, they have the ability to reflect on their role in the failure and to take on an appropriate amount of responsibility to adapt. Athlete is not easily swayed by others. Athlete appears to be aware of their thought patterns	Being an athlete seems to be this athlete's only identity. For example, they have dropped all other pursuits or relationships. Athlete seems to be primarily externally driven by motivators such as fame, money, recognition, parental pressure, or self-worth derived from accomplishments/success. When these athlete's fail, they may find excuses or place blame externally to try to protect their self-worth. Athlete seems to be easily influenced by others. Athlete doesn't seem to be aware of their thought patterns.	l've noticed that [insert indicator]. Are you noticing something similar? Note: Just because you see something doesn't make it true or real. What are some of the reasons why this might be happening? What can we do to improve in this area?	I've noticed that [insert indicator]. This is great! Keep it up. I noticed you've been making efforts to [insert indicator]. Great work today! I've seen you [insert indicator] and it is having a great impact on your/the team's success/ improvement. Way to go!
TO OTHERS	Athletes demonstrate interpersonal effectiveness to develop relationships in support of mutual fulfillment and performance objectives. Skills: Empathy, communication, vulnerability/ openness	The team is united in their goals. The team is communicating between points. Friendship groups within teams make efforts to include other players in their social environments. Athlete actively listens when their teammates speak. Athlete can assertively and effectively share their thoughts with others. Athlete often welcomes and accepts feedback.	The team acts more as a group of individuals. Athletes seem focused only on themselves. A group of athletes deliberately excludes other athletes in off-court environments. Athlete often interrupts and does not seem to consider others' perspectives. Athlete struggles to share their thoughts in a way that is conducive to building relationships. Athlete often seems to get defensive when given feedback.		

ELEMENTS	DESIRED STATE	INDICATORS OF DESIRED STATE	INDICATORS OF UNDESIRED STATE	REFLECTION QUESTIONS FOR COACHES	REINFORCING COMMENTS FOR COACHES
CARE					
FOR SELF	Athletes demonstrate self- compassion and apply self- regulatory skills to manage varied conditions and stages of development in life and sport. Skills: Self- compassion, reflection, planning	Athlete usually maintains positive body language and outlook even when things are not going well. Athlete bounces back after making a few mistakes. Athlete seems to consistently show up to practice with enthusiasm, motivation, and energy. While some players go sight-seeing inbetween two games, this athlete decides to take a nap. After a tournament, an athlete seems to priorize recovery and appears to be acting like their usual self.	When things are not going well, the athlete seems to evisibly get down on themselves. Athlete's performance seems to derail after making a few mistakes. Athlete appears to lack enthusiasm, energy, and/or motivation during a practice. Despite needing time to recharge in between two games, this athlete decides to go sight-seeing with some teammates. After a tournament, an athlete seems more irritated, emotional, or stressed than usual.		
FOR OTHERS	Athletes demonstrate care and concern for others in support of the other person's well- being and pursuit of performance objectives. Skills: Leadership, Empathy, Acceptance/ Forgiveness	Athlete attentively listens to their discouraged teammate and validates what they are feeling. Athlete gives their frustrated teammate a pat on the back or shows other types of encouragement. A veteran player on the team takes the time check on how a new player is doing. Athlete appears to take ownership after saying something offensive and apologizes to the person in question. Athlete demonstrates the ability to forgive a teammate for an offense.	Athlete appears to be checking their phone while their teammate expresses something they're struggling with. Athlete tells their frustrated teammate to step it up after making a mistake. Veteran players take little interest in the newer players on the team. Athlete does not seem to take ownership for offensive behaviour or genuinely apologize to the person affected. Athlete appears to hold a grudge over being hurt by a teammate.	l've noticed that [insert indicator]. Are you noticing something similar? Note: Just because you see something doesn't make it true or real. What are some of the reasons why this might be happening?	l've noticed that [insert indicator]. This is great! Keep it up. I noticed you've been making efforts to [insert indicator]. Great work today! I've seen you [insert indicator] and it is having a great impact on your/the team's success/
FOR GROUPS	Athletes demonstrate a sense of care and respect for broader groups (i.e., team, club, province, country, and outside groups) and support these groups and/or advocate on their behalf. Skills: Cultural awareness, Respect, Advocacy	Athlete asks questions about another player's traditional clothing to learn more about their culture. Athlete makes jokes that are not at the expense of others. An athlete addresses a teammate for making a homophobic comment and helps them to understand its inappropriate nature. The members of the men's team attend a rally for the women's team to get equal funding. Athlete treats all their teammates and opponents the same, regardless of their differences. Athlete appears to demonstrate a respect for their teammate's story about their religious holiday. The team puts together a drive for local food bank.	Athlete appears to bully another athlete for showing up to a competition in their culture's traditional clothing. Athlete makes a racist joke in the locker room. After an athlete makes a homophobic comment, no one in the locker room addresses it. The men's team is aware that the women's program receives less funding and does nothing. An athlete seems to choose not to set the ball to the one member of the team who speaks a different language. An athlete appears uninterested in their teammate's story about their religious holiday. The team is unaware of or indifferent towards underprivileged groups in their community.	What can we do to improve in this area?	improvement. Way to go!

ELEMENTS	DESIRED STATE	ED STATE INDICATORS OF DESIRED STATE INDICATORS OF UNDES		REFLECTION QUESTIONS FOR COACHES	REINFORCING COMMENTS FOR COACHES
COURAGE					
TO TAKE RISKS AND FAIL	Athletes demonstrate a willingness to fully engage in learning experiences that may involve uncertainty, perceived risks, and failure. Skills: Managing arousal, emotions and stress, reframing	Near the end of a close game, this athlete seems relaxed and maintains their level of play. Athlete seems to welcome the opportunity to serve with the game on the line. During a team discussion, athlete often expresses their point of view. Athlete tries out for a team even though they are unsure if they will make it. Athlete calls out a teammate who makes a racist comment. Athlete chooses to embrace the discomfort of trying a new position.	Near the end of a close game, this athlete seems nervous and their level of play often deteriorates. When the game is on the line, this athlete seems reluctant to serve, or executes an overly conservative serve. During a team discussion, athlete rarely expresses their point of view. Athlete doesn't want to try out for a team because they don't seem to think they can make it, despite having sufficient skills. Athlete chooses not to call out a teammate who makes a racist comment for fear of reprisals. Athlete either refuses to try playing a new position or doesn't make a full effort during the transition.	I've noticed that [insert indicator]. Are you noticing something similar? Note: Just because you see something doesn't make it true or real.	l've noticed that [insert indicator]. This is great! Keep it up. I noticed you've been making efforts to [insert indicator]. Great work today!
TO COMMIT AND PERSEVERE	Athletes demonstrate resilience and optimism in support of maintaining full engagement in situations of adversity and ease. Skills: Ambition/ motivation, optimism, commitment	Athlete sets goals to improve for next year after not making their provincial team. Athlete shows up early to practice a certain element they struggled with in their last competition. After losing the first two sets, the team demonstrates positive body language and full engagement starting the third set. Athlete is often able to find the positives in a game, regardless of the situation. Athlete is often able to focus on the process more than the outcome of the match.	After not making their provincial team, this athlete decides they won't try again, despite having the skills to make the team. After struggling in competition, this athlete misses the next practice. At the start of the third set, after losing the first two sets, the team seems to have stopped trying. Athlete typically focuses on the things that are going wrong in a game. Athlete is heavily focused on and affected by the outcome of a match.	What are some of the reasons why this might be happening? What can we do to improve in this area?	I've seen you [insert indicator] and it is having a great impact on your/the team's success/ improvement. Way to go!

The ATHLETE Pillar

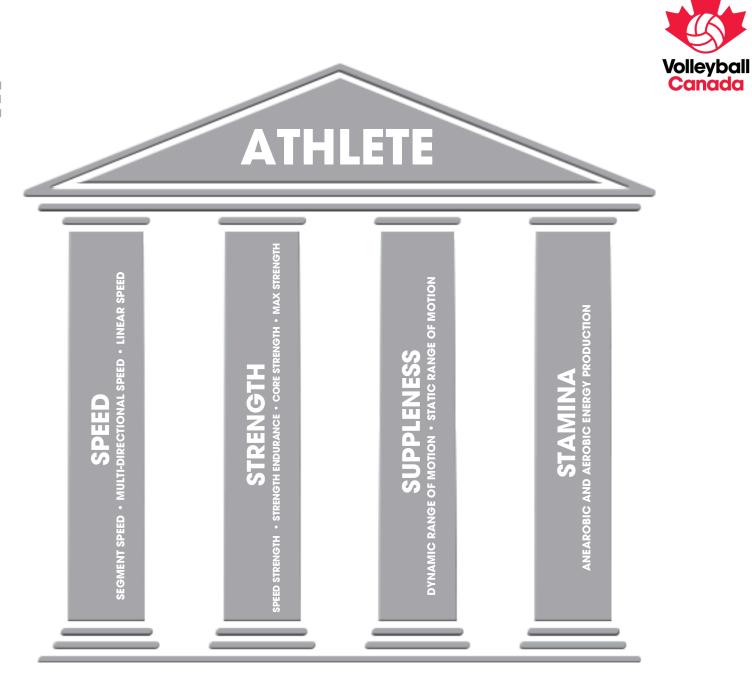
The ATHLETE pillar has 4 main dimensions.

Each dimension has 2-4 specific training objectives.

The dimensions are generally prioritized in order, beginning with speed and strength as the top priorities.

Three additional S's are not listed here as training objectives but are equally important. They are:
Sustenance, Sleep and Structural Tolerance.

Sustenance and Sleep are key elements of the recovery process; they also support growth. Improved Structural Tolerance is a musculoskeletal adaptation resulting from a gradual increase in training loads over time. Adequate training loads, progressions, recovery, and variety are key to a sound athletic development, and help to prevent excessive fatigue, overtraining, and burnout.



Exercises are integrated within games and play, such as tag games. Should be primarily developed through fun-focused activities towards the end of warmup. This is an excellent time to focus on the motor skills and technique of sprinting and changing of direction.

Strength

Boys: Relatively minimal emphasis on strength in this stage. Fun-based movement activities, which can include bodyweight exercises, are developed through sports, games, gymnastic style programs and other unstructured play. Participation in multiple sports is critical.

Girls: Early exposure to strength training as girls approach puberty (around age 10) is beneficial to counter the changes accompanying adolescent growth spurt for girls (average age at peak height velocity is 11.2 years for young female athletes). Introduction of strength training exercise techniques, including 1-2 weekly standalone off-court training sessions and on-court body weight exercises with instruction. Neuromuscular training, including balance exercises, core stability, coordination training and movement skills training on court with instruction during practices and integrated into dynamic warm-up.

Suppleness

This stage is a window of opportunity for developing flexibility. It is a priority to establish foundational habits of warm-up and cool down in this stage. Use dynamic stretching exercises as part of the warm-up and static stretching exercises during the cool down. Activities should be designed in a fun and gamified manner.

Some ideas to apply suppleness to practices include:

- Use music, such as the length of a certain section of a song to hold stretches. A player picks the song and the stretch then stretch together as a team.
- Combine a stretch with a hard challenge, so the stretch becomes a rest.
- Combine stretch time with practice wrap-up.
- Simon Says format

Stamina

Integrated into daily training. Maximum volleyball training three times per week plus participation in other sports or activities three times a week.

Speed can be trained year-round and in every LTD stage. For the Train to Train stage, speed is best trained within the practice setting, for 5-10 minutes every practice, after warm-up. Athletes must exert maximum effort for no more than 5 seconds, and have a full recovery before starting the next action/movement. Multi-directional and Segment speed can be developed through games that incorporate agility, balance, coordination. Remember to reduce total/overall volume for athletes in the midst of their growth spurts.

Strength

An important phase for monitoring growth and building a foundation of strength. The onset of the adolescent growth spurt and the time of Peak Height Velocity (PHV) are key markers. Growth should be individually tracked via regular measurement of seated and standing heights to gauge biological age and relative stage of players within the group to identify early, normal and late developers. The number of on-court jumps should be reduced to avoid excessive stress during periods of rapid growth. Dynamic balance, coordination and athletic movement skills for jumping, landing and multi-directional activities should be emphasized with instruction and feedback to adapt to changes in body size, strength and limb lengths and recalibrate following rapid growth.

Athletes must first be taught how to safely execute the recommended lifts using light weights, and the focus should remain on proper form, especially during periods of growth. Towards the end of the growth spurt, a greater emphasis can be placed on intensity and volume for strength gains.

Early stage (approx. 12-14 years old – up to and including age at PHV): One 30-minute formal weightroom session per week, learning the proper techniques and procedures of basic lifts, and two on-court sessions (before the cool down, 10-15 minutes of basic resistance training exercises using the athlete's own body weight).

Mid-late stage (approx. 15-16 years old – circa two years following PHV): 1-2 strength training sessions per week (45 min) outside of practice, supplemented with body weight exercises on-court.

Suppleness

Participants should have pain free mobility through the joint. Athletes can independently lead warm-up and cool down activities. Warm-up can include mini-games like 1 v 1, 2 v 2 to encourage the development of 'reading' and gaining additional contacts. Later in this stage (13-16) the addition of a pre-practice mobility routine, and dynamic stretch routine is established for warmup, as well as static stretching, foam roller and ball massage routines for cool down.

Stamina

Integrated into daily training. Stamina is developed though the weekly volleyball training activities, and any additional unstructured play.

Speed can be trained year-round and in every LTD stage. For the Train to Train stage, speed is best trained within the practice setting, for 5-10 minutes every practice, after warm-up. Athletes must exert maximum effort for no more than 5 seconds, and have a full recovery before starting the next action/movement. Multi-directional and Segment speed can be developed through games that incorporate agility, balance, coordination. Remember to reduce total/overall volume for athletes in the midst of their growth spurts.

Strength

Important phase for providing girls with a necessary boost in strength and capability. This is the phase when female players often struggle – at the time when they are most self-conscious and aware of social judgement, which explains why so many girls drop out. Off-court training is the best way to provide the required boost to give them the confidence to continue.

Continued emphasis on strength training for those who started training in the prior phase – two standalone off-court strength sessions per week comprising whole-body workouts with supervision. Progression of neuromuscular training (dynamic stability, coordination training) during on-court practices, including movement skills practice to reinforce safe and effective movement patterns with instruction and feedback. Activities to challenge dynamic control and stabilisation integrated into dynamic warm-up. On-court specific preventive strength exercise prior to practice, including shoulder strength and mobility exercises with elastic resistance.

For girls without prior strength training exposure, a combination of strength training off-court and neuromuscular training (balance, core stability, coordination, movement skills training) on court will be necessary to address the deficits and reverse any adverse changes that have started to develop following the onset of puberty. Greater care and caution will be required with intensity and volumes of practices until these issues are resolved through training intervention.

Suppleness

Participants should have pain free mobility through the joint. Athletes can independently lead warm-up and cool down activities. Warm-up can include mini-games like 1 v 1, 2 v 2 to encourage the development of 'reading' and gaining additional contacts. Later in this stage (13-16) the addition of a pre-practice mobility routine, and dynamic stretch routine is established for warmup, as well as static stretching, foam roller and ball massage routines for cool down.

Stamina

Integrated into daily training. Stamina is developed though the weekly volleyball training activities, and any additional unstructured play.

Speed can be trained year-round and in every LTD stage. For the Learn to Compete stage, speed can be trained within the practice setting, for 5 minutes every practice, after warm-up, as a minimum. In addition, athletes can complete two 30-minute sessions per week as part of their Strength and Conditioning regimen. For on-court speed training, athletes must exert maximum effort for no more than 5 seconds, and have a full recovery before starting the next action/movement. Multi-directional and Segment speed can be achieved through the simulation of game-like actions.

Strength

Strength and recovery programs are individually tailored to a greater degree. As athletes complete their growth spurt, greater emphasis is placed on weightlifting for strength gains. A certified Strength and Conditioning Coach provides tailored plans that include all 4 strength training objectives for the athletes. Strength exercises are completed outside of practice 2-4 times/week. Exercises such as Front Squat, Trap Bar Deadlift, Pull-ups, and Pushups are technically mastered and progressively loaded as the athlete develops. As athletes master the technique, maximal strength can be estimated safely for each of these key exercises from tests performed with sub-maximal loads. At this stage the athlete could also begin to incorporate loaded jumping and Olympic weightlifting techniques.

Suppleness

Participants should have pain free mobility through the joint. Warm-up and cool down activities are independently lead by the athletes. Warm-up can include mini-games like 1 v 1, 2 v 2 to encourage the development of 'reading' and gaining additional contacts. It is recommended to include a pre-practice mobility routine and dynamic stretch routine prior to a ball warm up. As part of the cool-down, athletes lead static or PNF stretching, as well as foam roller and ball massage routines. Athletes begin to selfassess muscle tightness and use ball massage or other devices outside of practice or book massage or physio appointments.

Stamina

Stamina is developed though the weekly volleyball training activities. Athletes include more systematic aerobic training during their off season programs as a way to enhance recovery and improve endurance.

Speed can be trained year-round and in every LTD stage. For the Learn to Compete stage, speed can be trained within the practice setting, for 5 minutes every practice, after warm-up, as a minimum. In addition, athletes can complete two 30-minute sessions per week as part of their Strength and Conditioning regimen. For on-court speed training, athletes must exert maximum effort for no more than 5 seconds, and have a full recovery before starting the next action/movement. Multi-directional and Segment speed can be achieved through the simulation of game-like actions.

Strength

For girls who have been engaged in strength training during the learn to train and train to train phases: 2-4 standalone sessions per week @ 30-60 min. Training should progress with more advanced exercises and greater focus on intensity and volume oriented towards strength gains and power development during off-court sessions, alongside more advanced athletic movement skills training and plyometrics on court. To that end, exercise selection will include variations of Olympic lifts and ballistic resistance exercises, including loaded jumps and throws.

For girls with minimal prior exposure, 2x weekly whole-body strength training sessions, plus supplemental remedial workouts targeting weak links. There will be a need to increase strength capacities in general, but also to address common weak links, with a particular focus on developing hip strength and hamstring strength. In addition to squat and deadlift variations and pushing and pulling lifts in different planes, single-leg squat, lunge, and step up variations will feature, along with more isolated remedial exercises in different planes for the shoulder girdle, hip girdle and hamstrings. Remedial neuromuscular training (balance, core stability, coordination training) delivered on court with instruction and feedback will also be vital to address deficits in control and stability. In addition, there will be a need to retrain movement patterns to address the compensatory patterns that tend to develop as a consequence of deficits in strength and function. This should be done in concert with strength training, as these altered movement patterns will tend to persist until the player becomes strong enough to move in a more optimal way.

Lack of strength training history also makes it more likely that there will be pre-existing injury issues that need to be resolved. As such, it will be necessary to monitor these players and regulate practice volumes and intensities until these various issues are resolved, as they will be less resilient and more prone to injury, especially under fatigue conditions.

Suppleness

Participants should have pain free mobility through the joint. Warm-up and cool down activities are independently lead by the athletes. Warm-up can include mini-games like 1 v 1, 2 v 2 to encourage the development of 'reading' and gaining additional contacts. It is recommended to include a pre-practice mobility routine and dynamic stretch routine prior to a ball warm up. As part of the cool-down, athletes lead static or PNF stretching, as well as foam roller and ball massage routines. Athletes begin to self-assess muscle tightness and use ball massage or other devices outside of practice or book massage or physio appointments.

Stamina

Stamina is developed though the weekly volleyball training activities. Athletes include more systematic aerobic training during their off season programs as a way to enhance recovery and improve endurance.

Speed can be trained year-round and in every LTD stage. Speed can be trained within the practice setting, for 5 minutes every practice, after warm-up, as a minimum. In addition, athletes can complete two 30-minute sessions per week as part of their Strength and Conditioning regimen, based on identified on-court deficiencies. For on-court speed training, athletes must exert maximum effort for no more than 5 seconds, and have a full recovery before starting the next action/movement. Multi-directional and Segment speed can be achieved through the simulation of game-like actions. A combination of many of these training objectives can be achieved through the simulation of game-like actions. Some sample training methods are: Sprint Training, Skipping, Plyometrics, Ultra-short interval training.

Strength

Strength and recovery programs are individually tailored to a greater degree. At this stage, athletes should have completed several years of consistent physical training. A certified Strength and Conditioning Coach provides tailored plans that include all 4 strength training objectives for the athletes. Strength training occurs outside of practice 2-4 times/week. Exercises should now begin to align with on-court deficiencies while still continuing to develop all aspects of strength. Athletes should now have mastered lifting techniques and feel confident with all resistance training exercises. Using tests performed with submaximal loads, maximal strength should be estimated at least twice a year; training loads for specific exercises should then be adjusted accordingly. At this stage, where possible, load velocity and jump performance profiling could be conducted.

Suppleness

Participants should have pain free mobility through the joint. Warm-up and cool down activities are independently lead by the athletes. Warm-up can include mini-games like 1 v 1, 2 v 2 to encourage the development of 'reading' and gaining additional contacts. It is recommended to include a and dynamic stretch routine prior to a ball warm up. As part of the cool-down, athletes lead dynamic or PNF stretching activities, as well as foam roller and ball massage routines. Athletes regularly self-assess muscle tightness and use ball massage or other devices outside of practice or book massage or physio appointments.

Stamina

Stamina is developed though the weekly volleyball training activities. Athletes incorporate aerobic training as part of an individualized yearly training program as a way to enhance recovery and improve endurance.

Learn to Win

Train to Win

Athletes competitive at the highest level: Olympics, Paralympics, and World Championships

At these stages of development players should have acquired the foundations of each of the 4 Ss and be working directly with Strength and Conditioning staff and Therapy specialists to optimize their individual daily routines. Greater emphasis is placed on creating player independence in assessing and correcting physical weakness and mobility issues. An individualized remedial training program may be required in the case of athletes who have had limited experience with strength and conditioning training earlier in their career. Programs are lead by national team and professional IST staff with a highly individualized focus.

General

Volleyball coaches, referees, and administrators fall into this phase of LTD. Therefore, the leaders within the sport system ideally maintain a healthy lifestyle to be at their best within these roles, and be role models for younger individuals. Below are some key expectations or recommendations for this stage, taken from the resource manual <u>Active for Life: Durable by Design</u>.

30's

Effort begins to switch from growth to maintenance. Professional athletes often retire around this age, while amateurs may find that injuries, work, and family commitments increasingly take up their time. New parents frequently suffer a decline in physical activity (Rhodes et al., 2013). Therefore, it is critical for adults to prioritize their time to include rest, respite from child rearing, activity and competition outlets, and social connections.

40's and 50's

At this stage muscle strength and endurance begin to insidiously erode, while recovery from minor injuries takes longer and major injuries may permanently limit movement. Engaging in strength training 1-2 times/week can help maintain strength and body composition. This is also an important time to consider transitioning from high to low impact sports.

50's and 60's

When thoughts may turn towards retirement, physical activity can be a means of optimizing well-being and quality of life. For some, activity is a goal unto itself; if, for instance, the individual wants to compete in a sporting event such as a triathlon or marathon. For others, physical activity is a means to an end. For instance, maintaining regular physical activity during the week can help prevent injuries at the ice rink on the weekend. While for others, engaging in exercise classes or group events can be an important component in developing and maintaining social networks.

70's, 80's, 90's and beyond

Regular physical activity is vital in managing physical, cognitive, and emotional well-being. Studying the effects of sedentary behaviour on human physiology is like watching a movie in fast forward; the biologic age appears to advance faster than expected from the chronological age. This area of research over the past decade has led insights into the impact movement, or inactivity, has on humans. Longer and more frequent sitting time is associated with increased abdominal girth, cardiovascular disease, dementia, and all cause mortality. Regular activity on the other hand is associated with increased cardiovascular fitness, lower risk of heart disease, stroke, dementia, diabetes, and osteoporosis. Resistance training has been shown to increase brain activity and lift one's mood.

Sustenance

	Active Start (0-5)	FUNdamentals (~6-9)	Learn to Train (~9-12)	Train to Train (~13-16)	Learn/Train to Compete (~17-21)	Train to Win (21+)	Active for Life
Nutrition	Good and basic nutrition supplied by parents and care givers.	Adults guide in selecting children's own "activity" snacks. Assist with food preparation at home.	Prepare and pack own snacks to eat at sport activity Help plan meals Understand what is quality food and what are 'fun' foods.	Food intake linked to demands of training and recovery. Develop pre, during, and post-competition nutrition plan. Trial and adjust nutrition plan.	High quality food intake linked to demands of the context of training. Develop nutrition plan for extended periods on the road and hotel living Ensure adequate nutrition when competing outside North America. Pre, during and post-competition food intake well trialed and well tolerated Monitor bio-markers for deficiencies (for example, iron for female athletes).	Active monitoring of bio-markers to ensure high quality nutrition and prevent nutritional deficiencies. Plan meals for peak nutrition at major events and transport own food if necessary.	Ensure adequate food intake for health and sport performance.
Hydration	tions in conditions of high te Note: Some athletes with a	for participants. Water or dilut mperature and humidity. disability particularly those wit , and for them, water intake a	th high spinal cord injuries do	Develop hydration plan for training and competition. Learn to monitor hydration status through urine colour. Monitor temperature and humidity and adjust fluid intake accordingly.	Develop, trial and adjust hydration plan for competition – especially multi-day events. Adjust hydration based on measured temp/humidity, fluid loss and travel. Measure specific gravity of urine. Consider "electrolyte" drinks matched to sport demands.	Develop, trial, record and adjust hydration plan for competition – especially multi-day events. Adjust hydration based on measured temp/humidity, fluid loss and travel. Measure specific gravity of urine. Use specific sport drinks to meet metabolic de- mands where appropriate.	Ensure adequate hydration for health, safety and sport performance.
Suplements	Actively discourage supplen for a medical condition by pl		Emphasize high quality nutrition over food supple- ments (across all stages).	In collaboration with nutrition expert, determine if there is a need for supplements. If supplements for peak performance are necessary, use only World Anti-Doping Agency (WADA) compliant products.	Consider WADA compliant supplements based on nutritional needs of athletes – to prevent spe- cific deficiencies that have been identified.	Use WADA compliant supplements for peak nutrition.	At the participant's discretion, but should be based on the advise of recognized health professionals.

CONTINUED...

	Active Start (0-5)	FUNdamentals (~6-9)	Learn to Train (~9-12)	Train to Train (~13-16)	Learn/Train to Compete (~17-21)	Train to Win (21+)	Active for Life		
Menstrua- tion	Not applicable		Female athlete prepared for the onset of menstruation. Consider iron supplements if appropriate.	For female athletes, screen menstrual history and current status. Athlete monitors their menstruation and concerns are referred to appropriate medical support.	Female athlete monitor menstruation. If there are concerns with menstrual status (e.g. Oligomenorrhea and Amenorrhea refer athletes to appropriate medical support.				
Bone Health	Ensure adequate, high quality nutrition including calcium intake. In the event of hormonal disruption in females (cessation of menstrual cycle), medical assistance should be sought to ensure bone health.								
Body Composition & Disordered Eating	In the event of hormonal disruption in females (cessation of menstrual cycle), medical assistance should be sought to ensure bone health. Focus on healthy eating and matching energy intake with energy expenditure, not focussing on body composition. Treat body composition as an OUTCOME of quality nutrition and training, NOT a target. Understand the role of coaches as potential triggers of disordered eating (undue focus on athlete weight). Raise awareness and learn the signs of disordered eating among athletes and coaches. Develop strategies to identify disordered eating in self and teammates and strategies to seek help. Understand where help can be obtained (see resources below). IOC consensus statement: beyond the Female Athlete Triad – RED-S, http://goo.gl/Ame8FV; and IOC Nutrition for Athletes, http://goo.gl/v9PMgd.								

Sleep

Post-exercise recovery and regeneration (PERR) is as important as the training regimen to the complex adaptive process of increasing athletic performance. A critical component of PERR is sleep. Sleep constitutes the passive recovery, regeneration and rest process. The table below is taken from SLEEP, RECOVERY, AND HUMAN PERFORMANCE A Comprehensive Strategy for Long-Term Athlete Development by Charles H. Samuels, MD, CCFP, DABSM & Brent N. Alexander, M.Sc. To review the full document click HERE.

LTD Stage		Sleep	Recommendations		
Specific Sleep Recommendations	Duration (hrs/night)	Quality	Phase	Key Points	
Active Start (Females & Males 0-6 years)	13-16	Establish and maintain a sleep/nap routine Ensure a comfortable/safe sleep environment Avoid stimulation 1-2 hrs before bed; minimize "screen time"	Consolidate nighttime sleep period Decrease naps to 1-2/day in the first year Natural light exposure first thing in the morning	Establish stable sleep routines and a bedtime routine Use a sleep transition object Introduce independent sleep initiating behaviours	
Fundamentals (Females 6-8, Males 6-9)	10-11 + 30 min nap between 2-4pm	Maintain a regular sleep/nap routine Ensure a comfortable sleep environment Establish independent sleep initiating behaviours Monitor quality of sleep for sleep disorders	Establish a neutral sleep pattern between 9pm and 8am Encourage predictable afternoon nap/rest Establish reliable meal routines (breakfast is the most important meal of the day)	Reinforce 15-30 min bedtime routine Avoid stimulation 1-2 hours before bed, control "screen time" Good nutrition and meal routines reinforce sleep routines	
Learn to Train (Females 8-11, Males 9-12)	9.5-10 + 30 min nap between 2-4pm	Maintain a regular sleep/nap routine Ensure a comfortable sleep environment Monitor quality of sleep for sleep disorders	Maintain neutral sleep pattern Get early morning light exposure for 30 min daily Maintain reliable nutrition routines (breakfast is critical)	Maintain 15-30 min. bedtime routine Monitor and control "screen time" Monitor caffeine intake	
Train to Train (Females 11-15, Males 12-16)	9 + 30 min nap between 2-4pm	Ensure a comfortable sleep environment Initiate regular napping strategy Monitor for excessive sleepiness and fatigue Monitor quality of sleep for sleep disorders	Maintain regular sleep/nap routine Get early morning light exposure for 30 min. daily Monitor for a delayed sleep phase (difficulty falling asleep and waking up for school) Maintain reliable nutrition routines (breakfast is critical)	Reinforce the importance of sleep routine Monitor for cumulative sleep debt (<9 hours/night or <56 hours/week) Monitor caffeine intake Do not train on an unrested body	
Train to Compete (Females 15-21 +/-, Males 16-23 +/-)	8-10 + 30 min nap between 2-4pm	Ensure a comfortable sleep environment when travelling and competing Monitor for competition stress and anxiety, insomnia Monitor for excessive sleepiness and fatigue Monitor quality of sleep for sleep disorders	Maintain regular sleep/nap routine Monitor for a delayed sleep phase (difficulty falling asleep and waking up for school) Get early morning light exposure for 30 min daily Maintain reliable nutrition routines (breakfast is critical)	Focus on reducing sleep debt. Get 56-70 hours of sleep/week Do not train if unrested and sleep deprived Avoid technology (screen time) before bed If your sleep is poor seek help	
Train to Win (Females 18+, Males 19+)	8-10 + 30 min nap between 2-3pm	Ensure a comfortable sleep environment when travelling and competing Monitor for competition stress & anxiety, insomnia Monitor quality of sleep for sleep disorders	Maintain regular sleep/nap routine Monitor for a delayed sleep phase (difficulty falling asleep and waking up for school) Get early morning light exposure for 30 min daily Maintain reliable nutrition routines (breakfast is critical)	Focus on reducing sleep debt. Get 56-70 hours of sleep/week Do not train if unrested and sleep deprived Avoid technology (screen time) before bed If your sleep is poor seek help	
Active for Life (Any age participant)	7-9 + 30 min nap between 2-4pm	Maintain a regular sleep/nap routine keep your sleep debt to a minimum Ensure a comfortable sleep environment If quality of sleep is poor seek help.	Maintain a regular sleep schedule Get early morning light exposure for 30 min daily Maintain reliable nutrition routines (breakfast is the most important meal of the day)	Get your sleep! Maintain meal routines and always eat breakfast Learn to nap Do not train if you are fatigued or sleep deprived	

Structural Tolerance

Structural tolerance is the ability to withstand a training load without the incidence of injury or excessive fatigue. In order to develop structural tolerance athletes must experience a progressive and carefully planned increase in both the volume (amount/duration) and intensity of training over time. Coupled with inadequate recovery, sudden and dramatic increases in practice, competition, or physical training hours from week to week, month to month or season to season can result in injury, excessive fatigue, overtraining and burnout. The table below represents a model progression of total activity hours over a sample athletes' volleyball career. This model considers the changing ratio of practice to competition hours, as well as physical training hours but does not consider other sports. Note that some athletes may enter a volleyball program without the necessary training background and progressions; these athletes may need a different training load compared to their teammates and coaches should plan accordingly.

The table on the following page provides greater detail on how to build structural tolerance. On page 48, a comprehensive series of sample Periodized Plans is also included for coaches to consider.

LTD Recommendations	11-12U	13U	14U	15U	16U	17U	18U	21U
Weeks in a season	8-16	22-30 (26)	22-30 (28)	28-34 (32)	28-34 (32)	32-40 (37)	32-40 (40)	38-46 (45)
Volleyball Practice Hours	8-24	100	120	140	155	135	150	185
Volleyball Competition	Integrated	75	85	120	135	200	225	280
Physical Training Hours	50	75	115	115	125	155	180	180
Total Activity Hours	74	250	320	375	415	490	555	645

Structural Tolerance

	FUNdamentals (~6-9)	Learn to Train Early (~8-10)	Learn to Train Late (~10-12)	Train to Train Early (~12-14)	Train to Train Late (~14-16)	Learn to Compete (~17-19)	Train to Compete (~19-21)	
INJURY PREVENTION	Exposure to Fundamental Movement Skills	Learns appropriate vol- leyball warm-up and cool down including stretches	Athletes can lead a group through warm-up and cool down	Learn the use of foam roller and ball to increase mobility	Lead a routine with foam roller and ball and proper cool down	Learn functional move- ment tests and work with trainer to develop mobility and stability exercises	Can self-assess and ad- dress mobility and stability issues and uses strength training to prevent over- use injuries*	
SEASON LENGTH	8-12 weeks	12-18 weeks	16-24 weeks	22-30 weeks	28-34 weeks	32-40 weeks	30-48 weeks	
PRACTICES PER WEEK	112 @ 40 60 min 123		2-3 @ 60-70 min	A) 2-3 practices/week B) Indoor: 3-4 @ 90 min B) Beach: 3-4 @ 60 min	A) 2-3 practices/week B) Indoor 3-5 @ 90-120 m B) Beach: 3-5 @ 60-90 min	A) 2-3 practices/week B) Indoor: 4-7 @ 120 min B) Beach: 4-7 @ 90 min	A) 2-3 practices/week B) Indoor: 5-8 @ 120-150 B) Beach: 5-8 @ 90 min	
				of practices per week required to o	levelop skills and progress toward "p	the workload associated with differer ersonal excellence" is 3x/week. A ma atter. The quality of the practice envir	aximum range of training sessions	
MATCHES PER WEEK	1 @ 40-60 min (10 min games)	1 @ 60 min (10 min games)	1 @ 60 min	1 @ 60 min (best of 3 sets) OR 1 tournament/month	1.5 @ 60 min (best of 3 sets) OR 1 tournament every 3 weeks	1.5 @ 90 min (best of 5) Beach: 2 tournaments/month or 4-6 matches every other week.	1 @ 90 min (1 match/week or 1 tournament/month) Beach: 2 tournaments/ month or 4-6 matches every other week.	
PRACTICE/ COMPETITION RATIO*	Instruction 15% Adult-led Play 35% Free Play 50%	70/30	65/35	60/40	60/40	2-4 @ 30-45 min (some 40/68essions may be integrated into practice)	40/60	
PHYSICAL TRAINING PER WEEK		Core and body weight strength exercises integrated into warm-up or prior to cool down.	1-2 weekly off-court stand alone strength sessions for girls and on-court body-weight exercises (at ~11 years old).	2 weekly off-court stand alone strength sessions for girls and 1 for boys.	2 weekly off-court stand alone strength sessions for girls and 1-2 for boys. On-court sessions may be included after practice.	2-4 @ 30-60 min	2-4 @ 60 min	
OTHER SPORTS	4+ Sports/Activities Sport 25% of year Activity 75% of year	2-3 organized sports or unstructured activities	2 organized sports or unstructured activities	1-2 other sports outside of the Indoor and Beach seasons	Indoor and/or Beach and other unstructured activities during the off-season	Indoor and/or Beach	Indoor and/or Beach	
MAXIMUM TOTAL	Athletic participation 4-6 times per week. If a child has a favourite sport, participation up to twice per week in that activity is suggested so long	spart a sport-specific training three times per week plus participation other sports or activities three times a week.		Maximum 6 sessions/week (1 session = 90 min of a practice, e.g. 3 practices, 1 match, 2 strength). Max 7 sessions/week (1 session = 60-120 min of a practice, match, or work out). For example: 4 practices + 2 physical training + 1 match = 7.				
ACTIVITY	as there is also participation in many other sports to ensure healthy and lifelong participa- tion in sport.		All athletes should have 5 hours between practices if doing two practices a day and have 1 full day off per week. Coaches in this stage should monitor the total number of activities the players participate in order to build the players' capacity to withstand training and minimize burnout and injuries. Coaches should also monitor the estimated volume of jumps for each practice. The number of jumps should gradually increase to meet the demands of training and competition events. Sharp increases in jumps from day-to-day or week-to-week greatly increase the risk of chronic or acute injuries. Training load can be recorded and monitored within the practice plan with great specificity or with simple symbols ()					

^{*}Competition ratio includes competition-specific training found within practice.

Physical Assessment Protocols

The following links provide detailed instructions for conducting physical assessments. Some assessments can be done individually by the athletes, or by a coach with minimal training, while other assessments must be completed by a trained professional. As a best practice, Volleyball Canada recommends clubs engage professionally certified Strength and Conditioning coaches to support the development of the Athlete Pillar. Assessments can begin in the late Train to Train stage or the Learn to Compete stage.

- INDOOR
- BEACH
- SITTING

PAIN SCALE

As a part of physical testing and the ongoing physical development regimen, coaches must monitor the pain level of their athletes. Volleyball Canada recommends using the pain scale below. If at any time an athlete experiences pain at level 2 for longer than 3 consecutive days, the athlete must be directed to a medical professional.

- 0. No pain I have no pain.
- 1. Minimal The pain is hardly noticeable.
- 2. Mild I have a low level of pain. I am aware of it only when I pay attention to it.
- 3. Uncomfortable The pain bothers me, but I can ignore it most of the time.
- 4. Moderate I am consistently aware of the pain but I can continue most activities.
- 5. Distracting I think about the pain most of the time. I can't do some activities because of pain.
- 6. Distressing I think about the pain all of the time. I can't do many activities because of pain.
- 7. Unmanageable I'm in pain all the time. It keeps me from doing most activities.
- 8. Intense My pain is so severe that it is hard to think of anything else.
- 9. Severe My pain is all that I can think about. I can barely talk or move because of the pain.
- 10. Unable to move I can't move because of pain. I need immediate help to alleviate this pain.



To support the collection of meaningful data for short- and long-term analysis, Volleyball Canada has developed a series of Physical Testing Combines, offered annually. Athletes looking to sign up for these combines can check out this webpage.

Physical Assessment Normative Data

INDOOR / Men

	Team	Rating	Spike Reach	Block Reach	Pro Agility	Attack Velocity	Spin Velocity	Reactive Strength Index	Counter Movement Jump
			cm	cm	sec	kmhr	kmhr		
		Best	372.11	358.10	3.10		109		
	SENIOR	Average	345.75	319.67	3.25		94		
		Minimum	335.30	312.39	3.45		80		
		Best	354.33	335.28	3.08				
s	JUNIOR	Average	338.19	314.33	3.23				
		Minimum	322.58	300.99	3.44				
		Best	340.36	316.23	3.36		95		
	YOUTH	Average	336.55	314.64	3.40		84		
		Minimum	332.74	312.42	3.43		72		
	SENIOR	Best	353.10	322.61	3.06	112	114		
		Average	346.46	319.52	3.21	108.75	107.29		
		Minimum	340.40	315.00	3.33	107	102.		
	JUNIOR	Best	367.03	331.47	3.00	113.67	118		
LS		Average	351.75	323.01	3.23	105.17	106.64		
		Minimum	341.63	313.69	3.52	94	99.3		
		Best	350.52	327.66	3.31	101	90		
	YOUTH	Average	342.90	320.68	3.49	93.33	86.91		
		Minimum	334.01	312.42	3.69	89	80		
		Best	373.40	342.90	3.13	115	116		
	SENIOR	Average	363.25	331.45	3.36	115	88.25		
		Minimum	353.10	319.99	3.55	115	10		
0		Best	382.27	347.98	3.22	107	107.33		
	JUNIOR	Average	363.32	333.42	3.27	107	107.33		
		Minimum	347.98	323.85	3.36	107	107.33		
	YOUTH		Орр	osites cor	nbined wi	th Left Sid	es at this a	age.	

	Team	Rating	Spike Reach	Block Reach	Pro Agility	Attack Velocity	Spin Velocity	Reactive Strength Index	Counter Movement Jump
			cm	cm	sec	kmhr	kmhr		
		Best	312.40		3.16				
	SENIOR	Average	312.40		3.27				
		Minimum	312.40		3.38				
		Best	347.98	326.39	3.16		92.67		
ᅵᅵ	JUNIOR	Average	318.48	293.66	3.23		92.67		
		Minimum	302.26	283.21	3.30		92.67		
	YOUTH	Best	341.63	314.96	3.42	98			
		Average	330.62	309.46	3.57	98			
		Minimum	322.58	306.07	3.71	98			
		Best	365.80	335.31	3.10	98	117		
	SENIOR	Average	353.30	327.89	3.24	93.83	107		
		Minimum	349.30	323.85	3.29	87	92		
		Best	372.11	339.09	3.10	102	111.30		
М	JUNIOR	Average	340.38	314.60	3.30	90.73	103.99		
		Minimum	309.88	281.94	3.73	83	98		
		Best	350.52	328.93	3.33	100	92		
	YOUTH	Average	343.32	323.22	3.53	92.40	86		
		Minimum	332.74	317.50	3.72	85	82		

Volleyball Canada does not recommend these tests for the early Train to Train stage due to the significant influence the rate of individual maturation may have on results. These tests can be introduced at the late Train to Train stage. During the Train to Train stage, athlete success should be measured through individual progress, not by comparing test results to normative data.

Best: Best result ever recorded. Average: Average score on the test. Minimum: Minimum acceptable level.

Physical Assessment Normative Data

INDOOR / Women

	Team	Rating	Spike Reach	Block Reach	Pro Agility	Attack Velocity	Spin Velocity	Reactive Strength Index	Counter Movement Jump
			cm	cm	sec	kmhr	kmhr		
		Best	311.15	285.75	3.29				
	SENIOR	Average	299.59	281.77	4.1				
		Minimum	292	277	5.89				
		Best	316.23	295.91	3.3	78.3	74		
s	JUNIOR	Average	306.31	284.46	3.6	76.33	71.54		
		Minimum	288.29	270.51	3.86	74	69		
		Best	290.83	274.32					
	YOUTH	Average	287.02	273.69					
		Minimum	283.21	273.05					
		Best	320.04	306.07	3.18				
	SENIOR	Average	310.66	292.61	4.69		121		
		Minimum	304.80	278	5.63		110.6		
	JUNIOR	Best	322.58	302.26	3.16	83.7	103		
LS		Average	305.99	288.63	3.53	76.13			
		Minimum	292.1	279.4	3.88	69			
		Best	306.07	290.83					
	YOUTH	Average	298.87	283.21					
		Minimum	292.1	279.4					
		Best	325.12	296.01	3.17				
	SENIOR	Average	324.23	293.4	3.17				
		Minimum	322.58	292.1	3.17				
0		Best	323.85	297.18	3.25	81.7	78.67		
	JUNIOR	Average	313.58	291.15	3.61	77.45	73.37		
		Minimum	295.91	279.4	4.03	71.7	63.3		
	YOUTH		Орр	osites cor	mbined wi	th Left Sid	es at this	age.	

	Team	Rating	Spike Reach	Block Reach	Pro Agility	Attack Velocity	Spin Velocity	Reactive Strength Index	
			cm	cm	sec	kmhr	kmhr		
		Best	296	277.01	3.28				
	SENIOR	Average	289.79	272.44	4.22				
		Minimum	284.48	269.24	5.15				
		Best	295.91	274.32	3.16	82.7	75.7		
L	JUNIOR	Average	288.08	269.66	3.44	80.9	72.23		
		Minimum	276.86	260.35	3.68	79	68.7		
	YOUTH	Best	283.21	267.97					
		Average	282.58	267.34					
		Minimum	281.94	266.7					
		Best	320.04	306.07	3.31				
	SENIOR	Average	309.17	292.09	5.17				
		Minimum	288	273.99	5.67				
		Best	335.28	304.8	3.15	86.7			
M	JUNIOR	Average	313.28	292.93	3.57	77.01			
		Minimum	302.26	279.4	3.98	68.7			
		Best	328.93	312.42					
	YOUTH	Average	314.54	297.18					
		Minimum	300.99	287.02					

Volleyball Canada does not recommend these tests for the early Train to Train stage due to the significant influence the rate of individual maturation may have on results. These tests can be introduced at the late Train to Train stage. During the Train to Train stage, athlete success should be measured through individual progress, not by comparing test results to normative data.

Best: Best result ever recorded. Average: Average score on the test. Minimum: Minimum acceptable level.

Physical Assessment Normative Data

Beach

Sex	Position	Program	Availability (%)	Hex Bar 3MR (% BW)	Force Plate CMJ (cm)	Reactive Pro Agility (s)	8m Return (s)	Approach (cm)	RHIET (s)
	Blocker	Next Gen	90	133	32	6.5	4.00	290	88
Female	Blocker	Senior	90	176	38	6.3	3.90	300	86
	Defender	Next Gen	90	150	36	6.26	3.90	285	84
	Defender	Senior	90	200	43	6.16	3.85	285	82
	Blocker	Next Gen	90	175	40	6.00	3.90	325	82
Male	Blocker	Senior	90	200	50	5.75	3.60	332	75
	Defender	Next Gen	90	175	45	5.75	3.65	320	78
	Defender	Senior	90	200	55	5.55	3.60	325	72

Physical Assessment Normative Data

Sitting

Team	Rating	Seated Height	Seated Spike Reach	Seated Block Reach	Wingspan	Seated T-Test (left)	Seated T-Test (right)	Seated 5-m Sprint	Seated 3kg Med Ball Throw	Bench Press Predicted 1RM	Back Squat Predicted 1 RM	Barbell Deadlift Predicted 1 RM
		cm	cm	cm	cm	s	s	s	cm	kg	kg	kg
	Best	97.00	150.00	148.00	178.00	9.44	9.67	1.90	515	54.11	84.18	
Women	Average	90.64	138.54	136.29	166.39	12.58	17.10	2.42	429	42.69	61.27	
	Minimum	82.50	125.00	126.00	151.50	19.29	12.60	4.12	325	30.00	49.09	
	Best	106.00	165.00	160.00	203.00	8.03	9.00	1.32	487	134.09		170.45
Men	Average	96.50	149.00	146.00	185.00	10.79	10.40	1.84	388	85.00		123.18
	Minimum	86.00	142.00	137.00	175.00	13.38	11.80	2.40	332	61.36		84.09

Best: Best result ever recorded. Average: Average score on the test. Minimal: Minimal acceptable level.

The PLAYER Pillar

The Player Pillar has 4 main dimensions that are closely linked to each other.

During play, most situations players are involved in can be viewed as a "problem to solve". To do so, they must first see or read certain cues that provide meaningful information, then make timely decisions about what to do next, and lastly skillfully execute the appropriate technical actions. To achieve success, the actions of each player must also be integrated into a system of play to ensure individuals connect with each other and perform as a unit.

All this happens very quickly during play... As a result, developing these abilities in a "seamless way" will occupy the majority of time during a practice, with the Athlete and Person pillars being integrated throughout.

Developing the player's ability to effectively "put together" the cue reading and decision-making components of basic skills, and then to implement them in the context of basic systems, is a priority before introducing intermediate skills and systems. However, athletes need not master all the components associated to a skill before new ones can be introduced.



Initiate / Aquire Fundamental Skills & Systems

Initiation: The first contact the athlete has with a particular skill.

Acquisition: Athlete can perform a rough form of the skill (they lack rhythm and flow). Form deteriorates further when under pressure or in competition.

F	undamental Skills
Toss	As a Serve, Pass or Set
Catch	A Serve or Pass
	Standing Float
Serve	Spin
	Underhand Serve (optional)
Pass	Forearm Pass
	Overhead Pass
Set	Front Set
	Bask Set
Attack	Standing Arm Swing
	Jump and Attack
Block	Blocker Movements
Defend	Basic Dig
Joina	Overhead Dig

	Fundamental Systems
POSITIONING AND HANDLING THE BALL	Players play 1 v 1. They can control the oncoming ball and maintain a rally using catch-throw-hit over the net. Players are at the net for offence and away from the net for defence.
MOVING AND COOPERATING	Players play 2 v 2. They can maintain a rally with their partner. Players can catch/toss to the net, throw along the net, hit over the net. Players can toss the ball with an arc to their target. Setters release early to the net to prepare for the set.
BUILDING AN ATTACK	Players play 3 v 3. They can maintain a rally using 3 contacts, including one catch-throw, one set, and a hit over the net. Players can move to make an effective toss followed by an attack. Players can set the ball with an appropriate trajectory and height (tempo). On serve reception or defence, the closest free player to the passing target becomes the setter (typically the player on the right). Players can attack from a variety of positions and reset themselves for defence. Introduce quick attacks.
PASSING AND DEFENDING	Players play 3 v 3. They can maintain a rally using 3 contacts, including a forearm pass, up to one catch/throw, and a hit over the net. Blocking movements (max 1 blocker) and defensive cue-reading are introduced. Players can adjust their defensive position for a variety of attacks.
DEVELOPING A STRUCTURED & ORGANIZED GAME	Players play 3 v 3 or 4 v 4. They can maintain a rally with their team using 3 consecutive contacts using volleyball skills with no bounces. Introduce serving rotations. Players can read and move for free balls consistently. Begin to designate a setter on serve reception. Offensive plays target weaknesses or gaps in the opponent.

^{*}Players progress to more complex playing formats as they reach a 70% success rate.

Consolidate BASIC Skills & Systems Acquire INTERMEDIATE Skills & Systems at the end of the stage

Consolidation: Athlete can perform the skill with correct form. Control and rhythm are good in easy/stable conditions. Some elements of performance can be maintained under pressure or in competitions but performance is inconsistent.

	Basic Skills
	Float
Serve	Jump Float
	Jump Spin - Power
Pass	Forearm Pass
1 433	Overhead Pass
Volley	Free Ball Pass
Volicy	Non-setter 2nd ball set
	High Ball to position 4 & 2
Set & Attack	Backrow from position 1 & 6
Jet & Attack	X's and Tandems (optional)
	Middle Quick Attack – 51 & 31
Attack	Hard Driven: Cross-court & Line
Allack	Off Speed: Tip & Roll
	Long Distances: Turn and Run, Shuffle and Cross-over 3
Block	Medium Distances: Cross-over 3, Cross-over 2, Shuffle 3
	Short Distances: Shuffle 2, Shuffle 1
Defend	Hard Driven: Forearms & Overhead

Acquisition: Athlete can perform a rough form of the skill (they lack rhythm and flow). Form deteriorates further when under pressure or in competition.

	Intermediate Skills
Serve	Jump Spin - Control
	Second tempo to pos. 4 & 2
	Second tempo from pos. 1 & 6
Set & Attack	Middle Quick Attack – 41
	Middle Quick Attack – 61
	Step Around - Short, Medium, Long
Attack	Off the block - Hit & Wipe
	Recycle
	Ball Pursuit and Retrieval
Defend	Dive
22.0	Roll and/or Sprawl
	Pancake
Systems	Basic & Intermediate
Offensive Systems	6-6 / 4-2, 6-3, 6-2, 5-1
Serve Reception	"W" Formation / 4-person, 3-person, 2-person
Defensive Systems	Spread Block System / Bunch Read System
Blockers	1-blocker / 2-blocker, 3-blocker
Defenders	6-up / 6-back
Coverage	2-3 / 3-2 or 2-3
Transition	All movements from one cycle of action to another

Consolidate BASIC Skills & Systems Acquire INTERMEDIATE Skills & Systems at the end of the stage

Consolidation: Athlete can perform the skill with correct form. Control and rhythm are good in easy/stable conditions. Some elements of performance can be maintained under pressure or in competitions but performance is inconsistent.

	D : 01 !!!			
	Basic Skills			
	Float			
Serve	Jump Float			
	Jump Spin - Power			
Pass	Forearm Pass			
	Hand Setting from Reception			
Set	Bump Setting			
	Back Setting			
	Hard Driven: Straight Ahead			
	Hard Driven: Cross body			
Attack	Hard Driven: Away from body			
Attack	Off-Speed: Low Roll (short)			
	Off Speed: High Roll (deep)			
	Off-Speed: Pokey			
	Blocking Line: Peel			
Block	Blocking Line: Block			
	Blocking Line: Block & Dig			
	Hard Driven: Forearms			
	Hard Driven: Fingers			
Defend	Off Speed: One hand pokey			
	Off Speed: Double Axe Handle			
	Off Speed: Chase (dive)			

Acquisition: Athlete can perform a rough form of the skill (they lack rhythm and flow). Form deteriorates further when under pressure or in competition.

Intermediate Skills				
Serve	Jump Spin - Control			
	Chest to net setting			
Set	Jump Setting			
Set	Speed and play-setting			
	Direct set after block touch			
Attack	Joust			
Attaon	Recycle			
	Blocking Cross: Peel			
Block	Blocking Cross: Block			
	Blocking Cross: Block & Dig			
	Identifying wind direction			
Adjusting to	Adjustments of skills based on wind			
conditions	Adjusting to rain and a wet ball			
	Equipment and weather			
Systems	Basic			
Offensive Systems	Pass straight, set straight			
Defensive Systems	True line, cross, peeling call, line peel, cross peel			

Refine BASIC Skills & Systems Consolidate INTERMEDIATE Skills & Systems

Refinement: Athlete can perform the skill with ideal form, speed, precision and control. The performance is very consistent, even under very demanding conditions. Only minor fine-tuning may be necessary. All components of the movement have been automated, which allows the athlete to make rapid adjustments during play.

	Basic Skills
	Float
Serve	Jump Float
	Jump Spin - Power
Pass	Forearm Pass
. 400	Overhead Pass
Volley	Free Ball Pass
voiley	Non-setter 2nd ball set
	High Ball to position 4 & 2
Set & Attack	Backrow from position 1 & 6
Jet & Attack	X's and Tandems (optional)
	Middle Quick Attack – 51 & 31
Attack	Hard Driven: Cross-court & Line
Attack	Off Speed: Tip & Roll
	Long Distances: Turn and Run, Shuffle and Cross-over 3
Block	Medium Distances: Cross-over 3, Cross-over 2, Shuffle 3
	Short Distances: Shuffle 2, Shuffle 1
Defend	Hard Driven: Forearms & Overhead

Consolidation: Athlete can perform the skill with correct form. Control and rhythm are good in easy/stable conditions. Some elements of performance can be maintained under pressure or in competitions but performance is inconsistent.

Intermediate Skills	
Serve	Jump Spin - Control
Set & Attack	Second tempo to pos. 4 & 2
	Second tempo from pos. 1 & 6
	Middle Quick Attack – 41
	Middle Quick Attack – 61
	Slide - Short, Medium, Long
Attack	Off the block - Hit & Wipe
	Recycle
Defend	Ball Pursuit and Retrieval
	Dive
	Roll and/or Sprawl
	Pancake
Systems	Intermediate
Offensive Systems	4-2, 6-3, 6-2, 5-1
Serve Reception	4-person, 3-person, 2-person
Defensive Systems	Bunch Read System
Blockers	2-blocker, 3-blocker
Defenders	6-back
Coverage	3-2 or 2-3
Transition	All movements from one cycle of action to another

Refine BASIC Skills & Systems Consolidate INTERMEDIATE Skills & Systems

Refinement: Athlete can perform the skill with ideal form, speed, precision and control. The performance is very consistent, even under very demanding conditions. Only minor fine-tuning may be necessary. All components of the movement have been automated, which allows the athlete to make rapid adjustments during play.

	Basic Skills						
	Float						
Serve	Jump Float						
	Jump Spin - Power						
Pass	Forearm Pass						
	Hand Setting from Reception						
Set	Bump Setting						
	Back Setting						
	Hard Driven: Straight Ahead						
	Hard Driven: Cross body						
Attack	Hard Driven: Away from body						
rittaon	Off-Speed: Low Roll (short)						
	Off Speed: High Roll (deep)						
	Off-Speed: Pokey						
	Blocking Line: Peel						
Block	Blocking Line: Block						
	Blocking Line: Block & Dig						
	Hard Driven: Forearms & Fingers						
Defend	Off Speed: One hand pokey						
Dorona	Off Speed: Double Axe Handle						
	Off Speed: Chase (dive)						

Consolidation: Athlete can perform the skill with correct form. Control and rhythm are good in easy/stable conditions. Some elements of performance can be maintained under pressure or in competitions but performance is inconsistent.

In	termediate Skills
Serve	Jump Spin - Control
	Chest to net setting
Set	Jump Setting
Jet	Speed and play-setting
	Direct set after block touch
Attack	Joust
Attaon	Recycle
	Blocking Cross: Peel
Block	Blocking Cross: Block
	Blocking Cross: Block & Dig
	Identifying wind direction
Adjusting to	Adjustments of skills based on wind
conditions	Adjusting to rain and a wet ball
	Equipment and weather
Systems	Intermediate
Offensive Systems	Speed set options
Defensive Systems	Trap cross, late peel, short peel

Refine INTERMEDIATE Skills & Systems

Refinement: Athlete can perform the skill with ideal form, speed, precision and control. The performance is very consistent, even under very demanding conditions. Only minor fine-tuning may be necessary. All components of the movement have been automated, which allows the athlete to make rapid adjustments during play.

	Basic Skills
	Float
Serve	Jump Float
	Jump Spin - Power
Pass	Forearm Pass
1 400	Overhead Pass
Volley	Free Ball Pass
Volley	Non-setter 2nd ball set
	High Ball to position 4 & 2
Set & Attack	Backrow from position 1 & 6
Set & Attack	X's and Tandems (optional)
	Middle Quick Attack – 51 & 31
Attack	Hard Driven: Cross-court & Line
Attack	Off Speed: Tip & Roll
	Long Distances: Turn and Run, Shuffle and Cross-over 3
Block	Medium Distances: Cross-over 3, Cross-over 2, Shuffle 3
	Short Distances: Shuffle 2, Shuffle 1
Defend	Hard Driven: Forearms & Overhead

Refinement: Athlete can perform the skill with ideal form, speed, precision and control. The performance is very consistent, even under very demanding conditions. Only minor fine-tuning may be necessary. All components of the movement have been automated, which allows the athlete to make rapid adjustments during play.

	Intermediate Skills
Serve	Jump Spin - Control
	Second tempo to pos. 4 & 2
	Second tempo from pos. 1 & 6
Set & Attack	Middle Quick Attack – 41
	Middle Quick Attack – 61
	Slide - Short, Medium, Long
Attack	Off the block - Hit & Wipe
	Recycle
	Ball Pursuit and Retrieval
Defend	Dive
	Roll and/or Sprawl
	Pancake
Systems	Intermediate
Offensive Systems	4-2, 6-3, 6-2, 5-1
Serve Reception	4-person, 3-person, 2-person
Defensive Systems	Bunch Read System
Blockers	2-blocker, 3-blocker
Defenders	6-back
Coverage	3-2 or 2-3
Transition	All movements from one cycle of action to another

Refine INTERMEDIATE Skills & Systems

Refinement: Athlete can perform the skill with ideal form, speed, precision and control. The performance is very consistent, even under very demanding conditions. Only minor fine-tuning may be necessary. All components of the movement have been automated, which allows the athlete to make rapid adjustments during play.

	Basic Skills						
	Float						
Serve	Jump Float						
	Jump Spin - Power						
Pass	Forearm Pass						
	Hand Setting from Reception						
Set	Bump Setting						
	Back Setting						
	Hard Driven: Straight Ahead						
	Hard Driven: Cross body						
Attack	Hard Driven: Away from body						
	Off-Speed: Low Roll (short)						
	Off Speed: High Roll (deep)						
	Off-Speed: Pokey						
	Blocking Line: Peel						
Block	Blocking Line: Block						
	Blocking Line: Block & Dig						
	Hard Driven: Forearms & Fingers						
Defend	Off Speed: One hand pokey						
	Off Speed: Double Axe Handle						
	Off Speed: Chase (dive)						

Refinement: Athlete can perform the skill with ideal form, speed, precision and control. The performance is very consistent, even under very demanding conditions. Only minor fine-tuning may be necessary. All components of the movement have been automated, which allows the athlete to make rapid adjustments during play.

lı	ntermediate Skills
Serve	Jump Spin - Control
	Chest to net setting
Set	Jump Setting
Jet	Speed and play-setting
	Direct set after block touch
Attack	Joust
7.11.651.	Recycle
	Blocking Cross: Peel
Block	Blocking Cross: Block
	Blocking Cross: Block & Dig
	Identifying wind direction
Adjusting to	Adjustments of skills based on wind
conditions	Adjusting to rain and a wet ball
	Equipment and weather
Systems	Intermediate
Offensive Systems	Fake jump set, wide spread speed sets
Defensive Systems	Trap line, fake peel
Serve Reception	Overload or spread-based systems

At these stages of development many players have refined all the basic and intermediate skills and are now developing creative variations of these skills. However, it is also common for some athletes to require some retroactive training to fill skill gaps not acquired in previous stages. In addition, a small amount of skill maintenance activities may have to be included on an as-needed basis during the season - or even planned more prominently when athletes deviate from sound mechanics. Programs are lead by national team and professional coaches with a highly individualized focus on technical and

tactical applications for specific competitions within the quadrennial plan.

Skills Assessment - Protocols

A process for improvement

Assessing skills can help the coach monitor progress over the course of a season. Utilizing a standard set of skill assessments can also help clubs, Provincial/Territorial Volleyball Associations and Volleyball Canada determine if the current key components of coach education, competition schedules, school/club infrastructure, etc., are helping to collectively improve Canadian volleyball within the high-performance context.

However, assessing skills can be a challenging task in volleyball since skill execution varies dramatically based on the strengths and weaknesses of the opponent. Furthermore, individual skills within one's own team can be drastically impacted by the skill level of positional players, such as the setter's impact on hitting efficiency.

Within Volleyball Canada's high performance programs, skill assessments are conducted against the top individuals and teams in the world. The tables on the following pages list some statistical benchmarks for Youth, Junior and Senior National Teams when playing against top 6 international teams, and are part of Volleyball Canada's Gold Medal Profile. These statistical benchmarks support the development of a gap analysis, which in turn, refines our focus in adapting our coach education and high-performance pathway programs.

As an example, in 2021, the women's indoor national program identified a significant gap in the skill of passing, and a secondary/corresponding gap in serving. As a means to alleviate this gap across the Canadian volleyball landscape, clubs and schools can make a few key changes to their practices as described <u>HERE</u>.

Measuring skill proficiency for LTD stages younger than the Learn to Compete stage is also a challenging task given the difficulty of comparing teams and individuals within clubs across such a vast country as Canada. However, one annual event, the Canada Cup, offers a good opportunity to evaluate skill proficiency when Canada's Provincial Teams compete against one another. At this event, Volleyball Canada collects the same statistical items as those collected internationally. Provincial Team programs can use this data to develop their own gap analysis and compare this data year over year to measure internal program improvement.

For club/school coaches in the Train to Train and Learn to Compete stages who are interested in measuring the skill development of their players over the course of a season, Volleyball Canada has developed a set of standardized skill tests for the 14U, 16U, and 18U categories. The drills listed within these tests are designed to be as game-like as possible, but also contain some limitations. Nonetheless, these tests are a great way to monitor and celebrate individual skill development. Also, coaches in these stages must always keep in mind that the single most important measure of success is that athletes enjoy their volleyball experience and want to continue to play the following season.

Indoor / Men

PLAY	'ER		FLOAT			SPIN			RECE	PTION	
Team	Rating	ACES %	ERRORS %	POINT SCORE %	%ACES	%ERRORS	POINT SCORE %	EXCELLENT %	ERROR %	PASS EFFICIENCY %	PASS SCORE 3-SCALE
	Best	10%	2%	38%	13%	19%	33%	69%	2%	49%	2.55
SENIOR	Average	6.50%	3.5%	34%	8.5%	23%	31%	59.5%	5.5%	44.5%	2.44
	Minimum	3%	5%	30%	4%	27%	29%	50%	9%	40%	2.32
	Best	14%	9%	35%	25%	20%	55%	65%	5%	41%	2.43
JUNIOR	Average	9.5%	12%	30.5%	20%	25%	38.5%	55%	10%	38%	2.34
	Minimum	5%	15%	26%	15%	30%	22%	45%	15%	35%	2.24
	Best	21%	7%	44%	25%	60%	54%	45%	12%	34%	2.29
YOUTH	Average	14%	14%	36.5%	20%	40.5%	40.5%	40%	18.5%	30%	2.19
	Minimum	7%	21%	29%	15%	21%	35%	35%	25%	26%	2.09

PLAY	ER	SF	PIKES - OPPOSITI	ES	S	PIKES - OUTSIDE	S	;	SPIKES - MIDDLE	S
Team	Rating	KILL %	ERROR %	EFFICIENCY %	KILL %	ERROR %	EFFICIENCY %	KILL %	ERROR %	EFFICIENCY %
	Best	50%	6%	30%	55%	6%	37%	60%	3%	53%
SENIOR	Average	47.5%	8%	29%	51%	7.5%	33%	59%	4.5%	51%
	Minimum	45%	10%	28%	47%	9%	29%	58%	6%	49%
	Best	55%	9%	46%	64%	9%	46%	78%	6%	75%
JUNIOR	Average	48.6%	13%	33.5%	50.5%	13%	31.5%	68%	9.5%	72.5%
	Minimum	42%	17%	22%	37%	17%	17%	59%	13%	70%
	Best	39%	12%	26%	56%	5%	44%	54%	9%	48%
YOUTH	Average	35%	16.5%	22%	51.5%	9%	34.5%	49%	10.5%	43.5%
	Minimum	31%	21%	19%	47%	13%	26%	45%	12%	39%

PLAY	ER			BLOCKS				DIGS	
Team	Rating	Blocks/Set TEAM	Blocks/Set MIDDLES	Blocks/Set LEFT SIDE	Blocks/Set RIGHT SIDE	Blocks/Set SETTERS	Digs/Set TEAM	Digs/Set LIBERO	Digs/Set OTHERS
	Best	3.04	1.11	.58	.42	.64	3.8	1.14	.96
SENIOR	Average	2.55	.84	.53	.4	.46	3.43	1.1	.9
	Minimum	2.05	.57	.48	.38	.28	.305	1.05	.83
	Best	2.98	1.48	.76	.86	.47	3.19	1.3	1.05
JUNIOR	Average	2.78	1.23	.65	.82	.35	3.09	1.2	1.01
	Minimum	2.57	.96	.54	.78	.23	2.99	1.1	.97
	Best	2.7	1.06	.42	.8	.51	8.05	2.32	2.07
YOUTH	Average	2.45	.86	.37	.72	.41	7.7	2.11	1.83
	Minimum	2.19	.65	.31	.64	.31	7.35	1.9	1.59

Indoor / Women

PLAY	ER		FLOAT		SPIN				RECE	PTION	
Team	Rating	ACES %	ERRORS %	POINT SCORE %	%ACES	%ERRORS	POINT SCORE %	EXCELLENT %	ERROR %	PASS EFFICIENCY %	PASS SCORE 3-SCALE
	Best	11%	4%	395	8%	14%	29%	40%	7%	55%	2.37
SENIOR	Average	8%	8%	33%	5%	215	25.5%	34.5%	10%	42.5%	2.24
	Minimum	5%	12%	275	2%	285	22%	29%	13%	30%	2.1
	Best	15%	5%	35%	5%	175	27%	37%	9%	52%	2.29
JUNIOR	Average	11%	11%	295	3.5%	20.5%	24%	32%	12.55	41%	2.17
	Minimum	7%	17%	23%	2%	245	21%	27%	16%	30%	2.06
	Best	19%	9%	28%	5%	18%	24%	355	9%	49%	2.21
YOUTH	Average	14%	165	24.5%	3%	235	22%	28.5%	14%	38.5%	2.11
	Minimum	9%	23%	215	1%	285	19%	22%	19%	28%	2.01

PLAY	ER	SI	PIKES - OPPOSIT	ES	S	PIKES - OUTSIDE	ES	,	SPIKES - MIDDLE	S
Team	Rating	KILL %	ERROR %	EFFICIENCY %	KILL %	ERROR %	EFFICIENCY %	KILL %	ERROR %	EFFICIENCY %
	Best	43%	5%	27%	48%	65	375	56%	3%	72%
SENIOR	Average	41%	7%	25%	44.55	9%	32.5%	52%	4.5%	68.5%
	Minimum	39%	9%	23%	41%	12%	285	48%	6%	65%
	Best	39%	8%	25%	47%	7%	33%	49%	5%	62%
JUNIOR	Average	35%	11.55	23%	43%	10.5%	31%	45.5%	7%	60.5%
	Minimum	31%	155	21%	395	14%	29%	42%	9%	59%
	Best	29%	9%	23%	37%	9%	31%	41%	6%	59%
YOUTH	Average	25.5%	13.5%	20%	35%	13.5%	28%	35%	8.5%	55%
	Minimum	22%	18%	17%	33%	18%	25%	29%	11%	51%

PLAY	ER			BLOCKS				DIGS	
Team	Rating	Blocks/Set TEAM	Blocks/Set MIDDLES	Blocks/Set LEFT SIDE	Blocks/Set RIGHT SIDE	Blocks/Set SETTERS	Digs/Set TEAM	Digs/Set LIBERO	Digs/Set OTHERS
	Best	2.48	1.08	.59	.42	.29	8.12	2.08	1.39
SENIOR	Average	1.95	.99	.49	.33	.24	7.51	1.77	1.27
	Minimum	1.41	.89	.39	.23	.18	6.9	1.45	1.15
	Best	2.23	.9	.54	.31	.25	9.8	3.05	1.89
JUNIOR	Average	2.22	.85	.46	.28	.22	8.43	2.97	1.75
	Minimum	2.2	.8	.38	.25	.18	7.05	2.89	1.61
	Best	2.19	.85	.4	.26	.2	10.03	2.95	2.43
YOUTH	Average	1.99	.75	.28	.2	.18	9.88	2.58	2.27
	Minimum	1.79	.65	.15	.13	.15	9.72	2.2	2.11

Beach / Men

PLAY	ÆR	ATT	ACKING - BLOCK	ŒRS	ATTA	ACKING - DEFENI	DERS	Д	TTACKING - SPL	IT
Team	Rating	KILL %	ERROR %	EFFICIENCY %	KILL %	ERROR %	EFFICIENCY %	KILL %	ERROR %	EFFICIENCY %
	Best	63.1	8.6	494	64.1	9.1	4464	55.2	8.3	399
SENIOR	Average	56.9	11.8	437	55.4	12.8	367	52.5	9.3	366
	Minimum	50.7	14.1	315	46.7	16.1	296	51.9	11.4	312
	Best	68.7	6.8	540	61.54	9	502	57.66	8.2	455
NEXT GEN	Average	63.2	9.3	464	57	11.4	443	54.5	12.1	422
	Minimum	56.7	14.9	377	47.3	16.9	342	50.6	14.8	358
	Best	71.6	5.2	563	57.1	6.7	473	65.6	8.1	511
YOUTH	Average	68.4	6.8	446	53.2	9.8	414	54.6	14.9	438
	Minimum	59.3	13.8	354	44.6	15.3	303	48.3	16.6	340

PLAY	ER		FLOAT SERVES			SPIN SERVES		RECE	PTION
Team	Rating	ACE %	ERROR %	POINT SCORE %	ACE %	ERROR %	POINT SCORE %	GOOD PASS %	ERROR %
	Best	7.6	6.8	37.1	11.5	16.9	37	74.6	3.4
SENIOR	Average	6.9	10.7	34.9	7.6	19	32	67.8	5.9
	Minimum	2.6	12.8	31.3	4.5	21	28	60.2	11.9
	Best	12.9	7.1	41.3	15.4	9.2	42.2	81.3	4.8
NEXT GEN	Average	9.6	11.3	37.6	8.2	12.3	35.1	70.4	8.2
	Minimum	3.8	12.4	29.9	4.3	18.3	28.9	59.5	13.7
	Best	11.1	4.3	50.2	16.6	12.8	53.4	86.8	5.6
YOUTH	Average	8.7	7.2	44.3	11.4	17.3	48.1	73.8	10.7
	Minimum	2.4	12.6	33.1	8.6	21.4	32.4	59.7	16.3

PLAY	ER	BLO	CKS		DIGS	
Team	Rating	BLOCKS/SET	BLOCKS/SET SPLIT	DIG/SET BLOCKER	DIG/SET DEFENDER	DIG/SET SPLIT
	Best	2.73	1.16	1.86	5.89	3.9
SENIOR	Average	1.64	.97	1.15	3.93	3.12
	Minimum	1.20	.76	.43	2.95	1.61
	Best	3.03	1.29	2.06	4.91	3.04
NEXT GEN	Average	1.82	1.08	1.28	3.33	2.26
	Minimum	1.33	.84	.48	1.97	1.46
	Best	2.08	1.03	2.78	6.93	4.76
YOUTH	Average	1.42	.86	2.00	5.35	3.98
,	Minimum	.76	.68	1.20	3.99	3.18

Beach / Women

PLAY	ÆR	ATT	ACKING - BLOC	(ERS	ATTA	CKING - DEFEN	DERS	А	TTACKING - SPL	.IT
Team	Rating	KILL %	ERROR %	EFFICIENCY %	KILL %	ERROR %	EFFICIENCY %	KILL %	ERROR %	EFFICIENCY %
	Best	60.7	5.4	494	57.4	7	479	55.6	8.1	407
SENIOR	Average	54.6	8.8	404	53.4	9.7	384	52.4	9.2	379
	Minimum	50.4	10.4	324	47.6	12.7	302	46.5	11.1	297
	Best	65	6.8	540	61.54	9	502	59.74	10.1	430
NEXT GEN	Average	59.8	9.3	464	54	11	443	53	12.1	397
	Minimum	54.4	14.7	377	47.6	16.9	342	46.5	15.3	334
	Best	62.3	5.2	458	56.88	9.1	325	58.68	8	397
YOUTH	Average	58	6.8	396	46.6	12	287	47.6	9.3	374
	Minimum	51.4	16	302	39.5	16.5	243	40.6	18.1	254

PLAY	ÆR .		FLOAT SERVES			SPIN SERVES		RECE	PTION
Team	Rating	ACE %	ERROR %	POINT SCORE %	ACE %	ERROR %	POINT SCORE %	GOOD PASS %	ERROR %
	Best	11.5	2.1	42.6	11.7	7.6	39.5	78.2	4.2
SENIOR	Average	7.1	6.5	37.8	8.6	11.9	34.8	65.3	8.8
	Minimum	2.8	8.3	34.9	4.3	16.1	32.1	56.9	12.2
	Best	14.9	4.3	45.7	15.1	12.9	43.8	83.3	4.9
NEXT GEN	Average	7.4	7.6	40.8	8.9	16.1	39	75.2	9.9
	Minimum	2.1	11.9	37.7	3.6	20.5	36.1	64.5	13.6
	Best	17.7	5.6	43.9	18.6	7.8	44.7	88.4	5.6
YOUTH	Average	11.6	7.6	38.3	13.4	17.1	39.6	79.4	11
	Minimum	2.4	12.6	31.2	3.6	21.9	32.4	68.2	15

PLAY	ER	BLO	CKS		DIGS	
Team	Rating	BLOCKS/SET	BLOCKS/SET SPLIT	DIG/SET BLOCKER	DIG/SET DEFENDER	DIG/SET SPLIT
	Best	1.51	1.36	2.44	6.71	5.4
SENIOR	Average	1.2	0.98	1.91	5.08	4.72
	Minimum	0.95	0.7	1.21	4.49	3.71
	Best	1.78	1.63	2.79	6.44	6.7
NEXT GEN	Average	1.47	1.25	2.26	5.76	5.5
	Minimum	1.22	0.97	1.56	5.17	3.91
	Best	0.87	0.62	4.14	7.39	7.74
YOUTH	Average	0.77	0.52	3.61	5.76	6.11
	Minimum	0.55	0.3	2.91	5.07	5.42

Sitting

PLA	AYER		SP	IKES - PO	S 4			SP	IKES - PO	S 2			SPIK	ES - MIDE	DLES			SPIKE	S - BACK	ROW	
Team	Rating	Total	Kill%	Blk%	Err%	Eff%	Total	Kill%	Blk%	Err%	Eff%	Total	Kill%	Blk%	Err%	Eff%	Total	Kill%	Blk%	Err%	Eff%
Women	Average	655	35%	8%	372	16%	372	39%	9%	10%	20%	619	40%	8%	8%	24%	208	29%	8%	21%	-
Men	Average																				

PLA	YER			FLO	AT RECEP	TION			SPIN RECEPTION						
Team	Rating	Total	Exc%	Pos%	Err%	Eff%	eSO%	3 pt.	Total	Exc%	Pos%	Err%	Eff%	eSO%	3 pt.
Women	Average	1008	19%	36%	14%	22%	44%	1.68	183	14%	32%	13%	19%	43%	1.62
Men	Average														

PLA	YER		В	LOCKS / SE	T				DIGS	/ SET		
Team	Rating	Total	P4	MID	P2	SERVE	Total	Direct	Block	Cover	Emerg	Error
Women	Average	3.06	0.44	0.75	0.77	1.01	17	7.68	1.68	2.15	0.38	5.49
Men	Average											

PLA	YER			FLOAT					SPIN		
Team	Rating	Total	Kill%	Blk%	Err%	PS%	Total	Kill%	Blk%	Err%	PS%
Women	Average	1105	17%	4%	16	50%	420	21%	8%	17%	46%
Men	Average										

Program Planning & Periodized Plans

In simple terms, planning is about determining how time, resources, and priorities will be managed. In sport, plans can be developed for the short (single session or day), mid (one or more weeks), or long term (a season, a year... and even a few years in the case of elite athletes). The planning of sport programs lasting several weeks or longer often reflects the concept of periodization. The term periodized plan refers to the somewhat complex temporal organization and mapping out of the training and competition activities, as well as other significant events, with the aim of enhancing athletic development and achieving peak performance for major competitions. There are many types of periodized plans. As the name implies, a season plan does not cover the entire year, but spans over a shorter period, typically from a few weeks before the first event until the end of the competitive season. A yearly training plan/program (YTP) goes further, and outlines the types of activities athletes should do to prepare during the off-season, and how they may transition and recover after the last competition. Quadrennial plans are even more complex, and aim at modelling how a succession of YTPs could be used to enhance preparation and improve performances over an Olympic cycle. Regardless of the type of periodized plan, the key challenges program designers face are arguably how to (1) achieve an "optimal vertical integration" between the physical, technical, tactical, and mental aspects of performance throughout the process, (2) determine the most effective ratio of training and competition activities, while knowing that some competitions can be viewed as "preparation events", and (3) ensure sufficient recovery amidst all of this.

A critical element underlying periodized planning is the Adaptation Principle. According to this principle, athletes need to be progressively exposed to a sufficient amount of training stress to improve, but enough time and adequate conditions must also be in place to ensure recovery. This is the only way to adapt and get better in the long term. It is also important to keep in mind that improvements resulting from training are not constant and linear. Progress can be fast initially, but a plateauing effect may be observed after a while, so performance may stagnate if the stimulus or "training load" is not adjusted periodically. In addition, because adaptations are also reversible, performance may even decrease if the "load" is too weak or if it is not applied frequently enough. Careful consideration must therefore be given to all these aspects when developing the periodized plan, as the longer an athlete has been training for, the more tricky it gets to keep improving. Therein lie the challenges alluded-to earlier... And this quickly brings up practical coaching questions: "How much training, then, is necessary to achieve the desired outcome of consolidating basic skills? How long does it take?" While many athletes differ in their rate of improvement, it can typically take 3 months or more for an athlete training 2-3 times a week to move from the "acquired" stage of skill development to "consolidating" a particular skill. Clearly, this means that we need to be conservative in planning the number of skills we target for a season, and ultimately understand that all plans may need to be adjusted at regular intervals.

A brief word on competition: while it is a critical piece of the sport experience and an important component of every periodized plan, it is often given too much emphasis, particularly during the first few years of an athlete's development. This can have a detrimental effect on individual skill development, on building an athletic base of strength and power and, most importantly, on providing a fun and enjoyable sport environment. Balance, perspective, and discernment should therefore be key factors guiding decisions about the number and the level of competitions athletes should be involved in, and more is not necessarily better...

Planning Continued...

Following a Person-Centered approach, a seasonal or yearly periodized plan should consider all the facets of the individual's life, which includes the non-volleyball sports young people may play, their education, family, and social life. By taking into account these elements and the other aspects mentioned previously, two important goals can be achieved: (1) a balanced development through sport, and (2) a reduced risk of injuries, excessive fatigue, and burnout.

With all this in mind, Volleyball Canada has developed several examples of periodized plans across the LTD stages for coaches to consider when planning their practices. For younger age groups, we feel that planning should only be done on a seasonal basis. The level of detail contained within these plans can appear overwhelming to some coaches, particularly those who are just beginning. Therefore, as a best practice scenario, within each Club an experienced certified Performance Coach should be offering support on how to concretely transpose and apply the priorities listed in the periodized plan into practice plans. A helpful tool for building practice plans is also available on the following page.

13U	14U	15U	16U	17U	18U	21U

Practice Planning - Putting It All Together

By reviewing the basic principles within the Long Term Development Framework, examining the Person Pillar, the Athlete Pillar and the Player Pillar in the Volleyball Development Matrix, and reflecting how all these elements can be prioritized in a periodized plan, the coach is now thoroughly prepared to build out the practice plan.

To support this process and to create a linkage with the evaluation criteria of the National Coach Certification Program (NCCP), Volleyball Canada has provided a tool and resource to support practice planning (see below). By using this tool, coaches will familiarize themselves with the same practice planning template used in evaluations toward NCCP certification.

The excel spreadsheet is also a resource that contains a variety of drills and activities to drop into the practice plan. The Drill Bank provides some good examples of game-like activities for different levels of play. However, the games and drills are not exhaustive and are meant only to be a starting point for coaches to develop their own favourite activities to suit the needs of their players.

PRACTICE PLAN BUILDER

VIDEO EXPLANATION

In the spirit of Kaizen (continuous improvement), please send us your great drills, ideas or resources to coaching@volleyball.ca.

Glossary

The purpose of this glossary is to outline a series of key concepts related to performance in Volleyball and to define some training terms used throughout this document and Volleyball Canada's NCCP material.

Performance - The result, manner, or quality of carrying out a task. What is accomplished, contrasted with capability (Webster dictionary). Performance therefore refers to what the athlete can do now, and it can fluctuate over time.

Volleyball demands – The factors that impact performance. In Volleyball, they can be grouped into three main categories: cue reading, decision- making, and skill execution.

Cue-reading - The ability to detect relevant information during the action. For instance: own position relative to others on the court; position of teammates and opponents; ball speed and trajectory; a sign that indicates what a player may do next; etc.

Decision-making - The ability to process the information gathered during play and choose the right options for action (what to do, where, when, and how) - and do so in a timely fashion.

Execution - The ability to perform effectively and efficiently the various offensive or defensive skills or actions that are required by specific game situations, i.e., to carry them out in a way that is mechanically sound, with the adequate degree of speed, power, range of motion, control, and accuracy, as well as with consistency throughout the game. Execution is supported by a range of athletic and mental abilities.

Athletic abilities – The physical attributes that support performance from a motor and metabolic (energy production) perspective. Some important athletic abilities are described in the following pages.

Mental abilities – The aspects that affect how an athlete behaves while performing. To achieve success, appropriate levels of arousal, focus, self-control, stress management, and resilience must be demonstrated throughout each game. Mental abilities may influence the expression of other performance factors/attributes.

Fatigue – A decrease in power output (intensity), a decline in the quality of execution, or an increase in the frequency and/or magnitude of errors that can be observed over time during an exercise bout, a training session, or a competition. Fatigue may be caused by a variety of physiological or neurological factors, and it typically occurs as a result of performing a high-intensity effort, a prolonged effort or task, or a series of efforts or tasks over and over again within a given time frame. Fatigue is a normal consequence of many training or competition activities. Adequate recovery strategies (time; rest; sleep; hydration; nutrition) are necessary to avoid a state of excessive fatigue and a drop in the athlete's performance capabilities.

Overtraining – A persistent state of fatigue that can occur over time because of incomplete recover, excessive training loads (too intense or too frequent), or a combination of these factors. Overtraining is characterized by a decrease or a stagnation of performance, and the athlete's incapacity to adapt to the training stimuli. A host of physiological, psychological, or biochemical signs and symptoms can be associated with overtraining, but those can vary between individuals. However, a decrease in the athlete's general sense of "well-being", chronic fatigue, pain in the muscles upon rising, and a poor quality of sleep could be signs that precede overtraining. The type of fatigue and perturbations that accompany overtraining are are not reversible in the short term. When an athlete suffers from overtraining, an extended period of time—several weeks or even months—may be required for recovery. Under such conditions, training must be significantly reduced et must resume very progressively.

Intensity – The power output (amount of work per unit time) associated with a task or effort. The concept of intensity can also be viewed relative to the overall demands of a sport: in addition to the physical and metabolic demands of the task, one can also factor in the technical challenges associated with it, as well as the perceptual (cue reading) and cognitive (decision-making) requirements, as well as the prevailing conditions (e.g., available time).

Endurance (athletic ability) – The ability to delay the onset of fatigue while performing a task under a given set of conditions. Conditions may relate to variables such as exercise mode (i.e., running; cycling; swimming; etc.), type of effort (continuous; intermittent), effort intensity and duration, nature of recovery periods if provided (passive or active; length and intensity of active recovery periods), environmental conditions (ambient temperature and humidity; altitude; wind; etc.), or the status of the individual (trained/untrained; nutritional and hydration status at the start of the activity; fatigue resulting from prior efforts; health; etc.).

Note: During exercise, the concept of endurance may therefore be applied to efforts of various intensities (e.g., short duration all-out efforts, or prolonged low to moderate intensity efforts), the key variable being the length of time the effort can be sustained or the number of times it can be repeated without a decrease in power output.

Maximum Strength (athletic ability) -The highest level of tension or force generated by a muscle or muscle group during a maximum contraction, regardless of the duration of the contraction. Because most sport movements involve some type of acceleration (change in speed per unit time), an alternative definition can be the highest level of tension or force generated by a muscle or muscle group during a maximum contraction at a specified velocity.

Speed-Strength (athletic ability) - The ability to perform a muscle contraction or to overcome a resistance as fast as possible, for instance when accelerating a limb or an object. Typically, such contractions are very brief. The term "explosive strength" is often used as a synonym.

Strength Endurance (athletic ability) - The ability of a muscle or muscle group to perform repeated contractions at intensities below maximum strength. While this concept is typically used in situations where 15 to 30 repetitions of a movement are performed during training, it can be applied to any sub-maximal load and to movements performed at different velocities.

Core Strength - The strength of the muscles that stabilize and control the pelvis, the trunk, and the spine. An adequate level of core strength is required to assume and maintain an optimal trunk posture and to generate high level of power while performing many Volleyball skills that involve rotations.

Speed (athletic ability) - The ability to perform a single movement in the shortest possible time, to perform a series of movements at the highest rate possible within a short time frame, or to cover a given distance in the shortest possible time during an all-out effort of short duration (8 seconds or less). This athletic ability is closely related to speed-strength and to maximal anaerobic power.

Agility (athletic ability) - The ability to execute movements or to move rapidly, with precision, and with ease. Also, the ability to change direction quickly and efficiently while moving.

Balance (athletic ability) - The ability to achieve and maintain stability. There are three types of balance: (1) static balance: adopting a controlled and stable body position at rest; (2) dynamic balance: maintaining control during movement or stabilizing the body by performing muscular contractions to offset the effect of an external force; and (3) the ability to keep an object or another body under control either statically or while movement occurs.

Coordination (athletic ability) - The ability to perform movements in the correct order and with the right timing. In volleyball, this ability should be considered from two angles: (1) the way the athlete moves on the court, and (2) the actions involving the ball (eye-hand coordination). The latter refers to motor control involving eye movement, the processing of visual information, and the action of one or of both hands.

Flexibility (athletic ability): The ability to move a joint through its complete range of motion (ROM). Many factors impact ROM, including distensibility of the joint capsule, adequate warm-up, muscle viscosity, and tightness of ligaments and tendons ((American College of Sports Medicine, 201 4). The assessment of flexibility typically involves some form of stretching action aimed at determining the ROM.

Static stretches - A stretch during which the person stands, sits or lies still, extends a body part relatively slowly and with control until the ROM is reached, and then holds the position for a period of time (typically 15 to 45 seconds). No external forces are applied in this case.

Dynamic Stretches – A stretch where the amplitude results from performing movements actively but in a controlled manner. Such movements may involve twisting, lunging, or swinging, and often replicate how body parts typically move when some sport-specific actions are executed.

Energy – In Physics, the capacity for doing work.

Metabolism – The processes that occur within cells and that produce energy through various biochemical reactions. During exercise, muscle cells may get the energy they need to contract and perform work from a variety of sources and pathways. Energy production can occur at a very fast rate anaerobically (i.e., without the need for oxygen), or at a somewhat slower rate aerobically (i.e., with oxygen being involved). During exercise, aerobic and anaerobic processes complement each other to meet the "energy production demands", and are somewhat intertwined. While it is beyond the scope of this document to review how the anaerobic and aerobic metabolic pathways work, it remains important to know a few essential points about them. The key variables that impact to what degree energy will be produced aerobically or anaerobically are intensity, effort duration, whether the effort is continuous or intermittent and in the case of intermittent efforts, the length of the pauses and whether they are active or passive. As a rule of thumb, the higher the intensity is, the shorter the length of the effort will be, and the more energy will be obtained from the anaerobic pathways. With this is mind, active muscles typically get most of the energy they need from the anaerobic energy production pathways during the first few seconds of an effort (particularly if it is intense and was preceeded by a pause), or whenever intensity increases significantly or suddenly and exceeds the rate at which aerobic pathways can provide energy. On the other hand, most of the energy is supplied by the aerobic metabolism at rest, during low to moderate intensity exercise, or after 45 seconds or so during an intense exercise. The intermittent nature of Volleyball, as well as the high intensity, speed, and power associated with most actions performed during play, make it a sport where anaerobic energy pathways play a key role. This being said, aerobic energy producing systems should also be developed to an adequate level.

Maximal oxygen consumption - The highest amount of oxygen the muscle cells of a person can utilize to produce energy aerobically during an intense effort involving large muscle groups (e.g., running, cycling; arm cranking; etc.). The corresponding abbreviation is VO2 max where V refers to the volume and O2 to oxygen. A person's VO2 max can be improved significantly as a result of training, though the upper limit is genetically determined. The key factors determining VO2 max are maximal cardiac output (the maximum amount of blood the heart can pump per unit time), the amount of oxygen that can be carried by the blood, and the ability of muscle cells to use the oxygen delivered to them to produce energy. Two common ways of expressing VO2 max are liters per minute (L/min), or ml/kg/min to account for the body mass of the athlete. For a given VO2 max expressed in L/min, a person with a lower body mass will have a higher VO2 max expressed in ml/kg/min.

Maximal aerobic power - The work output that can be generated at an intensity corresponding to VO2 max. The corresponding abbreviation is MAP. In addition to VO2 max, a person's MAP is also determined by his or her efficiency at producing the required movements during effort. If individuals A and B both have the same body mass and VO2 max, but B has a superior technique and is therefore more mechanically efficient, their MAP will be higher.

Maximal anaerobic power - The highest work output that can be generated by a person during an all-out effort. Because intensity will be very high, fatigue will manifest itself quickly, typically within a few seconds.

Anaerobic endurance – The ability to delay the onset of fatigue and minimize the decline in power output during a very intense effort whose intensity is significantly superior to MAP, and where a high percentage of the energy is provided by the anaerobic pathways. Protocols for estimating anaerobic endurance typically require the person to exercise at very high intensity for 30 to 90 seconds. In some publications, the term anaerobic capacity is used as a synonym.

Neutral sleeping position - Sleeping with the spine straight, from the head and neck all the way down.

