PREVENTION. CARE. RECOVERY.
Te Kaporeihana Āwhina Hunga Whara

PLAY SMART. GO THE DISTANCE.

ACC SportSmart Reference Resource

ACC SportSmart

accsportsmart.co.nz

CONTENTS

ACC 7170

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Background – what is ACC SportSmart?

ACC SportSmart is a sport performance and injury prevention framework with associated programme resources. The ACC SportSmart programme, first published in 1999, has been successfully adapted in collaboration with national sports organisations (e.g. RugbySmart, NetballSmart) and international sports organisations (e.g. BokSmart).

ACC SportSmart has been substantially updated using research and evidence of best practice. The panel of experts responsible for the update were from AUT University, High Performance Sport New Zealand, Sport New Zealand, the University of Otago and national sports organisations, and included sports science and sports medicine experts from Australia and New Zealand.

ACC SportSmart provides advice on how to improve performance by minimising the risk of injury for everyone who is physically active.

All coaching policies, educational documents and curricula should have clearly identified and consistent content on injury prevention to help ensure that strategies to minimise injuries become one of the major elements of coach/trainer knowledge, attitudes and behaviours.

ACC SportSmart is intended for:

- secondary school physical education teachers
- tertiary institution tutors and lecturers
- all national sports and sports training organisations
- secondary and tertiary students
- everyone who is physically active.

Everyone is encouraged to integrate the ACC SportSmart principles with their sports and activity-related education programmes, policies and practices.

Everyone needs to take responsibility for injury prevention in sport. Lead agencies (e.g. ACC, national sports organisations, Sport New Zealand) are responsible for developing and directing sports injury prevention strategies, while other organisations (e.g. sports clubs, sports trusts, schools) can implement the strategies at the community level and are vital to their success. Personal responsibility is key to reducing the risk of injury and ensuring that performance is enhanced and enjoyment is maximised.

Welcome to ACC SportSmart – how it works

ACC SportSmart is a multifactorial programme that aims to help reduce the risk of injuries among athletes so that they can maintain and improve their performance. ACC SportSmart uses the four Es of injury prevention: Education, Enforcement (laws and rules of the game), Engineering (player equipment) and Environment (physical and behavioural).

The ACC SportSmart principles

1. Player profiling
2. Physical conditioning
3. Psychology
4. Skill and technique
5. Food and fluid
6. Player wear
7. Athlete environment
8. Injuries
9. Target populations

Within each ACC SportSmart principle, information is provided on:

What – a definition of the ACC SportSmart principle

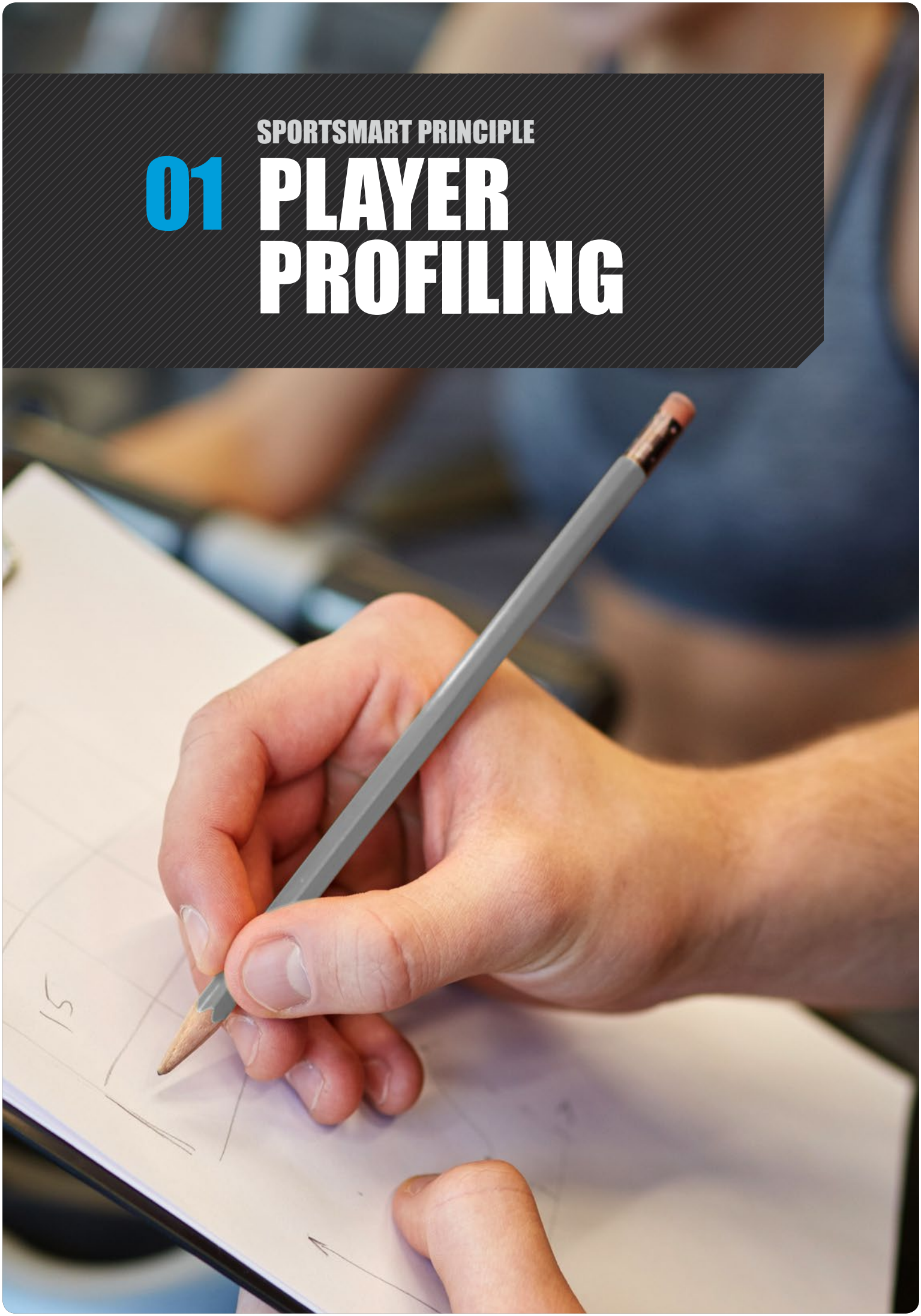
Why the point is important – evidence for reducing injury risk when the ACC SportSmart point is addressed

How to implement the point in sport – practical advice and examples from national sports organisations on how to implement the ACC SportSmart point

Further information and resources – literature and best-practice information on the ACC SportSmart point

SPORTSMART PRINCIPLE

01 PLAYER PROFILING



PLAYER PROFILING
KEY POINTS

What	⏩	A player profile describes a player's physical and behavioural composition.
Why	⏩	To help identify strengths and weaknesses in a player's physical and behavioural composition that may predispose them to injury.
How	⏩	Athlete profiling needs to be multifactorial and include general health, physical health, psychological health, neuromotor function and physique.
When	⏩	Players' functional movement abilities and muscle imbalances should be established pre-season to identify those who are predisposed to injury.
Follow-Up Actions	⏩	Injury prevention strategies tailored to the individual athletes should be developed, based on the issues identified in their profiles. Follow-up screening is needed to assess the effectiveness of any strategies implemented.
Important Points	⏩	In particular, the risk of ACL knee ligament, hamstring and ankle sprain injuries should be profiled. The injury profiles of specific sports need to be understood so that additional risk factors can be profiled.

"I'VE CREATED A QUESTIONNAIRE FOR MY CLIENTS THAT IS NOW MORE HOLISTIC, BASED ON PAGES 7-14."

Ben, personal trainer.

What is an athlete profile?

The purpose of developing a player profile is to identify athletes who are at risk of specific issues (e.g. musculoskeletal injuries, eating disorders, heart problems), to determine an athlete's fitness for play, or to establish a baseline measure from which conditioning programmes can be developed.

Why conduct an athlete profile?

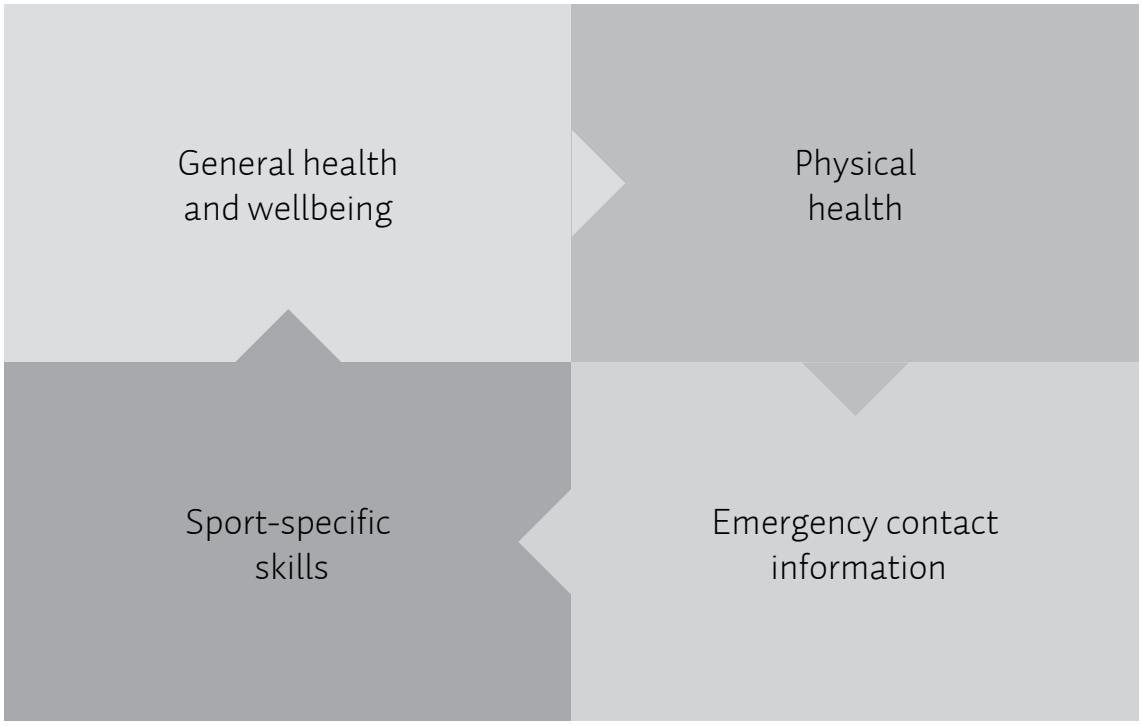
An athlete profile should be conducted to help identify strengths and weaknesses in a player's physical and behavioural composition that may predispose them to injury.

How to conduct an athlete profile

In the ideal situation, comprehensive screening for a player profile should cover their:

- general health and lifestyle
- physique via body composition
- physical health
- specific skill abilities and neuromotor function
- food and fluid consumption, including supplementation
- psychological health
- previous and current injuries
- emergency contact information.

For injury prevention, the minimum screening should cover:



In developing a player profile, the following need to be considered:

- When athlete profiling should be conducted (pre-season, during the season, post-injury and return to sport, follow-up screening to identify progress).
- How to respect privacy issues during screening.
- The types of athlete profiled: children, sub-elite athletes, elite athletes, community athletes.
- Sport-specific screening needs.
- How to address lifestyle factors that may contribute to injury, such as diet and psychological issues.
- How coaches can address movement pattern issues before loading the athletes.

When the coach has access to a variety of sports and healthcare professionals (i.e. doctors, physiotherapists, strength and conditioning coaches, nutritionists, sports psychologists), screening should be developed and conducted as a collaborative effort.

General health and lifestyle

A general health assessment needs to include medical information such as chronic illnesses (e.g. epilepsy, asthma), allergies and medications. The implications of medical screening need to be addressed as this is an ethical dilemma. Create a health questionnaire that asks players to:

- list their known medical conditions and how severe they are (e.g. they may have severe asthma or mild epilepsy)
- list their previous injuries, the treatment they received and their treatment providers
- provide information about drug use.

If possible, have a doctor confirm any undiagnosed medical conditions. Provide examples of medical conditions and injuries to prompt players' memories.

Lifestyle factors can have a large role in potential injury risks, whether they are nutritional (e.g. insufficient nutrition, high alcohol consumption), psychological (i.e. personal characteristics or behaviours) or general (drug taking, smoking, economic status, marital status, employment status).

Key lifestyle issues for the individual sport should be identified and an approach to address the issues decided, so that the coaching staff can progress smoothly with the key goals (i.e. developing the athletes/team in their sport). This information will help in identifying

the suitability of training and therefore reduce the players' risk of injury or improve their performance. For example, a player who works on a construction site for 40 hours a week may need a different fitness programme from someone who works in an office.

Some issues, such as basic nutrition for athletes and understanding the injury risks involved with different aspects of play, can be addressed in group seminars/workshops. Others may need more individualised treatment, such as to address disordered eating.

Physique via body composition

Physique can be important for performance in sport and can also affect the risk of injury. Physique assessments can be conducted easily and reliably with surface anthropometry. The sum of skinfolds can be tracked and is a valid measure. Percentage of body fat equations should not be used as there are more than 100 equations based on gender and ethnicity. The International Olympic Committee's guidelines on body composition should be taken into account.

Physical health

A physical assessment by a sports trainer or physiotherapist can identify factors that may put players at risk of musculoskeletal injury. Physical health assessments need to include speed, endurance, strength and power, flexibility, balance, agility, and anatomical and biomechanical abnormalities. The construction of the physical assessment will depend on the physical requirements of the sport. The results can be used to determine fitness to play, strengths and weaknesses and baseline levels for return-to-play criteria.

Physical assessments may cover:

- endurance/stamina
- isokinetic strength
- joint laxity
- balance and flexibility (i.e. the Star Excursion Balance Test)
- joint range of motion
- muscle size
- left to right and anterior to posterior differences (in any of the above).

The information gathered from a physical condition screening questionnaire can be used to measure the effectiveness of training programmes and develop conditioning programmes targeted at individual weaknesses. For more information, see the SportSmart 'Physical condition' principle 2.

Specific skill abilities – neuromotor function and functional movement screening

Specific skill ability screening needs to consider the movement patterns in the sport (e.g. jumping and landing, change-of-direction tasks). Screening should enable the identification of movement patternweaknesses.

The majority of functional movement screening studies have focused on the lower body, where injuries are most prevalent in many sports. In some sports (e.g. tennis) a left to right imbalance is a result of the nature of the game; however, imbalances can also lead to injury. Isokinetic strength testing can reveal side-to-side weaknesses or agonist/antagonist imbalances and can also be used to assess the progress of rehabilitation when a player is returning from injury. In this case a percentage of the baseline strength should be determined and achieved before the athlete is allowed to return (usually 80% of the unaffected side). As with all other protocols associated with screening, this should be decided on before the season begins based on relevant research in the area.

Two screening tools – the Movement Competency Screen and the Functional Movement Screen – have been shown to identify incorrect movement mechanics with good reliability[1].

Emergency contact information

Emergency contact information needs to be recorded and easily accessible in the event of an emergency.

The **Movement Competency Screen** was developed to enable strength and conditioning coaches and physiotherapists to identify issues in individuals' movement patterns that need to be addressed before further load (in weight training programmes) is added. This is particularly important if the athlete is to be provided with specific strength and conditioning training.

While some skill is required to use the screen, the information provided is useful in determining the level of loading (i.e. body weight, bands, assisted weight, weight, plyometrics, ballistics) at which an athlete should start and when they are ready to progress. An important issue to be aware of is the learning effect: coaches should be careful not to correct specific aspects of technique during the screening. Instead these issues should be addressed when prescribing the strength and conditioning programme, by focusing the athlete on specific parts of the movement (e.g. tracking of the knee). For more information, see the SportSmart 'Skill and technique' principle 4.

Food and fluid consumption, including supplementation

Nutrition should be assessed where possible. For more information, see the SportSmart 'Food and fluid' principle 5.

Psychological health

A psychological health assessment needs to include stress, perception ability and cognitive tests for sports where concussion injuries are relatively common.

Concussion is another issue that needs to be addressed early with athletes who participate in sports with a high chance of head impacts. Cognitive testing for baselines should be implemented and athletes should be asked how many previous concussions they have had during the general health screening section. Further testing should be considered for athletes who have had multiple previous concussions. Once the number of head injuries has been declared, athletes should be made aware of the procedures surrounding concussion, including tests that may be performed, time away from play, and minimal requirements to return to play. Athletes should agree to these conditions in order to avoid later conflict. For more information, see the SportSmart 'Psychology' principle 3.

These protocols should cover:

- informed consent
- storage (times and places)
- record destruction
- data release (to healthcare professionals, families, media, the athletes)
- the athletes' rights.

Previous and current injuries

A questionnaire that includes injury history and current injuries is needed to identify the risk of re-injury and enable the implementation of prevention strategies for specific injuries. For more information, see the SportSmart 'Injuries' principle 8.

When athlete profiling should be conducted

Athlete profiling may be conducted pre-season, during the season and post-injury and return to sport, with follow-up screening to identify progress.

Screening should occur at the beginning of the sports season, preferably before any participation, and follow-up screening should be scheduled on a regular basis. Some

aspects of screening may need to be reassessed more often, such as movement competency every six to eight weeks, whereas psychological screening may only be required once or twice in a season. Follow-up screening is used to record an athlete's progress, an athlete's readiness to progress with certain training, or an athlete's fitness to return to play after injury.

The purpose of the initial pre-season screening is to provide a generalised assessment of an athlete's readiness to participate in training and competition. Any problems identified during the screening can be further investigated with more in-depth and specific testing.

Baseline and follow-up results can be used to determine an athlete's readiness to return to play after an injury. Detailed records of their progression may also provide insights into the factors that combined to produce the injury, allowing coaches and healthcare professionals to tailor treatment, advice and training to the athlete's needs.

Schedule follow-up screening at an appropriate time to ensure that players get consistent assessments. If a thorough pre-season screening is done, a follow-up physical assessment mid-season is appropriate. Remember to record any changes in players' medication. Compare information collected during follow-up with the baseline results, to measure player improvements and training effectiveness.

How to respect privacy issues during screening

The results of screening should be held in athletes' files, and the athletes encouraged to take their files with them when moving between teams (ideally this information should be held in secure electronic systems by national sports organisations' medical teams). As screening involves recording personal data, it is important that privacy protocols are developed before any data is collected.

All information on the protocols for data collection, storage and release should be provided in writing to athletes before the data collection starts, as part of gaining

MORE THAN
5000

Kiwis suffer an ACLknee ligament injuries every year. For some that means the end of promising sporting careers.

informed consent. Children under the age of consent should have parents or guardians with them during the screening process, from whom consent is required.

It is important that athletes understand the requirements of the screening and what will be done with the information. In some cases ethical issues will arise, so the coaching and management team should have a clear idea of how such situations will be handled. The most topical issue is that of heart problems in otherwise healthy athletes. With the recent sudden deaths of a number of athletes, screening for heart conditions has become more popular. However, is it ethically acceptable to prevent an individual participating in sport should a heart condition be identified?

Things to consider in this situation include:

- the impacts on selection
- the liability of the team, coach and other players
- the management of the athlete (e.g. regular screening).

Types of athlete profiled

Children, sub-elite athletes, elite athletes and community athletes may require different types of screening for their player profiles. Screening should be tailored to the needs of the sport, the level of the athlete and their age. While physical screenings of children will be less demanding than those of adults, they should consider the children's specific vulnerabilities (i.e. when it is safe to apply load) and limited attention spans. And given the often limited resources available to undertake comprehensive screening of sub-elite athletes, the coach/management needs to determine what is essential and what is feasible.

Sport-specific screening needs

Each sport needs to consider the priority of the screening factors and how the information will be used to help reduce the risk of injury in the sport. It also needs to understand the most frequent and the most severe injuries, and the mechanisms that result in those injuries. For more information, see the SportSmart 'Injuries' principle 8.

How to address factors identified in the player profile that may contribute to injury

Having plans and protocols that work alongside the screening tools enables those working with athletes to make the best use of the information gathered during screening to prevent injuries.

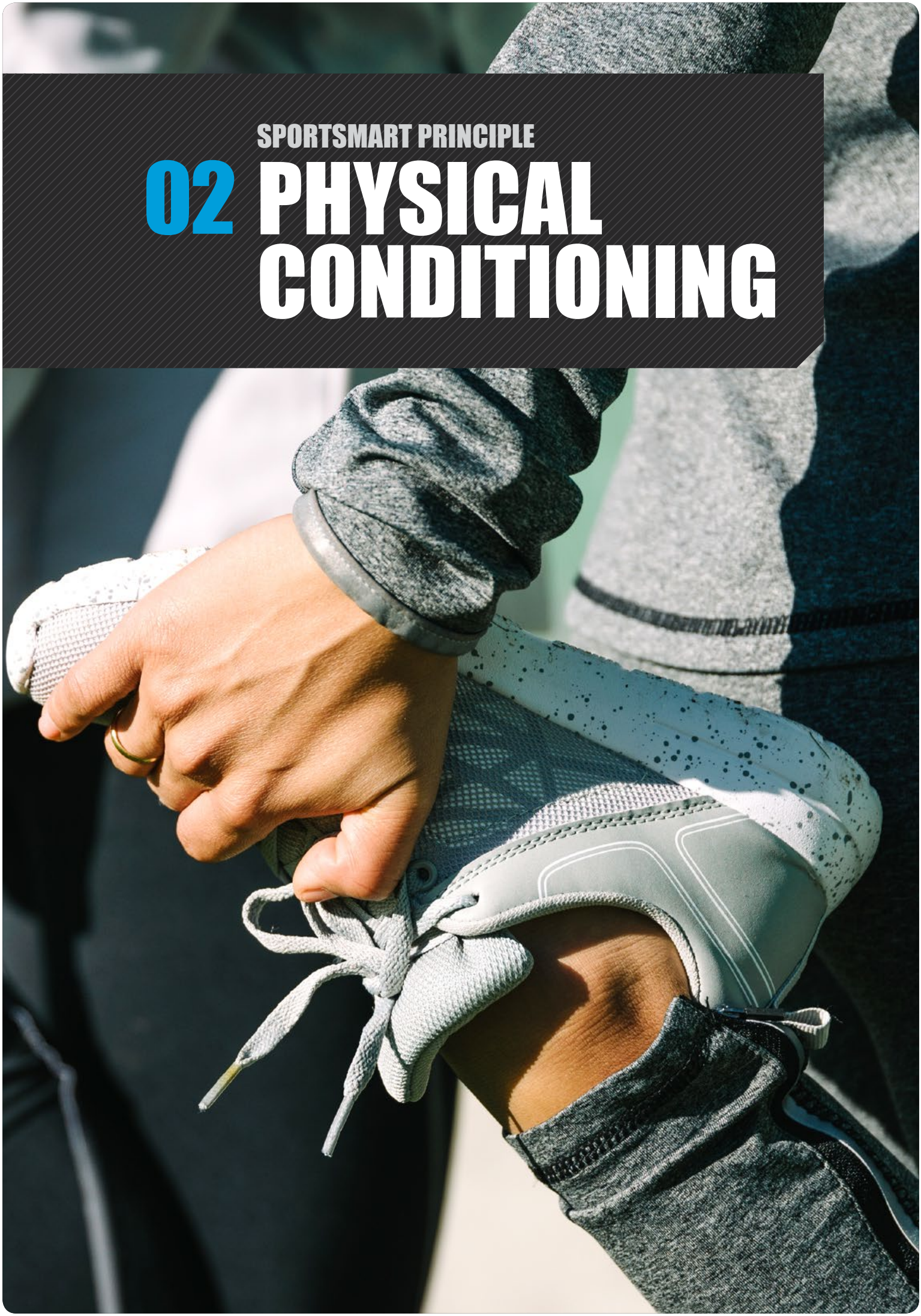
Further information and resources

Screening forms can reveal key information to help enhance performance levels and keep players injury-free. Respect the confidential nature of the information that is given, and keep these forms safe. Choose a screening form that best suits your sport and your team's level of activity. The screening forms have been created to collect the right amount of information for the selected activity level. Screening forms for general sport include:

- Social (PDF74K)
- Competitive (PDF74K)
- Junior (PDF74K)
- Masters (PDF74K)
- International Olympic Committee guidelines*.

SPORTSMART PRINCIPLE

02 PHYSICAL CONDITIONING



PHYSICAL CONDITIONING
KEY POINTS

What	⏩	Player physical conditioning involves preparing the musculoskeletal and neural systems of the body for sport. The physical conditioning components include warm-up and cool-down, flexibility, strength, endurance and power.
Why	⏩	To help improve a player's physical composition to improve their performance and reduce their injury risk. In particular the FIFA 11+ warm-up programme should be used to help reduce the risk of knee ligament, hamstring and ankle sprain injuries.
How	⏩	Player physical conditioning needs to be multifactorial, with warm-up and cool-down, flexibility, strength, endurance and power components.
When	⏩	Warm-up and cool-down are required for any training or competition. A physical conditioning programme should be planned based on the level of the athlete.
Follow-Up Actions	⏩	The strength and conditioning programme should be monitored to assess its effectiveness in improving performance and reducing injury risk.
Important Points	⏩	A single physical conditioning injury prevention programme is unlikely to be effective across multiple sports and between genders. Conditioning protocols for injury prevention should be tailored to individual sports and genders based on injury risk profiles.

"I GOT LOTS OF IDEAS FROM THE FIFA 11+ WARM-UP PROGRAMME ON PAGE 21. IT GETS THE TEAM READY TO PLAY."

Nic, football team organiser.

What is athlete physical condition?

Athlete physical conditioning involves preparing the musculoskeletal and neural systems of the body for sport. The physical conditioning components include warm-up and cool-down, flexibility, strength, endurance and power.

Physical conditioning is all about making sure that the athlete reaches competition in a state that allows them to perform with maximal effort and enjoyment. Conditioning should be specific to the demands of the sport, targeting areas of weakness to reduce the risk of injury and maximise performance. Physical conditioning incorporates a number of aspects, including endurance, speed, strength, power, flexibility and balance. Each aspect's emphasis depends on the sport, the athletes' ability, age and gender and the level of competition.

Why improve athletes' physical condition?

The aims and benefits of improving a player's physical composition are improvements in performance and reduced injury risk. In particular the FIFA 11+ warm-up programme should be used to help reduce the risk of knee ligament, hamstring and ankle sprain injuries.

Warming up before playing sport prepares the mind, heart, muscles and joints for the upcoming event. It improves performance, helps players to become mentally prepared, and is a great step towards injury prevention. Cooling down is equally important. It helps the body to recover and gradually return to its normal temperature.

Research has shown that the use of a structured warm-up may be beneficial in preventing injuries. Exercises such as the Nordic hamstring have been shown to reduce knee injuries in female football and basketball athletes and in military recruits.

Warm-up programmes generally require minimal equipment and incorporate the following aspects:

- Aerobic warm-up
- Stretching
- Targeted strengthening
- Balance exercises
- Sport-specific agility drills
- Landing techniques.

It is important to note that injury prevention results are improved when the coach believes in the programme and there is good compliance from the athletes. Coaches should therefore be involved in developing sport-specific warm-up regimes or modifying one of the existing warm-up programmes, such as the FIFA 11+.

Specific neuromuscular **warm-up programme**s aim to address a number of injury risk factors. The aerobic warm-up gets the muscles moving, the joints lubricated and the blood moving around the body, as well as focusing the athlete's mind on the work.. Stretching in the warm-up is designed to loosen up the muscles prior to exercise and prevent excessive tightening, which can lead to musculotendinous injuries. By incorporating strengthening work in the warm-up, the coach is able to ensure that all athletes are doing strength work that is key to the specific sports performance and injury prevention. Strengthening can target muscle imbalances that develop as a result of a sport (e.g. strengthening the non-dominant kicking foot) or weaknesses that have been shown to be specific to an athlete group (e.g. knee stabilising muscles in females).

Balance exercises develop proprioceptive feedback in the ankles and knees, improving the athlete's ability to sense when the joint is moving outside stable limits and correct it before injury happens. This is important in all situations that involve a single leg stance, changes of direction and unstable surfaces (which can include a pitted field surface after wet weather). Sport-specific agility drills build on the balance and strengthening exercises by making the movements more dynamic and specific to what will be encountered during training and game situations, but in a more controlled environment. This develops the athletes' proprioceptive requirements for such movements and strengthens the muscles required to execute the movements safely (within individuals' injury boundaries).

When **landing** is required for a sport, such as netball, specific landing drills should be incorporated into the warm-up to teach good landing technique. The athletes should start off landing on both legs, progress to single-leg landing (focusing on both legs) then incorporate other sport-specific skills such as turning in the air, taking single steps after landing and landing and changing direction.

Being conditioned for sport means greater enjoyment and better performance. It reduces the risk of injury so that athletes can play to their maximum potential. This doesn't always mean they need extensive training – just that the programme must be right for the style and level of the sport or activity.

Neuromuscular control training has been shown to be beneficial in improving performance and reducing rates of injury. The training regimes address specific strength problemsas well as enhance proprioception and balance. Injury profiles and the physical

demands of play differ between genders and positions of play. Therefore, in an ideal situation, a pre-screen of athletes followed by individualised conditioning programmes targeting identified weaknesses and potential injury risk factors should be utilised. However, a generalised conditioning programme delivered to the entire team has been shown to reduce injuries and is more cost effective – so in a team sport the use of a single conditioning programme delivered regularly to the entire team is also useful.

The **injury profiles** of the specific sport and sportspeople should be investigated before designing the conditioning programme. For example, a sport with a high hamstring injury rate should have a different programme from a sport with a high ankle sprain rate. In all sports where balance and change of direction are needed, proprioception training should be provided, with unstable surfaces and limited visual feedback during some tasks.

Any aspects of **conditioning** should be progressed slowly over time, with progressions that include increasing the complexity of the task, adding decision-making, increasing intensity, increasing volume, increasing load and reducing stability. Information gathered from the pre-screening process should be used to inform the stage at which an athlete should begin. A decision to progress the athlete should be made based on the results of follow-up testing.

While the pre-season is seen as a time to develop the different aspects of physical conditioning, the majority of injuries occur during this period so the training load should be monitored carefully. Should injury numbers be high or increase, a reduction in the training load should be considered, as remaining injury free is essential for good performance.

Children's training should be approached with caution, especially for a competitive sport. The aim of sport is to provide a fun environment through which children can learn physical, social and emotional skills. The International Olympic Committee's Consensus Statement on Training the Elite Child Athlete provides an overview of appropriate levels of physical conditioning.

Boys and girls tend to respond to physical conditioning similarly once their initial fitness is accounted for; however, differences begin to emerge between the genders as puberty progresses. Maturation rates differ from individual to individual, so the progression of training load should be based on testing rather than age.

Children who are active in sport should be carefully monitored and any signs of prolonged focal pain should be addressed immediately due to the increased risk of overuse injuries in this age group. As with adult athletes, training should be carefully divided into periods to allow adequate recovery. Other stresses, including school and parental pressure, should be monitored to prevent overtraining.

How to improve athletes' physical preparation

Players' physical conditioning needs to be multifactorial, with components that include warm-up and cool-down, flexibility/stretching, strength, endurance and power.

Athletes must warm up and cool down for every training session and game. A physical conditioning programme should be planned based on each athlete's level.

The strength and conditioning programme should be monitored to assess its effectiveness in improving performance and reducing injury risk.

The type of warm-up and the ordering of the specific aspects depends on the sports and sportspeople. While stretching posters are no longer best practice, posters displaying a typical warm-up protocol for gym-goers may still be the best way to target this population. Alternatively, warm-up apps may provide easier access to this group, allowing individuals to choose from a range of warm-up activities that have attached videos to facilitate good technique and appropriate progression. Children, on the other hand, require minimal warm-up and are easily bored, therefore warm-up protocols should be short and progress quickly to game-like activities. Teaching warm-ups in children is likely to be beneficial later in life as they develop the habit, rather than deliver immediate injury prevention gains.

In coach-led situations, warm-up protocols can incorporate sport-specific activities. It is recommended that the movements progress from slow through to dynamic to plyometric to loaded, so that drills gradually increase in complexity – for example, progressing from walking to striding to lunging and then agility ladders. Adding an element of concentration later in the drills helps to prepare the athletes mentally (e.g. partners walking along, one drops a drink bottle and the other has to react and catch it, or adding instability such as BOSU or Swiss ball activities). Such activities improve mindfulness and start prepping the athletes for reactive tasks they may incorporate later in the training session. Balance and proprioceptive tasks should be incorporated into warm-ups for all athletes.

It is recommended that warm-ups follow a regular pattern to help in the gradual shift of concentration (e.g. create four different warm-up structures that allow for the incorporation of different sport-specific skills or drills, as well as the addition of a variety of mental challenges). Current best practice is not a black-and-white warm-up, strengthening, training progression, but a seamless progression from low to high intensity and loading.

While there is debate about the benefits of stretching, the literature agrees that dynamic stretching prior to activity is likely beneficial in sports with high muscle-injury rates. In other sports, long-term flexibility is likely to be important for injury prevention, so incorporating a stretch session at the end of a session may be useful in ensuring

compliance. Alternatively and if time is short, athletes can be given stretching regimes to complete in their own time.

Each sport should design and develop its own warm-up programmes or collection of warm-up structures. When presenting or distributing to coaches, warm-up procedures should be targeted at the performance benefits rather than injury prevention. While injury prevention may be the aim, performance is always a higher priority for athletes and coaches.

Warm-up

Warming up prepares the body for physical activity. It prevents a rapid increase in blood pressure, improves blood flow to the heart, increases muscle temperature and makes muscles more pliable. In warming up, players improve their performance and reduce the risk of injury. Warm-ups should focus on aerobic exercises followed by stretching and finally sport-specific exercises.

The suggested best-practice programme for warm-up is the FIFA 11+ programme. This programme has been shown to help reduce the risk of lower limb injury – in particular knee ligament injury.

FIFA 11+

Strength and conditioning

A physical conditioning programme should include the following types of conditioning:

Type of conditioning	Description	Exercises
Strength	Players can apply force against resistance.	▪ Body weight strength training. ▪ Resistance training using stretch bands, free weights or machines.
Speed	Enables players to move the body or parts of the body rapidly.	▪ Sprint training. ▪ Short bursts of speed integrated into the normal training session.
Power	Players can combine speed and strength to produce explosive force.	▪ Hill sprints. ▪ Squat jumps.
Flexibility	Provides a greater range of pain-free motion.	▪ Follow the stretches in warm-up, cool-down and stretch.
Endurance	Allows players to repeat the same action or exercise continuously without getting too tired.	▪ Stair walking or circuit training. ▪ Brisk walks, jogs or runs each week.
Balance	Reduces the risk of tripping, falling or landing in an awkward position, and the risk of overbalancing on uneven surfaces.	▪ Walking along a straight rope on the ground. ▪ Balancing on one leg with eyes closed.

Aerobic exercise

Aerobic exercise involves doing some easy exercise (e.g. jogging, cycling and skipping) continuously for 5-10 minutes to raise the body temperature so the body is sweating lightly.

Flexibility

Flexibility exercises should stretch all the major muscle groups used when playing sport. Choose dynamic methods where possible.

ACC 7520 Warm-up stretching poster – Colour

Sport-specific exercises

Sport-specific exercises are those frequently used in a sport, such as short sprints, shuttle runs, changing direction quickly, shooting drills and defensive exercises. For more information, see the SportSmart 'Skill and technique' principle 4.

Cool-down and stretch

Cooling down may reduce the risk of injuries and helps with flexibility. Cooling down should last 5-15 minutes and include aerobic exercise, stretching and recovery.

Slow jogging around a field or court is one of the best ways to cool down. Alternatives to jogging include low-intensity cycling and brisk walking.

Cooling down should last 5-15 minutes and include aerobic exercise, stretching and recovery.

Stretching to improve range of motion

Athletes should stretch for 10 minutes after light jogging. For greater flexibility, static stretches should be held for 60 seconds during the cool-down.

ACC 7520 SportSmart Warm Up poster – Colour

Recovery

After any exercise the players must rehydrate. Treat any sprains, strains or bruises with the R.I.C.E.D. (Rest, Ice, Compression, Elevation, Diagnosis) procedure. See page 82 – 'Injury management'.

Conditioning principles

- Training must be planned, directed and purposeful.
- Follow the F.I.T.T.E. (Frequency, Intensity, Time, Type, Enjoyment) principle. Each element should be specified in the training programme and developed for each player's needs. See page 27.
- Progressively increase the training intensity and/or duration as players improve their conditioning levels.
- Ensure that training is specific to the players and sport or activity.
- Maintain physical condition with two or three workouts every week.
- Reduce the amount of training during competition to prevent burn-out and fatigue.

Conditioning process

1. Identify the sport and position requirements.
2. Evaluate the players' current condition.
3. Determine the players' training needs.
4. Design and implement the training programme.
5. Monitor progress and evaluate the players' condition.

Note: Steps 3-5 are a continual process.

Aerobic endurance training

Aerobic endurance training may include activities such as walking, running and circuit training.

General guidelines

- Good shoes are important if walking or running is the principal form of aerobic exercise.
- Warm up before training or competing to improve performance and decrease the amount of stress on the heart.
- Follow the F.I.T.T.E. principle to achieve an increase in aerobic endurance.

Individualisation

Prescribe aerobic endurance exercises based on age, gender and fitness level and encourage more vigorous activity in those who are young and healthy.

Progressive overload

Progress from:

- three alternate days to five or six sessions per week.
- 10-15 minutes to 40-60 minutes depending on the players' playing levels.
- 60% to 80% HRmax (maximum heart rate) or from 5 to 8 RPE (rate of perceived exercise) using the Borg Category Ratio Scale.

Specificity

Select exercises that train the appropriate musculature. For example, to achieve running fitness (legs) do not go swimming (arms).

Intensity

- The heart rate maximum is usually calculated as 220 minus age.
- The heart rate for an activity can be determined after two to four minutes of all-out exercise in that activity.
- The heart rate is significantly lower (10-13 beats per minute) in arm exercises.

Health and safety considerations

- Make sure players have medical examinations before training, which include measures of blood pressure and resting heart rates.
- Supervise training programmes if a player has a poor health status.
- The potential hazards associated with long-distance running in young players are heel cord injuries, growth plate injuries, chronic joint trauma, thermal intolerance and shin splints. Distances less than two kilometres are recommended forthose under 12 years of age.

Strength training

Strength training is often thought of as weight training. It may include activities such as squats and press-ups.

General guidelines:

- Begin each session with a warm-up.
- Provide thorough instruction on the exercises. Competent and close supervision is vital in the beginning stages of the programme.
- Avoid single maximal lifts (where a player can lift a load once but not the same load twice in a row), in particular overhead lifts, until after adolescence.
- Progress exercises from using body weight with a low-volume load to traditional weightlifting exercises, with appropriate increases in volume and/or intensity.
- Progressively load the training, e.g. apply more load or more repetitions in small increments. A general rule is to increase the training load by no more than 5-10% per week. Some individuals may require a slower increase.
- Ensure adequate recovery between training sessions. A beginning-training frequency of two or three times a week is desirable.
- Include exercises for a variety of movements (squat, push, pull, press, lunge) and muscle groups. Where possible provide a balance between opposing muscle groups, e.g. quadriceps and hamstrings.

Health and safety considerations

- Players should be mature enough to be coachable and to follow prescribed safety and technique factors.
- Parents, coaches, health professionals and players should pay particular attention to exercise-related joint pain.
- Teach proper breathing. Players should avoid prolonged breath holds during repetitions to avoid blackouts or fainting.
- Ensure that players maintain the curvature of their spines during exercise.
- Never encourage children to lift more weight than they can comfortably manage.
- Ensure that correct techniques are used and that there is appropriate supervision at all times.

Example of progressive overloading

In this example the muscles are progressively overloaded by making the player's base of support less stable, or having greater body mass act on the muscles by changing the exercise from an incline press-up to a decline press-up.

1. Incline press-up – against a wall or stable object, e.g. a table.
2. Half press-up (from the knees) – on the floor.
3. Full press-up – on the floor.
4. Decline press-up – with feet up on a stable object, e.g. a table.
5. Incline press-up – with hands on a less stable object, e.g. a Swiss ball.
6. Decline press-up – with feet on a less stable object, e.g. a Swiss ball.

The F.I.T.T.E. principle

Keyword	Description
Frequency	Three to five times per week
Intensity	60–85% of heart rate maximum (HRmax)
Time	20-60 minutes per session
Type	Run, brisk walk, bike, swim, dancing, etc.
Enjoyment	Find an enjoyable activity and increase the likelihood of exercise adherence

Further information and resources

FIFA 11+

ACC 7520 SportSmart Warm Up poster – Colour

This stretching resource is an A1 composite poster of static stretches for the cool-down. To order, see Publications at acc.co.nz, phone 0800 844 657 or email sport@acc.co.nz.

SPORTSMART PRINCIPLE

03 PSYCHOLOGY

PSYCHOLOGY

KEY POINTS

What	⏩	The psychology principle is about preparing an athlete's mind for sport. The components of an athlete's psychological preparation include mental approach, levels of stress, fair play behaviour and risk-taking.
Why	⏩	To help improve a player's psychology and risk-taking behaviour to improve their performance and reduce their injury risk.
How	⏩	An athlete's psychological preparation needs to include mental approach, levels of stress and risk-taking components.
When	⏩	Athletes should be psychologically prepared for any training or game. A psychological preparation programme should be planned based on each athlete's level.
Follow-Up Actions	⏩	The psychological preparation programme should be monitored to assess its effectiveness in improving performance and reducing injury risk.
Important Points	⏩	Athlete psychology, mental approach, levels of stress and risk taking are all important in reducing the risk of injury.

"I USE PAGE 32 TO MENTALLY PREPARE MY TEAM BEFORE A MATCH, AND LOWER THE LIKELIHOOD OF INJURY."

Chris, rugby club coach.

What is athlete psychology?

Athlete psychology includes an athlete's mental approach, levels of stress, risk taking and fair play behaviour, which are all important to improve their performance and reduce their risk of injury.

Why improve athlete psychology?

Both conscious and unconscious behaviours are important injury risk factors, as are an athlete's injury preventionbehaviours and behaviours during practice and competition. Behaviours can be modified to increase the uptake of preventive interventions and to influence injury risks.

Although the focus is usually on external factors such as training regimes, equipment, coaching techniques and the repetitive nature of some sports activities, the role of psychological factors that may influence athletes' vulnerability or resilience to injury in sport is also important. Stress-injury models suggest that when faced with potentially stressful events, athletes undertake cognitive appraisal processes that can result in the events being interpreted as stressful. The associated physiological and attentional changes (stress response) that result may put the athletes at greater risk of injury. Whether an individual perceives a situation as stressful is moderated by their personality, history of stressors, and coping resources. Psychosocial factors relating to competitive sport anxiety and general life events are most consistently linked to injury risk.

Studies have investigated whether psychological interventions can prevent injury by reducing the effects of stress in an athletic setting. In these studies the participants were screened for factors considered to put them at risk of injury, such as high stress. Those deemed susceptible to stress took part in a psychological intervention programme. On completing the programme the members of the intervention group were less likely to get injured and also had fewer absences from training in comparison with the control group. In a recent study, psychological skills training resulted in a lower number of overuse and traumatic injuries in the intervention group, with the occurrence of overuse injuries decreasing to a greater extent than traumatic injuries.

In snow sports, athletes taking responsibility for their safety has been shown to have significant benefits for injury prevention. The issue of responsibility is of particular interest in children and adolescents.

How to improve athlete psychology

Athletes' psychological preparation needs to include mental approach, levels of stress and risk-taking components. It should be performed for any training or game, with the programme based on the level of the athlete.

The psychological preparation programme should be monitored to assess its effectiveness in improving performance and reducing injury risk.

Psychological issues such as anger should be addressed as quickly as possible in training and games, by either the coach or other players. Everyone involved in sport has a responsibility to maintain fair play and to hold others accountable. When a blind eye is turned to incidences of foul play, this can start to creep into the culture of the sport. Outside stress can also contribute to how an athlete behaves during competitionor practice. Coaches and sports organisations should address stress management with athletes, particularly young and professional athletes, so that they have methods of coping other than retaliating during the high stress and drama of play.

SPORTSMART PRINCIPLE

04 SKILL AND TECHNIQUE

SKILL AND TECHNIQUE
KEY POINTS

What	⏩	The skill and technique principle is about the way in which a specific sport skill (e.g. a rugby tackle) is performed. Good technique reduces injury risk and is essential in enabling players to participate fully and enjoy their sport. Player skill and technique development involves preparing the neuromuscular system of the body for sport. Skill and technique includes an understanding of the biomechanics of sport movements – particularly the fundamental movement patterns of coordination, jumping and landing, throwing and kicking, grip and posture and catching.
Why	⏩	To help improve players' skill and technique to enhance their performance and reduce their injury risk. In particular, techniques should be used to help reduce the risk of knee ligament, hamstring and ankle sprain injuries.
How	⏩	Player skill and technique development needs to use the neuromuscular system effectively and efficiently to enable fundamental movement skills to be performed. Sport-specific demands should be a focus.
When	⏩	Skill and technique programmes should be delivered in training, with applications in games. They should be based on the level of each athlete and the specific demands of the sport.
Follow-Up Actions	⏩	Skill and technique programmes should be monitored to assess their effectiveness in improving performance and reducing injury risk.
Important Points	⏩	Technique changes should be addressed early in the pre-season and reiterated often to ensure that they are second nature come competition time. It is important that rugby, league and football players practise both being tackled and tackling – and the roles should be reversed often in practice to ensure that they are conditioned to respond to both situations. Consider forces during movements and how these can be moderated.

What is athlete skill and technique?

Technique is the way in which a specific sport skill (e.g. a rugby tackle) is performed. Good technique reduces the risks of injury and is essential for players to participate fully and enjoy their sport.

Athlete skill and technique development involves preparing the neuromuscular system of the body for sport. An understanding of the biomechanics of sport movements is useful in developing skill and technique. The fundamental movement patterns of coordination, jumping and landing, throwing and kicking, grip and posture and catching are key.

Why improve athlete skill and technique?

The aims and benefits of improving a player's skill and technique are improvements in performance and reduced injury risk. In particular, techniques should be used to help reduce the risk of knee ligament, hamstring and ankle sprain injuries.

Technique is the way in which a specific sport skill (e.g. a rugby tackle) is performed. Good technique reduces the risks of injury and is essential for players to participate fully and enjoy their sport. Player skill and technique development involves preparing the neuromuscular system of the body for sport. Skill and technique includes an understanding of the biomechanics of sport movements. The fundamental movement patterns of coordination, jumping and landing, throwing and kicking, grip and posture and catching are key.

The technique requirements of different sports vary with the nature of the loading and movement. Most sports involve the application of high loads to the body through a point of contact with the ground or another object. How this contact is made and how the athlete distributes the load through the rest of their body have large influences on performance and injury risk. Poor technique can expose players to the risk of acute injury and, if used for a prolonged time, can cause persistent injuries.

The most common and most severe injuries in sport should be used to focus technique training. Understanding athletes' physical and skill capabilities as well as any limitations is important when designing training for injury prevention.

How to improve athlete skill and technique

Players need to use their neuromuscular systems effectively and efficiently to perform fundamental movement skills. Sport-specific demands need to be a focus.

Skill and technique programmes should be delivered in training, with applications in games. They should be based on the level of each athlete and the specific demands of the sport.

> Ensure that technique changes are addressed early in the pre-season and reiterated often to ensure they are second nature come competition time.

Practising tackling techniques, for both being tackled and tackling, is important for rugby, league and football players. Roles should be reversed often in practice to ensure that they are conditioned to respond to both situations.

Consider forces during movements and how these can be moderated.

The skill and technique programme should be monitored to assess its effectiveness in improving performance and reducing injury risk.

Good technique should be taught and practised from an early age and be a key focus of pre-season training. Drills to encourage proper technique should be continued throughout an athlete's career to maximise performance and minimise injury risk.

Different sports have inherently different risks associated with movements and loading. For example, runners are at a high risk of developing overuse injuries due to repetitive loading. Technique training for injury prevention should focus on minimising braking forces and ensuring economical running to reduce fatigue. Runners should also be aware of the hazards of running on the road and on trails, and that when fatigued they need a heightened awareness of these risks to avoid acute injuries.

Team sports

Team sports have additional risks, including collisions with others and sports equipment, jumping and landing and changes of direction. Learning good techniques for these situations is important to mitigate the risk of injury. A number of research studies have shown a reduced risk of knee ligament injury when jumping and landing training is provided. Such training programmes have also showed improved performance. Practising landing, falling and recovery skills in the rugby codes may reduce the risk of injury. As tackling involves very high collision forces, learning how to tackle and receive a tackle effectively is important in reducing the risk of injury.

Limb dominance

Many sports result in the enhanced development of a preferred or used side in terms of strength and coordination. While acknowledged as part of some sports, this may increase the risk of injury, so technique training should be bilateral to ensure that athletes can respond appropriately to potentially injurious situations regardless of direction.

Young athletes

For younger athletes, drills should be incorporated into game scenarios to limit boredom. Teaching young athletes drills and explaining how they benefit from them in performance may help to establish good practice in later years. It is important to understand the differences in risk factors for younger age groups and how the rules of games alter their injury risks.

The length and intensity of play influence injury risk, so conditioning should be designed accordingly. While technique is traditionally incorporated early in practice in order to ensure that athletes are not fatigued, incorporating a low loading technique towards the end of a session may be useful in teaching athletes to use the correct technique even when tired, or to notice how fatigue alters their technique.

Fundamental movement patterns

Many sports have essential skills such as tackling, jumping, landing, stopping and catching that involve large forces and a high risk of injury. The body positions adopted, the range and frequency of motion, and the actions of other players are additional risk factors for injury in many sports. It is important to identify the risky elements in your sport and make sure that the players learn and use the correct techniques at all times. A good idea is to record a player's performance with a video camera for the coach and athlete to review, and discuss how a particular performance might place the player at risk of injury and hamper performance.

The fundamental movement patterns of coordination, jumping and landing, throwing and kicking, grip and posture and catching are key.

Coordination

Good skills improve performance and reduce the risk of injury. Skills are also easier to teach and learn when a player has a good base level of coordination. Put simply, coordination is the timing and actions of the parts of the body performing a skill (e.g. a step, turn and throw in an overarm throw).

Encourage players to:

- develop coordination early, with practice on the fundamental skills of the sport
- develop the basic skills before refining any technical aspects
- practise the basic skills regularly and with variety
- once proficient in a skill, add distractions, decisions and environmental variability in a controlled way to help them practise techniques in more complex and functional scenarios.

Jumping and landing

When jumping and landing, forces more than twice the body weight are transmitted through the body.

Encourage players to:

- keep their trunks and legs aligned and not twisted on landing and during take-off
- bend and flex their hips, knees and ankles when landing, to spread the impact over time and to transfer the impact to the muscles. This avoids jarring at the joints
- keep legs aligned, with knees over the toes. If the knees come together on landing the player should be encouraged to complete a lower-limb strength training programme.

When jumping and landing, forces more than twice the body weight are transmitted through the body.

Throwing and kicking

Large muscular forces are created in kicking and throwing objects such as a ball. A coordinated step-turn-whip action is characteristic of good throwing and kicking. This involves a sequence, beginning with large muscle groups and finishing with the smaller muscles of the limb that is in contact with the object.

Encourage players to:

- involve all their body parts to achieve maximum power when the goal is at the maximum distance
- move the body parts in sequence, starting with the large body parts and ending with the part of the body that is in contact with the object. This reduces the risk of injury to smaller muscles
- involve body parts simultaneously in a push-like motion when the goal is accuracy.

Grip and posture

Holding equipment (e.g. an oar, bat, stick, club or racquet) incorrectly may lead to poor performance, tissue damage and the development of overuse injuries. A posture enabling a mid-range joint position when gripping is characteristic of good gripping technique.

Encourage players to:

- learn the correct grip as soon as they start playing the sport, to reduce the risk of injury
- use good posture in play and at school or work
- work at maintaining posture.

Catching

An incorrect catching technique results in poor performance and is a frequent cause of injury to the fingers and hands.

Encourage players to:

- stretch out their arms and pull them back towards the body when catching a ball. This will minimise the risk of injury to the small joints of the fingers, as the larger muscles of the arms can absorb the impact of the ball.

Environment

Playing conditions – indoor as well as outdoor surfaces, for practice or competition – are environments that at times will pose additional risks to players.

Players should be educated on the additional risks and given strategies to mitigate them. These could include practising on different surfaces to ensure that strength and coordination improvements can be carried through to the different environment. Encourage an extensive warm-up if competition will be on a new surface so that the athletes understand the differences in the surfaces and how to respond. Incorporate small competitions in practice sessions to help athletes learn to adapt to competition situations successfully.

Equipment

Using a racquet or bat that is too large or too heavy limits performance, and may increase the risk of injury. Encourage players to use the appropriate equipment for their age and ability levels. When equipment (e.g. a bike or a boat) can be adjusted to fit an athlete, it is important that an experienced individual sets it up and that the athlete is educated on the benefits of a good set-up in reducing the risk of overuse injuries.

Footwear

Slips and falls can be minimised with good footwear. Encourage players to use the correct footwear for the sport and consider the surface conditions when choosing footwear.

SPORTSMART PRINCIPLE

05 FOOD AND FLUID

FOOD AND FLUID
KEY POINTS

What	⏩	The food and fluid principle is about preparing the body for sport via food and fluid intake. The components of nutrition include carbohydrates, proteins, fat, water, minerals and vitamins.
Why	⏩	To help improve a player's body composition and fuel sources to improve their performance and reduce their injury risk – and in particular to reduce fatigue from inadequate nutrition, to help reduce the risk of cardiovascular and musculoskeletal issues.
How	⏩	Player nutrition needs to be multifactorial and include food and fluid.
When	⏩	Nutrition should be adequate for any training or game. A nutrition programme should be planned based on the level of the athlete.
Follow-Up Actions	⏩	The nutrition programme should be monitored to assess its effectiveness in improving performance and reducing injury risk.
Important Points	⏩	Sports drinks are not recommended except in very hot, humid environments with high physical activity where electrolyte loss and carbohydrate use may be increased.

"I'M TRAINING FOR THE LAKE TAUPO CYCLE CHALLENGE AND HAVE MADE A REALLY HELPFUL HYDRATION PLAN USING PAGE 44."

Tim, keen cyclist.

What is athlete food and fluid consumption?

Player nutrition involves preparing the body for sport via food and fluid intake. The components of nutrition include carbohydrates, proteins, fat, water, minerals and vitamins.

Hydration (drinking adequate fluid) and **nutrition** (the foods you eat) are critical parts of the sporting experience and enhance the enjoyment of participation in sport. Maintaining ideal hydration and nutrition levels requires the attention of both coaches and players before, during and after exercise – in training as well as in competitive games and events.

Nutrition provides an essential fuel and nutrient supply for growth, development and mental function, as well as exercise. When provided correctly it promotes an environment that allows players to recover efficiently between training sessions and therefore perform optimally on all occasions.

Good nutrition

- provides energy for activity, leading to more active participation
- helps the development of strong bones, which reduces the possibility of fractures
- helps to repair damaged muscle tissue
- allows the body to recover between physical activity sessions
- maintains alertness and decision-making abilities.

Poor nutrition

- decreases concentration through decreased energy levels (blood glucose), and inadequate energy leads to fatigue
- may cause poorly developed muscles and bones
- may lead to iron deficiency
- decreases a player's endurance capacity
- delays the recovery process.

Why improve athlete food and fluid consumption?

The aims and benefits of improving a player's body composition and fuel sources are to improve performance and reduce injury risk – and in particular to reduce fatigue from inadequate nutrition, to help reduce the risk of cardiovascular and musculoskeletal issues.

Hydration replaces fluid lost during sweating, helping to regulate body temperature and enabling athletes to maintain high levels of performance. The evidence is unclear

as to what level of dehydration begins to affect performance; however, this is likely to be individual so athletes should experiment with hydration to work out their personal levels.

Children produce more heat and are less effective than adults at sweating during exercise. They will also become engrossed in play or not wish to interrupt adults, so should regularly be encouraged to drink during and after physical activity. Children should be encouraged to drink water primarily.

How to improve athlete food and fluid consumption

Player nutrition needs to be multifactorial and include food and fluid.

Nutrition should be adequate for any training or game. A nutrition programme should be planned based on the level of each athlete.

The nutrition programme should be monitored to assess its effectiveness in improving performance and reducing injury risk.

Sports drinks are not recommended except in very hot, humid environments with high physical activity where electrolyte loss and carbohydrate use may be increased.

Water, sports drinks and sports water

Plain water is appropriate for exercise lasting less than one hour. Drinks containing 4-8% carbohydrates and 0.5-0.7g/litre of sodium are recommended for intense exercise lasting longer than one hour. Consuming carbohydrate-containing fluid can help to maintain concentration, skills and pace.

It is important that athletes understand the difference between energy drinks and sports drinks, with energy drinks containing high levels of caffeine and other energy supplements such as taurine, guarana and carbohydrates. Energy drinks are not recommended. Sports drinks can contain electrolytes and carbohydrates, or electrolytes alone. Athletes should be aware of the carbohydrates in sports drinks and incorporate this into their daily energy intake.

The amount of carbohydrate consumed should be determined based on the athlete and the duration and intensity of the exercise. For exercise lasting longer than one or two hours, or in hot, humid environments that promote heavy sweating, electrolytes should be included in the hydration strategy either as tablets or in sports drinks.

Encourage players to:

- be **hydrated** before arriving at training or competition (e.g. recommend they have a glass of water with breakfast for a morning game, or sip a bottle of water in the hour leading up to training or competition). This is particularly important with high-intensity exercise lasting over 30 minutes with no opportunity to drink during this

time. In hot, humid conditions a greater focus on maintaining hydration between practice and matches is warranted

- practise **drinking** in the 15 minutes before exercise to find out how much is tolerated
- drink to quench thirst during **training and competition**. Players should be encouraged to hydrate whenever there is an opportunity to drink. If there are limited opportunities to hydrate during exercise, a hydration plan should be developed to maximise their ability to perform well and to limit the injurious effects of dehydration. The goal of any hydration plan should be to minimise dehydration and prevent the loss of more than 2% body weight
- monitor their **sweat rates** using pre- and post-exercise weights. Replace every kilogram lost during exercise with 1.5 litres of fluid. If weight loss cannot be monitored, drinking until urination frequency and urine colour are back to normal is a good guide to hydration
- test any **hydration plan** prior to an event, including the type of sports drink, to ensure it is well tolerated
- drink fluid that is **flavoured and cool** (not very cold), which promotes intake.

In addition:

- **sports drinks** should be formulated to suit the athletes, the sport and the conditions. A higher electrolyte content may be needed in hot, humid environments and for individuals with a high sweat/sodium loss. Carbohydrate levels should match the intensity and duration of the activity, generally 2-8%. Salt losses can be gauged by getting athletes to wear dark clothing during a session, allowing it to dry and observing the size of the salt stains
- **store** water bottles in a hygienic way (e.g. off the ground in a carry case) and ensure they are well labelled
- keep water bottles **clean** – especially if using solutions containing carbohydrate.

Discourage players from:

- drinking energy drinks (e.g. Red Bull, V, smart drinks) and alcohol after exercise as these increase fluid losses
- sharing drink bottles with other players, to prevent the spread of 'flu, hepatitis and other infections.

Carbohydrates

Carbohydrates and fats are the main source of energy used to power the muscles for exercise. The greater the intensity of the exercise, the more the body relies on carbohydrates for energy. Very short bouts of very high-intensity exercise rely on a different energy system, which utilises fats and carbohydrates to replenish energy during recovery periods.

Athletes' carbohydrate requirements vary depending on the duration, intensity and type of activity. Energy requirements also change from day to day and through the different cycles of periodised plans, so athletes need to be aware of their energy requirements and adjust their carbohydrate consumption accordingly.

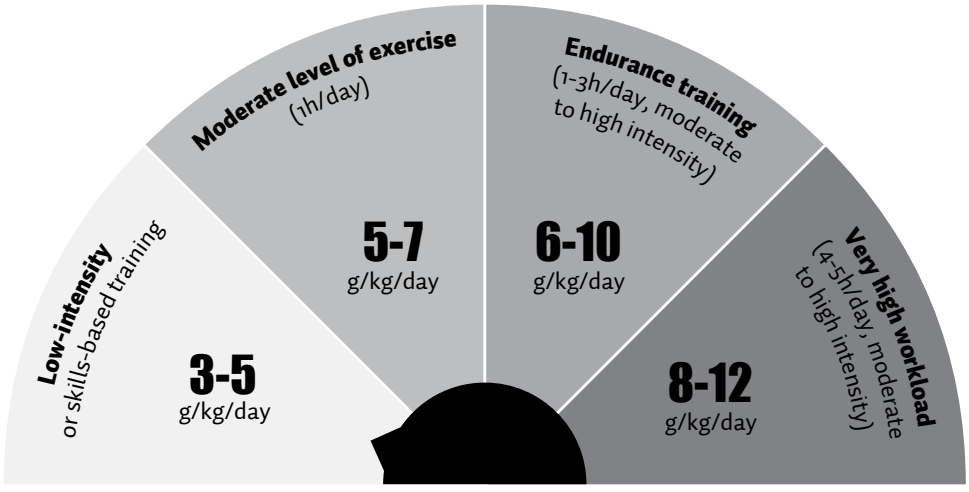
Dietary intake should be fine-tuned according to how athletes are feeling and performing and meet any specific body composition requirements. As with hydration, athletes should test during training the nutrition they intend to use prior to and during competition, to ensure that it is well tolerated.

The timing of nutrition after exercise is important; carbohydrates and proteins need to be delivered to the body within 30 minutes.

Increasing carbohydrate intake in this meal in accordance with the duration and intensity of the workout can help to balance energy needs. When the time between workouts is longer than 24 hours, the timing of nutrition appears to be less crucial. Where possible, athletes should consume whole foods that have had minimal processing, as this maximises the nutritional benefits.

Training with low carbohydrates can be beneficial, especially for developing endurance during long, slow training sessions. However, it is important to ensure good muscle glycogen levels prior to high-intensity workouts or competition.

A rough guide for carbohydrate intake is:



In general, males' intake tends to be closer to the higher end while females' intake is usually near the lower end of each range.

In sports that last more than an hour, it may be important to top-up blood glucose levels in order to prevent fatigue and maintain performance. Carbohydrate loading (carbo loading) is sometimes used for endurance athletes, who consume foods with high carbohydrate levels in the days prior to events. In the majority of cases muscle glycogen levels can be topped up during the taper process without too much focus on consuming extra carbohydrates.

Athletes should eat between one and six hours prior to their event, depending on the start time and how well they tolerate food in their stomachs during competition. Athletes participating in an event that results in a significant increase in carbohydrate use should ensure that their pre-event meals have adequate carbohydrate (1-4 g/kg/day carbohydrate is recommended).

During an event or competition most athletes will not need to consume carbohydrates at levels above those that can be supplied in sports drinks. However, during endurance events and tournament situations it is important to continue to fuel the body until exercise is completed. Carbohydrate needs can be met via a variety of sources including gels, sports bars, bananas, cola and confectionery. Normal food is preferable when the athlete has time to eat it and can tolerate it without gastrointestinal distress. The recommended carbohydrate intake during 1-2.5 hours of continuous or stop-start exercise is 30-60g per hour. For longer-duration exercise, up to 90g per hour is recommended, with the actual amount depending on the athlete's ability to consume and tolerate it.

Foods containing 50g carbohydrate include (average values)	
2 bananas	2 muffins
4-5 Weet-Bix	2-3 crumpets
1 cup cooked rice	1 cup baked beans on 2 slices toast
1.5 cups cooked pasta	1 large bagel
1 cup kumara	600ml sports drink
2 cups fruit salad with 200g yoghurt	1.5-2 gels or carbo shots
sandwich with meat and salad filling	500ml fruit juice or cordial
500-750ml fruit smoothie or liquid meal supplement	1.5-2 muesli bars or sports bars (check the labels)
2 cups porridge or other cereals with milk	600ml flavoured milk
	2.5 potatoes

Protein

Protein is essential for building, maintaining and repairing the body's tissue (especially to repair muscle damage and promote adaptation from training). Dairy products provide a valuable source of calcium in addition to protein, while dark meats and some shellfish provide good amounts of zinc and iron.

As with carbohydrates, protein needs fluctuate depending on the training method and are different for different athletes and different sports. Protein is only a small source of fuel for the muscles but it has a role in recovery, provides the building blocks for most cellular processes and hormones, and is important to support the immune system. Therefore protein intake should be dictated by the required outcomes, with a higher intake required when muscle hypertrophy is the goal.

Most athletes will consume adequate protein through their normal food without the need for further supplementation. Consuming protein from a wide range of food sources also provides essential vitamins and minerals, which are absorbed better when consumed as part of a whole food. Animal-source proteins are considered a complete source of protein as they contain all the essential amino acids that humans are unable to synthesise. Plant-based proteins tend to be missing one or more of these amino acids, so a vegetarian or vegan diet requires protein sourced from a wide range of plants.

The one meal where protein is an important focus for an athlete is the meal following a workout, particularly if the athlete will be exercising again within 24 hours. Consuming a higher-protein meal (20-25g high-quality protein – animal source) helps to promote glycogen replenishment in the muscles and targets amino acid uptake to the working muscles for repair and adaptation. Whey protein, while not a whole food, can be useful in this case as it is rapidly absorbed; however, having a milk-based smoothie or other everyday foods is just as effective and less expensive.

Athletes should be advised to include small amounts of protein in every meal in order to spread consumption over the day. Including all three macronutrients in every meal ensures that the body receives all the signals it needs to register satiety. This is particularly important when body composition is an issue and an athlete is restricting or monitoring their energy intake.

The timing of nutrition after exercise is important; carbohydrates and proteins need to be delivered to the body within 30 minutes.

Protein content of food (average values)			
27g	100g lean red meat	10g	1 cup yoghurt
3g	2 slices (30g) ham	8g	30g cheese
18g	1 hamburger pattie	5g	2 slices bread (white, wholegrain)
8g	100g tofu	5g	1 cup cooked rice
25g	100g chicken	5g	1 cup cooked pasta
23g	100g white fish	8g	2 Weet-Bix
20g	100g canned salmon	2-3g	1 baked potato
20g	12 mussels	7g	1/2 cup baked beans
26g	100g canned tuna	5g	1/2 cup green peas
6-7g	1 egg	5g	1 tbsp peanut butter (15g)
3g	1 egg white	5-6g	2 tbsp milk powder
9g	1/2 cup bean salad	5-10g	2 tbsp protein powders (whey or isolate)
7g	1 glass flavoured milk (200ml)		

Fat

Fat is an important component of cells, the building block of hormones and an important source of energy. Therefore incorporating healthy fats into an athlete's diet is crucial to maintain health and performance. Many vitamins can only be absorbed in the presence of fat, and fats contribute to feelings of satiety, so fats should be incorporated into every meal.

Manmade fats are considered unhealthy fats; these include vegetable oils, hydrogenated fats such as in spreads, and trans fats. Western diets are also omega 6 heavy and athletes will benefit from increasing their consumption of omega 3 fatty acids. Omega 3 fatty acids from oily fish may have anti-inflammatory benefits that aid recovery between exercise. However, athletes should be aware that many fish are exposed to toxic levels of mercury, so it is important to understand the source of the fish.

Fats from olive oil, coconut oil, avocado, fish, nuts and seeds, as well as some animal saturated fats, should be incorporated into the diet.

Fat intake recommendations differ depending on the diet, with much higher fat intakes recommended for people on low-carbohydrate, moderate-protein diets that may be beneficial for fat loss and promoting endurance. In general fats should make up the

rest of an athlete's energy requirements when carbohydrates and protein have been accounted for. Increasing fat intake can promote fat burning for increasing fat-free body mass or to enhance endurance; however, this should be accompanied by a reduction in carbohydrates so that the athlete's energy requirements remain balanced.

Vitamins and minerals

Some athletes are at risk of vitamin and mineral deficiencies and may benefit from supplements. In general, athletes with a healthy, balanced diet do not require any further nutritional supplementation. Exceptions to this may be athletes who are restricting energy intake to meet weight criteria, who may benefit from a broad-spectrum multivitamin to maintain health.

Athletes who spend a lot of time indoors, have darker skin, are sun conscious or have their skin covered may benefit from vitamin D supplementation. Some females and vegetarians may become anaemic and require iron supplementation. Increased calcium in teenagers during periods of growth and in females may be beneficial to support bone health. In all cases athletes should be screened and supplementation provided under medical supervision.

Athletes and coaches should be advised on iron-rich nutrition (red meat, legumes, green leafy vegetables, cereals, eggs consumed with a source of vitamin C) and calcium-rich nutrition (milk, cheese, yoghurt, calcium-fortified soy). One supplement that may benefit athletes' immune function, particularly those with gastrointestinal complaints or who have been on antibiotics recently, is probiotics. However, probiotics can also be found in fermented foods including sauerkraut, kefir, kombucha and yoghurt.

Special situations

Athletes who need to dehydrate in order to make a weight category will require special hydration strategies prior to and during competition, and should be aware of the need to rehydrate well after competition to assist their recovery. Athletes training or competing during a fast (e.g. Ramadan) should develop and practise a hydration strategy to preserve their performance and recovery.

Further information and resources

AUT University nutrition advice

SPORTSMART PRINCIPLE

06 PLAYER WEAR

PLAYER WEAR
KEY POINTS

What	⏩	The player wear principle relates to preparing the body for sport using shoes, clothing, protective equipment, bracing, taping and monitoring devices.
Why	⏩	To help improve a player's wear and use of appropriate protective equipment to improve their performance and reduce their injury risk. The rules of sports' governing bodies need to be considered.
How	⏩	Player wear preparation needs to be multifactorial and based on sports performance needs and rules.
When	⏩	Player wear preparation should be considered for any training or game. A player wear programme should be planned based on the level of the athlete.
Follow-Up Actions	⏩	The player wear programme should be monitored to assess its effectiveness in improving performance and reducing injury risk.
Important Points	⏩	Mouthguards, helmets and bracing appear to be effective in preventing some types of injury. However, the benefits and cost effectiveness of such interventions are sport specific. Protective eyewear for high-risk sports is an important injury prevention strategy.

"THE ADVICE ABOUT CORRECT PLAYER WEAR ON PAGE 54 MADE ME BUY THE RIGHT FOOTWEAR. IT'S MADE ALL THE DIFFERENCE."

Gemma, jogging enthusiast.

What is athlete wear?

Player wear involves preparing the body for sport using shoes, clothing, protective equipment, bracing, taping and monitoring devices.

Why improve athlete wear?

A player's wear and use of appropriate protective equipment can help to improve their performance and reduce their injury risk. The rules of sports' governing bodies need to be considered.

Protective equipment such as mouthguards and headgear helps to protect players from injury. It should be used for the intended purpose, fit well, be comfortable, not restrict movement in the sport, and be worn at both practices and matches.

There is no sound evidence to support the mandatory use of protective headgear in rugby from the viewpoint of reducing the incidence or severity of concussion injuries. Mouthguards help to reduce dental injuries. Whilst the efficacy of some forms of protective equipment – most notably mouthguards to reduce dental injuries – is established in rugby and other contact sports, the evidence to support other worn protective equipment is more equivocal. Despite positive results from laboratory testing for both headgear and shoulder padding, in their current form these garments have yet to show a corresponding decrease in the incidence or severity of contact injuries. A complicating factor is that players wearing these garments may have an unwarranted perception that the protection conferred gives them freedom to play more aggressively or even recklessly, and this is likely to have adverse results from an injury viewpoint.

There is some evidence from laboratory testing that modifications to the materials used to manufacture equipment, or changes to the specifications relating to the thickness and density of padding in worn protection, can result in superior performance in terms of dissipating energy during impacts. Foam padding employed in these garments might show superior performance in 'live' situations if it were shaped to the anatomy of the protected area rather than being of uniform thickness.

Manufacturers should review protective equipment design in view of the growing body of evidence relating to the mechanism for injuries such as concussions.

Whatever new designs and technology are developed for worn protective equipment, the ergonomic performance remains paramount, as this will dictate compliance. From an ergonomic viewpoint manufacturers should be highly selective in terms of the specific anatomical areas requiring padding based on empirical evidence, in an effort to minimise restriction of movement, as this will determine whether players actually choose to wear these garments. Considerations in the design and selection of materials used to manufacture garments are the physiological impacts (particularly with respect to thermoregulation) and the extent to which removing and working around these garments might interfere with players receiving lifesaving treatment in the event of on-field medical emergencies.

How to improve athlete wear

Player wear preparation needs to be multifactorial and based on sports performance needs and rules. It should be considered for any training or game.

A player wear programme should be planned based on the level of the athlete, and monitored to assess its effectiveness in improving performance and reducing injury risk. Mouthguards, helmets and bracing appear to be effective in preventing some types of injury. However, the benefits and cost effectiveness of such interventions are sport specific. Protective eyewear for high-risk sports is an important injury prevention strategy. Worn protective equipment, clothing and padding should be comfortable or athletes will not wear it.

Buying protective equipment

When buying protective equipment, buy sport-approved items. Do not alter the equipment, as this will reduce its effectiveness. Avoid sharing protective equipment between players of different sizes. Ensure the equipment complies with the rules of the sport and is not a risk to other players.

Padding should absorb impact, minimising its effect on the player's body and reducing the risk of injury. Use padding on areas of the body that are likely to have contact with other players or equipment, such as the hips and shoulders. Ensure that the padding conforms with the rules of the sport.

Use protective equipment appropriate to the players' gender, e.g. chest protection for women in contact sports such as rugby, and boxes for men in sports such as cricket.

Always use high-density foam padding around goal posts and other high-risk areas.

Headgear

Make sure headgear is approved and appropriate to the sport.

Hard helmets, such as those worn when cycling and horse riding, help to protect the brain from injury in an impact. Hard helmets and faceguards should be worn in sports involving small, hard balls travelling at high speeds, such as hockey, cricket and lacrosse. Hard helmets should be replaced if a significant head impact occurs, as damage will reduce the protective effects.

Soft headgear, such as that worn when playing rugby, can help to prevent serious cuts to the scalp and ears. It has a limited ability to protect the head from impacts, and this decreases with repetitive contacts. Athletes should be aware of this to reduce any increases in risk-taking behaviour.

Improvements are constantly being made to protective headgear, so it is important to stay informed of developments in the industry to ensure optimal protection.

When judging the effectiveness of helmets it is important to consider the quality of concussion detection in different situations.

Eyewear

Protective eyewear reduces the risk of injury from fast-moving projectiles such as balls and racquets. If an athlete is functionally one-eyed, any risk of injury to the functional eye should result in mandatory protective eyewear use.

Street eyewear is considered adequate for children and low-intensity activities; however, players participating in sports involving fast-moving objects should wear approved safety eyewear that has lenses that stay in and will not shatter and have been fitted properly. The risk of eye injuries and the availability of protective eyewear should be advertised in sports considered high risk for eye injuries.

Mouthguards

Mouthguards should always be worn in activities with a risk of collision, body contact or projectiles. They:

- reduce cuts to the lip, mouth and tongue
- protect teeth
- help to prevent jaw injuries.

Footwear

Good footwear provides protection from impact and support for the foot and ankle. Make sure that footwear:

- fits well to provide support
- has enough cushioning for absorbing impacts
- has a surface-appropriate sole for good traction
- complies with the rules of the game.

External braces and supports

Bracing and supports can provide some protection against injury to joints.

Braces are reusable and adjustable and can provide continuous support. Use braces rather than tape, as the effective support provided by taping is generally reduced after 20 minutes of play. Do not use braces and taping to allow an injured player to play while injured.

While there are potential benefits to wearing external supports, particularly for previously injured athletes, longer-term studies indicate that similar outcomes can be achieved with or without braces. The evidence suggests that any potential negative effects on performance of wearing non-rigid, sleeve-type, external joint supports can be managed to a considerable extent by allowing a short period of familiarisation, after which performance appears to be largely restored to levels demonstrated without a brace.

There is insufficient evidence to suggest the need for mandatory use of these devices or to advocate their use too strongly; rather it should remain at the discretion of the individual athlete. While the relevant information should be made available to allow players to make informed choices, the final decisions will depend in large part on personal preferences.

Monitoring devices

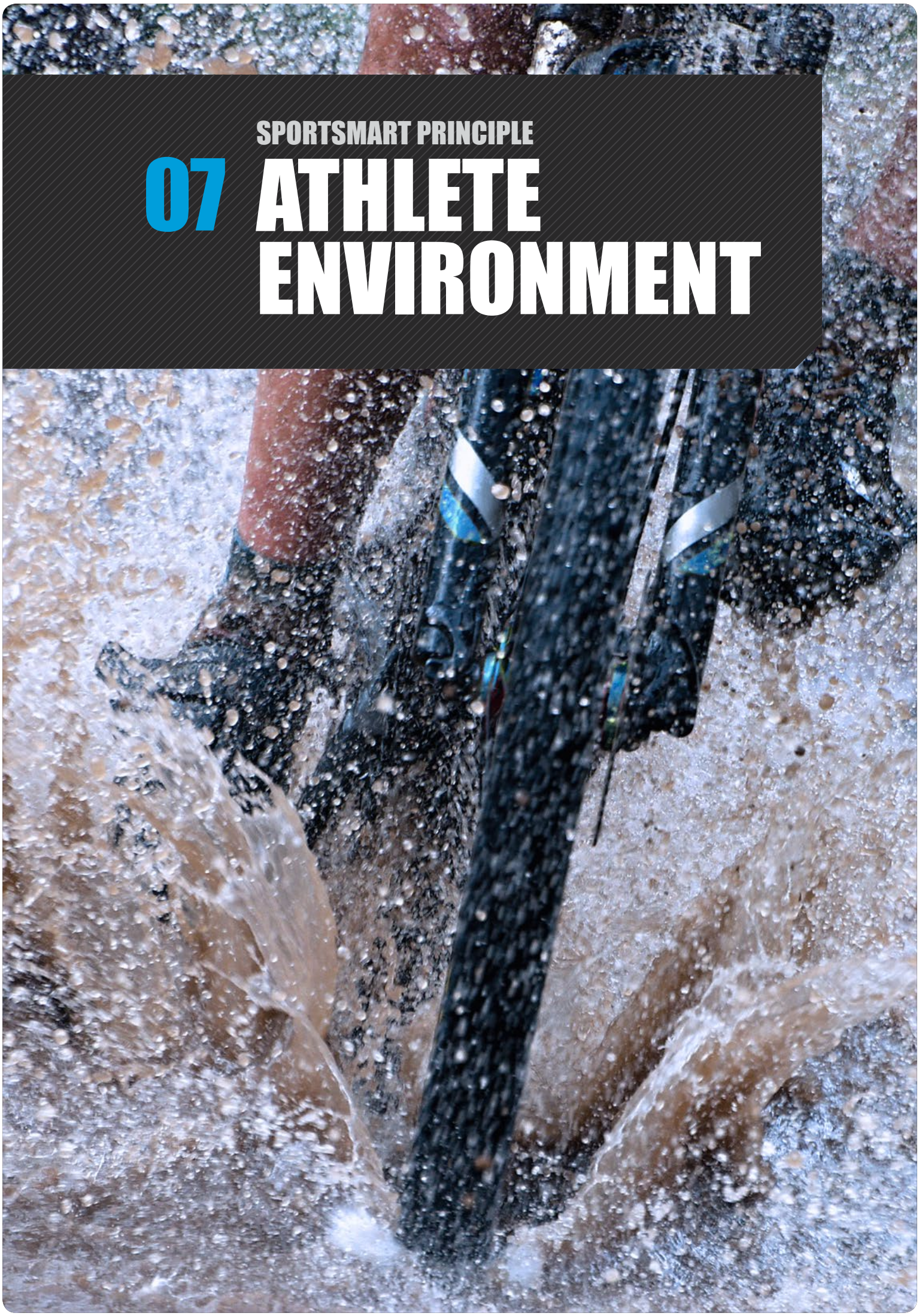
There are now numerous technical devices that help to monitor performance and loads on the body. Where appropriate, and where allowed by the rules of the sport, these devices can provide useful information to help improve performance and reduce injury risk. Examples are instrumented mouthguards and ear patches for monitoring loads to the head in an attempt to assess concussion risk.

Further information and resources

Official laws around rugby player clothing/equipment

SPORTSMART PRINCIPLE

07 ATHLETE ENVIRONMENT



ATHLETE ENVIRONMENT
KEY POINTS

What	The athlete environment principle applies to both a sport's physical environment (weather, surfaces, equipment) and the social-behaviour environment (fair play, rules, crowd and player behaviour).
Why	Both the physical and the social-behaviour environments are important in helping to improve a player's performance and reduce their injury risk.
How	The physical and social-behaviour environments need to be multifactorial, with components including warm-up and cool-down, flexibility, strength, endurance and power.
When	Environmental preparation and monitoring plans should be developed for any training or game. The environment programme should be planned based on the level of the athletes.
Follow-Up Actions	The environment programme should be monitored to assess its effectiveness in improving performance and reducing injury risk.
Important Points	Regular 'warrant of fitness' inspections for sports facilities should be carried out to maintain safety standards. Sports played on hard surfaces carry an increased risk of injury. Be aware of the risk of concussion and other injuries, and use the required safety equipment. Well-documented procedures for extreme weather conditions need to be developed specific to the sport. Athletes need to acclimatise to changes in surface conditions as well as hot and humid environments. Weather-appropriate clothing is encouraged, including additional layers in cold weather. Concussion information and protocols must be highly visible around facilities for sports with high concussion rates. Players need to be clear, early in their careers, about the reasons behind fair play and the potential outcomes of breaking rules. Understanding how rules lower injury rates will help in rule-related decisions. Governing bodies of high-injury sports should monitor how injuries occur, and change rules to decrease the risk of injury.

What is the athletic environment?

The athletic environment includes a sport's physical environment (weather, surfaces, equipment) and social-behaviour environment (fair play, rules, crowd and player behaviour, the use of drugs or alcohol).

Why is the athletic environment important?

Both the physical and the social-behaviour environments are important in helping to improve a player's performance and reduce their injury risk. Rule changes can help to alleviate injury risk, as has been successfully implemented in rugby with scrum engagement.

Sports played on hard surfaces may have an increased risk of concussion and other injuries, so increased awareness and perhaps safety equipment may be necessary in such situations.

Crowd behaviour and athlete team and opposition behaviour can increase or decrease injury risk.

How to improve the athletic environment

The athletic environment includes both the physical and the social-behaviour environments. A sport's physical environment includes the weather, the surface on which it is being played and the equipment with which it is being played. Taking steps to increase the safety of the physical and social-behaviour environments will reduce the number of potential injuries and should allow greater participation and enjoyment.

Facilities

Check that the facilities are large enough for play. Perimeter fencing and advertising boards should not be too close to the playing area. Keep spectators and vehicles well away from the playing area. Ensure that facilities are clean and hygienic.

Netball requires a two- or three-metre run-off around the playing area for umpires and to reduce obstacles. When netball is played outdoors, wet weather has been associated with increased injuries. Roofing outdoor netball courts would greatly reduce the risk of injury in this environment.

'Warrant of fitness' inspections of facilities dedicated to sports participation should be initiated to maintain regular checks of safety.

Concussion awareness and protocols should be prominently displayed around facilities for sports with high concussion rates.

Surfaces

Check that the ground is level and there are no holes in the ground or exposed sprinkler heads. Remove broken glass, rubbish and stones. Avoid excessively muddy and boggy areas.

Artificial surfaces should be free of surface water (where appropriate) and debris such as sand, gravel and leaves. Ensure there are no water spills on the floor. Where there is a choice of playing surfaces, natural surfaces appear to have a lower risk of injury and should be preferred. Artificial surfaces should be upgraded to generation 3 surfaces to prevent the increased injury risks reported for the older-generation surfaces.

It is essential that all playing surfaces have adequate lighting. Training should take place as much as possible in the same conditions as competition, including surface, temperature, weather and lighting. For example, if there is a chance of having to compete in rain, some training should also be done in rain.

Athletes need to be acclimatised to changes in surfaces and to exercising in hot and humid conditions. Acclimatise them to different surfaces by slowly increasing the intensity and difficulty of activities on the surfaces. Encourage appropriate clothing for the weather, including additional layers in cold weather.

Equipment

Check that equipment is regularly maintained. Ensure that goal posts are padded and nets are secured to avoid entanglement. Corner posts and marker flags should flex on impact and have no sharp edges. Equipment should be stable so that it does not fall over or collapse.

Check that players use equipment suited to their size and abilities. Ensure that equipment is stored appropriately to prevent inappropriate use that may cause damage and increase the potential for injury.

Weather

Players, coaches and referees need to be prepared for changes in weather conditions during training and competition. Extreme weather procedures need to be developed specific to the sport and be well documented.

Coaches should be familiar with the signs of hypothermia and heat stress, especially when coaching children, as they are more susceptible to weather extremes. Each sport should develop recommendations for appropriate clothing for cold and hot conditions.

Athletes need to be acclimatised to changes in surface and to exercising in hot and humid conditions.

It may be useful to develop a resource that uses MetService data to give advice to athletes on what to wear and to officials on effective preventive measures to take (e.g. cancellation, extra water breaks, extra clothing mandatory) to avoid heat and cold injuries. It may be beneficial for a large range of sports to incorporate this information in an app, with locations colour coded according to the predicted weather hazards. This could be expanded to mountaineering and other activities where the weather can play a huge role in safety.

In cold weather, players (particularly children) should be allowed to wear clothing layers (e.g. polypropylene of a matching colour) under their uniforms. Cold, wet, windy and low-humidity conditions are associated with cold injuries. Athletes playing cold-weather sports, particularly snow sports, should have supplies available to them of hot food and drink, and facilities for changing wet clothing, to aid in retaining their body temperatures.

Hot and humid conditions combined with strenuous exercise can lead to heat illness. Children should be encouraged to drink whenever they are thirsty, regardless of the activities in which they are participating. In game situations additional water breaks should be considered as well as the provision of a sheltered environment during rest and recovery. Acclimatising to heat can take up to 14 days and may take longer in children. In hot conditions, intensity and duration should be reduced based on a measured temperature to prevent heat stress. Should heat or cold illness be suspected, medical help should be sought immediately.

Symptoms of heat stress include:

- heavy sweating
- skin flushed or cool and pale
- headache
- dizziness
- muscle cramps
- weakness
- rapid pulse
- loss of consciousness (seek immediate help).

Symptoms of hypothermia include:

- shivering (mild to intense)
- weakness
- pale, waxy skin
- uncoordinated movements
- confusion or agitation
- slow, slurred speech
- strange behaviour
- refusal of help
- slow, shallow breathing.

Sunscreen should be supplied at all venues where summer sports are played, as well as appropriate shelter for players and spectators.

Rules

Understanding how the rules contribute to injury rates in specific sports will help in rule-related decisions in the future, and may also have crossover to other sports.

Sports' governing bodies whose sports havehigh injury rates should examine their mechanisms of injury and consider whether rule changes could help alleviate injury risk (as has been successfully implemented in rugby with scrum engagement).

The reasons behind fair play and the potential outcomes of deviating from the rules should be made clear to players early in their careers.

Some rules are designed and enforced to reduce or remove the risk of injury. For example, hockey players are not allowed to raise their sticks above shoulder level, spear tackling in rugby is illegal, and physical contact in non-contact sports is penalised.

Fair play

Fair play, a healthy competitive spirit and an injury-free environment are key to participation and enjoyment – and that's why sporting rules and codes have been introduced. Coaches, players, referees and supporters all have a role in upholding the principles of fair play. Good sport is about positive attitude.

While fair play is often considered with respect to the athletes in competition and coaches', supporters' and athletes' responses to referee decisions, the impacts of parents, coaches and sports organisations on an athlete should not be dismissed. It is especially important for young athletes that parents, coaches and schools support and encourage participation rather than winning.

Training regimes that are inappropriate for the age and level of an athlete not only contribute to the development of injury, but can also have a large psychological influence on them. Self-responsibility for injury risk should be driven for all sports at all levels. Educating athletes and coaches on the injury risks of their sports and how the rules relate to injury risk may help to improve respect for fair play and encourage better decision-making during competition.

Fair play means respecting the opposition, the officials and the rules, staying calm no matter what happens, and maintaining your dignity whether or not you are winning.

If a game gets out of control, play can become reckless and dangerous, and increase the potential for injury. Remember, many referees are volunteers and need support and respect for their decisions.

A referee should:

- be trained in the game's rules and apply them fairly and consistently
- encourage fair play
- always be firm but friendly
- help players to understand the rules
- enforce disciplinary actions appropriate to levels of misconduct
- respect coaches

A coach should:

- emphasise the guidelines of fair play to all players
- make sure that all players know the rules
- accept all decisions by the referee and not try to influence them
- speak out against violence, poor behaviour and cheating
- make sure that training loads and activities are age and stage appropriate
- respect officials and their decisions.

A player should:

- understand the rules before starting the game
- play fair and within the game's rules
- respect the referee's calls by not challenging their decisions
- respect their opponents.

Parents and supporters should:

- encourage players to play fair
- support their teams positively
- respect referees and their decisions.

Psychological issues such as anger should be addressed as quickly as possible, by either the coach or other players. Everyone involved in sport has a responsibility to maintain fair play and to hold others accountable. When a blind eye is turned to incidences of foul play, this can start to creep into the culture of the sport.

Outside stress can also contribute to how an athlete behaves during sports practice or play. Coaches and sports organisations should address stress management with athletes, particularly young and professional athletes, so that they have other methods of coping than retaliating during the high stress and drama of play.

Presentations of rule changes and other factors associated with fair play should be brief, colourful and eye catching, with strong messages for the target audiences. For younger teams, an incentive for good conduct (e.g. added team points as in the ice hockey Fair Play programme) may help to encourage the athletes to play fair. Teaching children and teenagers that they can still be competitive while respecting opponents and the rules may help them to develop good habits for later in life.

Drugs and alcohol

Coaches and players are all responsible for keeping sport drug-free. The misuse of drugs to enhance sports performance is wrong for three important reasons. It:

- contravenes the code of fair play
- breaks the laws of sport and society
- carries the risk of serious health problems and the risk of injury.

Alcohol affects physical and psychological performance, so has no place in sport for an athlete during training or a game.

Monitoring and reporting

Make sure you have a system for monitoring and reporting both potential and current hazards. Make individuals responsible for checking areas or equipment regularly. Facilities regularly used for or dedicated to sporting use should have 'warrant of fitness' systems that allow for regular checks of safety measures, and put in place recommendations and procedures for cancellations of play. Recommendations could cover extreme weather, wind-chill factors, wet bulb globe temperatures and surface conditions. Minimum run-off areas should be included in a warrant of fitness.

Monitoring and reporting good behaviour and poor behaviour need to be actioned.

Emergency procedures

Ensure that:

- a qualified first-aider is always at training and competitions. In large venues hosting multiple games, at least one qualified first-aider should be available at each game
- a first-aid kit is always available and well signposted. An area dedicated to first-aid care should be designated and signposted so that people know where to go to seek first aid
- emergency access ways are always clear, and that coaches know the directions to the nearest Accident and Emergency clinic
- a phone is always available to contact emergency services. Facility staff should be on hand in cases of emergency with a well trained and documented emergency protocol in place.

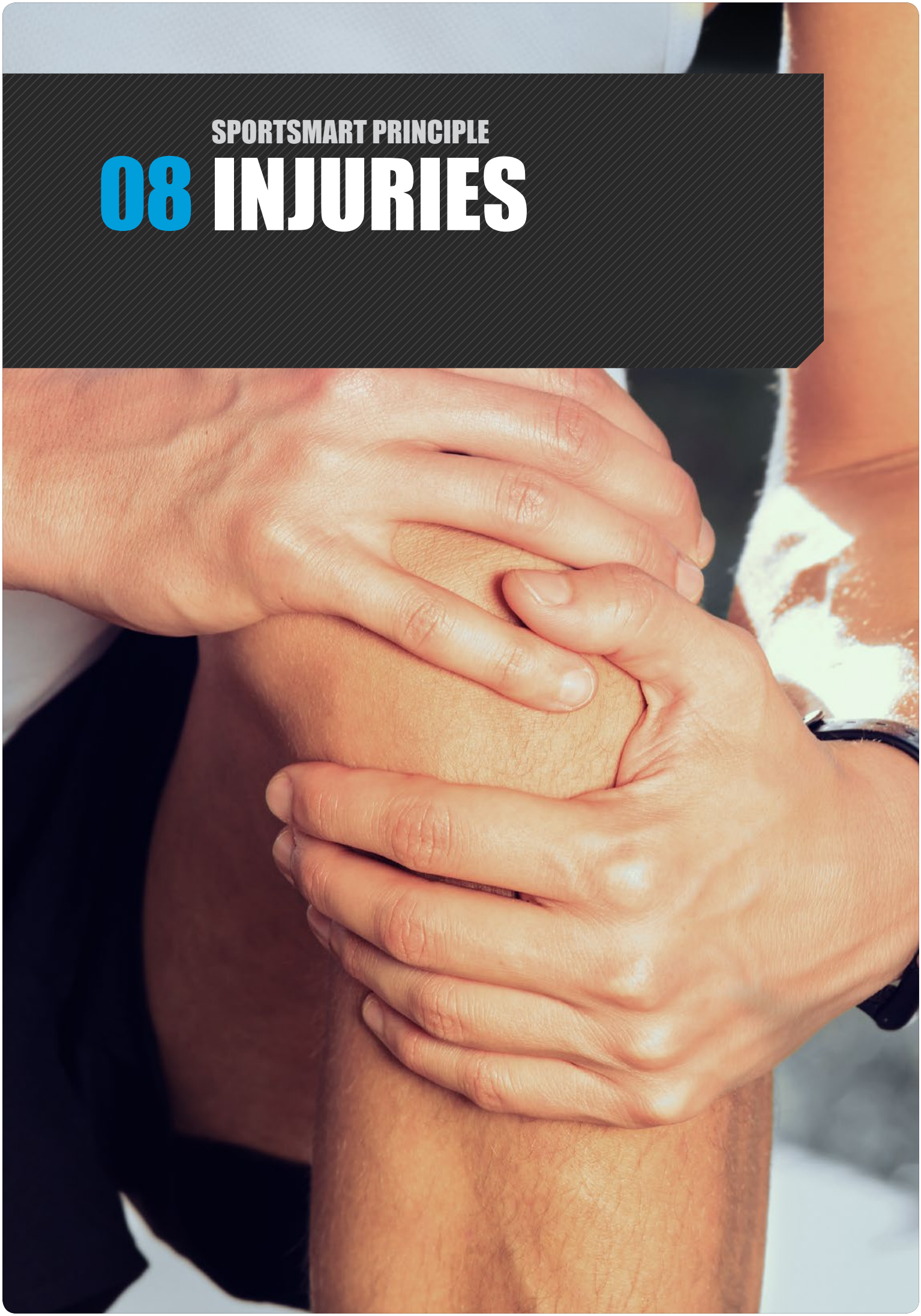
Note: Ensure that any visiting teams know the emergency procedures at your venue.

Further information and resources

Club Warrant of Fitness

SPORTSMART PRINCIPLE

08 INJURIES



INJURIES
KEY POINTS

What	⏩	The injuries principle is about preventing key injuries, assessing injuries quickly and accurately, managing injuries to ensure return to play, and reporting injuries to enable evaluations of their incidence and the effectiveness of injury prevention programmes.
Why	⏩	To help reduce the risk of injuries so that players' performance can be maintained and improved. Reducing the risks of concussion, acromioclavicular joint dislocations, knee ligament injuries, ankle sprains, groin pain, hamstring injuries and tendon injuries is particularly important for sport in general. The mechanisms of injury in each sport need to be understood so that injury prevention programmes can be implemented to help reduce injury.
How	⏩	Injury identification, assessment, management and reporting need to be coordinated and reported.
When	⏩	Injury assessments and initial injury management should be available for any training or game (i.e. concussion protocols, R.I.C.E.D. for soft tissue injury). An injury-specific prevention programme should be planned based on the level of the athletes and the sport.
Follow-Up Actions	⏩	The injury-specific prevention programme should be evaluated to assess its effectiveness in improving performance and reducing injury risk.
Important Points	⏩	Ensure that players and support staff are aware of the importance of reporting concussions, and that withholding a return to play is not to prevent the athlete participating but to ensure brain healing to prevent potential catastrophic injury in the future. This is important at all levels of play, school to professional.

What are athlete injuries?

Athlete injuries can be frequent and severe. Knee ligament, hamstring, ankle sprain and concussion injuries are of particular concern. We need to prevent injuries, assess injuries that do happen quickly and accurately, manage injuries to ensure return to play, and report injury characteristics to enable evaluations of the incidence of injury and the effectiveness of injury prevention programmes.

Why reduce athlete injury risks?

Reducing the risks of injury helps players to maintain and improve their performance. It is particularly important for sport in general to reduce the risks of knee ligament, hamstring, ankle sprain and concussion injuries. The mechanisms of injury in each sport need to be understood so that injury prevention programmes can be implemented to help reduce injury.

How to reduce athlete injury risks

Reducing the risks of athlete injuries requires an understanding of the sport-specific types of injury and the mechanisms of injuries. Injury identification, assessment, management and reporting also need to be coordinated and reported.

Sports injuries need to be carefully managed to reduce the risk of re-injury. A key factor in reducing the occurrence of re-injury is determining when an athlete is ready to resume training and return to play. While all injuries are different, it has been shown that, in many cases, a premature return to play results in a greater risk of subsequent injury. Therefore the management of sports injuries goes beyond immediate treatment to include advising athletes and coaches when it is safe and at what level an injured athlete is able to begin participating in their sport again. Injuries of primary concern include concussion, acromioclavicular joint dislocations, knee ligament injuries, ankle sprains, groin pain, hamstring injuries and tendon injuries.

Concussion injuryv

The ACC Sport Concussion Guidelines[2, 3] should be used to find out what to do in the event of a concussion injury, how to recognise the signs and symptoms and the actions to take, and how sports organisations can develop concussion policies and implementation plans for their particular activities. The ACC website (www.accsportsmart.co.nz/concussion) and the Sports Medicine New Zealand website (www.sportsmedicine.co.nz) have downloadable PDFs of the Concussion Recognition Tool (CRT), the Sport Concussion Assessment Tool version 3 (SCAT3 – a standardised tool for evaluating injured athletes for concussion) and the ACC Sport Concussion Guidelines.

We need **concussion guidelines** because concussion can be a serious injury to the brain and occurs frequently in New Zealand. Concussion is a mild traumatic brain injury defined as a 'complex pathophysiological process affecting the brain, induced by biomechanical forces'. Several common features that incorporate clinical, pathologic and biomechanical injury constructs can be used in defining the nature of a concussive head injury.[4]

- **Recognise and remove**. If concussion is suspected, remove the athlete from play/activity immediately and seek urgent assessment by a medical doctor.
- Concussions often occur **without** loss of consciousness (only 10-20% of people with concussion lose consciousness).
- Extra caution is required for child and adolescent athletes.
- It may take several hours (or even days) post-injury for some or all of the symptoms of concussion to emerge.
- Non-medical personnel have an important role in recognising the signs and symptoms of concussion. Concussion can present in a similar manner to other catastrophic conditions whose symptoms take time to appear.
- A medical doctor must assess and diagnose concussion because the diagnosis may be difficult and relies on clinical judgement.
- It has been unanimously agreed that an athlete with a concussive injury **must not** return to sport/activity on the day it happens[4].
- The effects of concussion can interfere with the athlete's ability to learn in the classroom or function well at work. Their return to school/work may need to be graduated and demands altered to reflect their level of function, guided by a healthcare professional experienced in this area. They should return to school/work and social activities before returning to sport/activity.

Concussion presents with a range of signs and/or symptoms that may or **may not** include loss of consciousness.[4] It is important to remember that not every sign and symptom will be present in every case and signs and symptoms may take some time to appear.

Physical signs (you see)	Clinical symptoms (they feel)	
▪ Loss of consciousness or non-responsive ▪ Lying on the ground not moving or slow to get up ▪ Loss of balance/ coordination ▪ Disorientation/Confusion ▪ Visible injury to face or head (especially in combination with any other signs) ▪ Seizure or convulsion ▪ Vomiting	▪ Blurred vision ▪ Neck pain ▪ Nausea ▪ Dizziness ▪ Confusion ▪ Difficulty sleeping ▪ Headache/ Pressure in the head ▪ Sensitivity to light and /or noise	▪ Fatigue ▪ Generally feeling 'not quite right' ▪ Drowsiness/ trouble sleeping ▪ More emotional than normal ▪ Irritability ▪ Problems with memory ▪ Reduced ability to think/ concentrate

When a concussion or possible concussion occurs it is important to take action and to get help. The most important steps in the early identification of concussion are to recognise a possible injury and remove the athlete from the sport/activity.

Recognise and remove

Pocket Concussion Recognition Tool

- Non-medical personnel have an important role in observing possible concussion and its effects (e.g. behaviour/symptoms), and should take responsibility for removing the injured athlete from the sport/activity.
- If a suspected concussion has occurred it is important that the athlete sees a medical doctor for assessment immediately.
- Medical doctors are available at general practices, concussion clinics and hospital emergency departments.
- It has been unanimously agreed that an athlete with a concussive injury must **not return** to sport/activity on the day it happens[4].
- In cases of uncertainty, always adopt a conservative approach – **'If in doubt sit them out'.**

Pocket CONCUSSION RECOGNITION TOOL™

To help identify concussion in children, youth and adults

RECOGNIZE & REMOVE

Concussion should be suspected **if one or more** of the following visible clues, signs, symptoms or errors in memory questions are present.

1. Visible clues of suspected concussion

Any one or more of the following visual clues can indicate a possible concussion:

Loss of consciousness or responsiveness
Lying motionless on ground/Slow to get up
Unsteady on feet / Balance problems or falling over/Incoordination
Grabbing/Clutching of head
Dazed, blank or vacant look
Confused/Not aware of plays or events

2. Signs and symptoms of suspected concussion

Presence of any one or more of the following signs & symptoms may suggest a concussion:

- Loss of consciousness
- Seizure or convulsion
- Balance problems
- Nausea or vomiting
- Drowsiness
- More emotional
- Irritability
- Sadness
- Fatigue or low energy
- Nervous or anxious
- "Don't feel right"
- Difficulty remembering
- Headache
- Dizziness
- Confusion
- Feeling slowed down
- "Pressure in head"
- Blurred vision
- Sensitivity to light
- Amnesia
- Feeling like "in a fog"
- Neck Pain
- Sensitivity to noise
- Difficulty concentrating

3. Memory function

Failure to answer any of these questions correctly may suggest a concussion.

"What venue are we at today?"
"Which half is it now?"
"Who scored last in this game?"
"What team did you play last week/game?"
"Did your team win the last game?"

Any athlete with a suspected concussion should be IMMEDIATELY REMOVED FROM PLAY, and should not be returned to activity until they are assessed medically. Athletes with a suspected concussion should not be left alone and should not drive a motor vehicle.

It is recommended that, in all cases of suspected concussion, the player is referred to a medical professional for diagnosis and guidance as well as return to play decisions, even if the symptoms resolve.

RED FLAGS

If ANY of the following are reported then the player should be safely and immediately removed from the field. If no qualified medical professional is available, consider transporting by ambulance for urgent medical assessment:

- Athlete complains of neck pain
- Increasing confusion or irritability
- Repeated vomiting
- Seizure or convulsion
- Weakness or tingling/burning in arms or legs
- Deteriorating conscious state
- Severe or increasing headache
- Unusual behaviour change
- Double vision

Remember:

- In all cases, the basic principles of first aid (danger, response, airway, breathing, circulation) should be followed.
- Do not attempt to move the player (other than required for airway support) unless trained to so do
- Do not remove helmet (if present) unless trained to do so.

from McCrory et. al, Consensus Statement on Concussion in Sport. Br J Sports Med 47 (5), 2013

ACC Pocket Concussion Card

WHAT YOU SHOULD DO

- **Recognise** the signs and symptoms of concussion
- **Remove** the player from play
- **Refer** them to a medical doctor for assessment

RECOGNISE THE SIGNS AND SYMPTOMS OF CONCUSSION

Concussion should be suspected if one or more of the following visible clues, signs, symptoms or errors in memory questions are present.

01 PHYSICAL SIGNS (WHAT YOU SEE)

- ☐ Loss of consciousness or non-responsive
- ☐ Lying on the ground not moving or slow to get up
- ☐ Loss of balance/ co-ordination
- ☐ Dazed or vacant look
- ☐ Disorientation/ confusion
- ☐ Visible injury to face or head (especially in combination with any other signs)
- ☐ Grabbing/clutching of head

02 MEMORY (WHAT THEY SAY)

Failure to answer any of these questions correctly may suggest a concussion.

"What venue are we at today?"

"Which half/quarter is it now?"

"Who scored last in this game?"

"What team did you play last week/game?"

"Did your team win the last game?"

03 CLINICAL SYMPTOMS (WHAT THEY FEEL)

If any of the following symptoms appear, concussion may be present.

- ☐ Blurred vision
- ☐ Neck pain
- ☐ Nausea
- ☐ Dizziness
- ☐ Confusion
- ☐ Irritability
- ☐ Problems with memory
- ☐ Reduced ability to think/concentrate
- ☐ Difficulty sleeping
- ☐ Sensitivity to light &/ or noise
- ☐ Nervous or anxious
- ☐ Fatigue
- ☐ Headache/pressure in the head
- ☐ Drowsiness/trouble sleeping
- ☐ More emotional

04 RED FLAGS (WHAT REQUIRES HOSPITALISATION)

If no qualified medical professional is available, consider transporting by ambulance for urgent medical assessment.

- ☐ Player complains of neck pain
- ☐ Increasing confusion or irritability
- ☐ Repeated vomiting
- ☐ Seizure or convulsion
- ☐ Weakness or tingling/burning in arms or legs
- ☐ Deteriorating conscious state
- ☐ Severe or increasing headache
- ☐ Double vision
- ☐ Unusual behaviour change

REMOVE THE PLAYER FROM PLAY

Any athlete with a suspected concussion should be IMMEDIATELY REMOVED FROM PLAY, and should not be returned to activity until they are assessed medically.

- Apply first aid principles: **DRSABC** (Danger, Response, Send for help, Airway, Breathing, Circulation).
- Treat as though they have a **neck injury.**
- **ONLY be moved by a medical professional** trained in spinal immobilisation techniques.
- **Do not remove helmet** (if present) unless trained to do so.
- **Call 111** if there is concern regarding the risk of structural head or neck injury.

REFER THEM TO A MEDICAL DOCTOR FOR ASSESSMENT

Anyone with a suspected head injury needs to see and be assessed by a medical doctor.

Only a qualified medical doctor can assess and diagnose a concussion. This is essential to confirm the diagnosis of concussion and to assess the risk for more serious injury.

It is useful to have a list of local medical doctors, concussion clinics and emergency departments close to where the sport/activity is being played.

WHAT HAPPENS NEXT REST, RECOVER AND RETURN

It is unanimously agreed that no return to sport/ activity on the day of concussive injury should occur.

- **Rest** until symptom-free.
- **Recover** by following your medical doctor's advice and gradually becoming more active.
- **Return** to the full demands of your sport when fully recovered & cleared by your medical doctor.

It is important to note that different sports have different rules and return to play guidelines. Before returning it is important to check with your sports code on the rules for your sport.

ACC
PREVENTION. CARE. RECOVERY.
Te Kaporeihana Awhina Hunga Whara

accsportsmart.co.nz/concussion

Based on the Concussion Recognition Tool™ produced by the 2013 Concussion in Sport Group.

ACC 7551 - April 2016

It is useful to have a list of local medical doctors, concussion clinics and emergency departments close to where the sport/activity is being played. A pre-activity checklist of the appropriate services could include:

- local doctors or medical centre
- local hospital emergency department
- ambulance services (111).

To help an unconscious athlete:

- apply first-aid principles – D.R.A.B.C. (Danger, Response, Airway, Breathing, Circulation)
- treat them as though they have a neck injury (this is extremely important)
- ensure they are only moved by a medical professional trained in spinal immobilisation techniques
- call 111 for urgent hospital care if there are concerns about the risk of structural head or neck injury
- **urgently** refer them to hospital if they have any of the following:
  - loss of consciousness or seizures
  - persistent confusion
  - deterioration after being injured – increased drowsiness, headache or vomiting
  - report of neck pain or spinal cord symptoms – numbness, tingling, muscle weakness
- refer them to hospital if there is any doubt at any time

Only a qualified medical doctor can assess and diagnose concussion.

Anyone with a suspected head injury needs to see and be assessed by a medical doctor. This is essential to confirm the diagnoses of concussion and to assess the risk of more serious injury.

We endorse SCAT3 and Child-SCAT3 as validated means of assessing concussion by a medical doctor.
SCAT3
Child-SCAT3

SCAT3 is **not** to be used for a diagnosis of concussion alone. It provides a standardised assessment to aid diagnosis by a medical doctor.

NOTE: In some areas of the world, sports physiotherapists and other trained medical personnel can do assessments (e.g. SCAT3), but **only a medical doctor can diagnose concussion.**

How do you feel?

"You should score yourself on the following symptoms, based on how you feel now."

	none	mild		moderate		severe	
Headache	0	1	2	3	4	5	6
'Pressure in head'	0	1	2	3	4	5	6
Neck pain	0	1	2	3	4	5	6
Nausea or vomiting	0	1	2	3	4	5	6
Dizziness	0	1	2	3	4	5	6
Blurred vision	0	1	2	3	4	5	6
Balance problems	0	1	2	3	4	5	6
Sensitivity to light	0	1	2	3	4	5	6
Sensitivity to noise	0	1	2	3	4	5	6
Feeling slowed down	0	1	2	3	4	5	6
Feeling like 'in a fog'	0	1	2	3	4	5	6
'Don't feel right'	0	1	2	3	4	5	6
Difficulty concentrating	0	1	2	3	4	5	6
Difficulty remembering	0	1	2	3	4	5	6
Fatigue or low energy	0	1	2	3	4	5	6
Confusion	0	1	2	3	4	5	6
Drowsiness	0	1	2	3	4	5	6
Trouble falling asleep	0	1	2	3	4	5	6
More emotional	0	1	2	3	4	5	6
Irritability	0	1	2	3	4	5	6
Sadness	0	1	2	3	4	5	6
Nervous or anxious	0	1	2	3	4	5	6

Total number of symptoms (Maximum possible 22)

Symptom severity score (Maximum possible 132)

Do the symptoms get worse with physical activity? ☐ Y ☐ N

Do the symptoms get worse with mental activity? ☐ Y ☐ N

☐ self-rated ☐ self-rated and clinician monitored

☐ clinician interview ☐ self-rated with parent input

Overall rating: If you know the athlete well prior to the injury, how different is the athlete acting compared to their usual self?

Please circle one response:

no different	very different	unsure	N/A

Initial concussion management involves physical and cognitive rest until the acute symptoms resolve, then a graduated programme of exertion (physical and mental activity) prior to medical clearance and return to sport.

All athletes diagnosed with concussion must go through a graduated return-to-activity protocol led by a person trained in concussion management (e.g. coach, physical trainer, teacher, parent). Athletes should have fully returned to school or work and social activities **before** returning to activity.

Clearance by a **medical doctor** is required before return to sport/activity.

There is a lack of research to support the optimal period of time in which an athlete should be out of training and competition. Below is an example of a graduated return-to-sport protocol based on the best available evidence and expert experience.

Return to activity stage	Functional exercise at each stage of rehabilitation	Objective of each stage
No activity	Avoid all physical and mental exertion including the use of technology (e.g. phones, computers, reading, watching TV).	Recovery.
Light aerobic exercise	Walking, swimming or stationary bike; keep intensity of exercise very low/easy. No resistance training.	Increase heart rate.
Sport-specific exercise	Running drills. No head impact activities.	Add movement.
Non-contact training drills	Progress to more complex training drills, e.g. passing, drills.	Exercise, coordination and cognitive load.
Full contact practice	Following clearance from medical doctor, participate in normal training activities.	Restore confidence and have functional skills assessed by coaching staff.
Return to play	Normal sport.	Full return to sport.

- It has been unanimously agreed that an athlete with a concussive injury must not return to sport/activity on the day it happens[4].
- Returns to activity should be particularly cautious where children and adolescents are concerned.

- Individual international sports federations may have specific rules that must be considered (e.g. World Rugby rules for New Zealand rugby).
- The athlete's safety is the priority and must not be compromised.
- The decision on return to school/work and clearance to return to restricted activity should always be made by a medical doctor.
- The decision on the timing of return to sport/activity should always be made by a medical doctor.
- In some cases symptoms will be prolonged or graduated activity will not be tolerated. If recovery is prolonged, an evaluation by a concussion specialist or clinic may be warranted to determine if there are other aspects of the concussion that could respond to rehabilitation.

In summary, the figure shows the roles and responsibilities for concussion management (i.e. the stages of identification, assessment and diagnosis, rehabilitation and return to school/work/sport).

	Responsibility	Tool/How	Education required
Recognition of injury	Everybody.	CRT.	General public. Ambulance staff. First aiders.
Assessment and diagnosis	Medical doctors.	SCAT3 medical assessment and diagnosis.	GPs, emergency department doctors, sports physicians – use of SCAT3.
Rehabilitation and management	Physiotherapists, occupational therapists, coaches, parents, athletes, teachers, physical therapists, sports medics.	SCAT3 – symptom checklist only. Return to play. Graduated protocol.	All responsible.
Return to school/work/sport	Medical doctors.	SCAT3 medical assessment and diagnosis.	GPs.
Sport training and competition			

Shoulder (acromioclavicular) joint dislocations

A dislocation of the shoulder joint is commonly associated with increased instability and the risk of reoccurring dislocations, particularly in athletes under 20-30 years of age. Strengthening the rotator cuff and scapular stabilisers should be the first step in rehabilitation, with the athlete slowly increasing their range of motion to prevent re-dislocation. A return to play after surgical repair generally happens around nine months later, depending on the above strength analysis.

Knee ligament injuries

It is generally agreed that knee ligament injuries require surgical repair to return athletes to a high level of sport. The best approach is to prevent the injury occurring. The FIFA 11+ programme has been shown to be effective in reducing the risk of knee ligament injuries. For more information, see the SportSmart 'Physical condition' principle 2.

No single measure has been shown to determine reliably a player's suitability to return to play, so it is suggested that a number of measures be used:

- at least six months of rehabilitation
- an absence of knee effusion and pain
- full knee active and passive range of motion
- ≥90% symmetry with bilateral hopping
- 85-90% quadriceps isokinetic strength of theuninjured leg , or preferably baseline.

A combination of sport-specific tests should also be incorporated to ensure that the athlete can perform the movements required of the sport safely in a controlled situation.

Ankle ligament sprains

There are two main types of ankle sprain: inversion or lateral ankle sprain, which is the most common; and ankle syndesmosis or high ankle sprain, which is most often associated with contact sports. Ankle sprains are associated with an increased risk of re-injury.

Four phases of rehabilitation have been described:

Phase 1 – reduce swelling (R.I.C.E.D), protect the injured ligaments (bandage, brace or boot) and begin weight bearing as soon as possible. Full weight bearing should be achieved within two weeks with high ankle sprains. Light resistance work targeting all muscles of the lower leg to prevent atrophy (e.g. body-weight heel raises and resistance bands) can be incorporated into this phase as tolerated.

Phase 2 (once there is no swelling and walking is pain-free) – restore ankle range of motion and build strength in the stabilising muscles, particularly the peroneal tendons on the outside of the ankle. Bands, cords and body weight should be used for resistance, progressing to isokinetic exercises. Start with low-resistance high repetitions and progress to high-resistance lower repetitions. It is important to restore the full dorsiflexion range of motion for restoring speed, explosiveness and jumping ability, but forceful dorsiflexion and external rotation should still be avoided. Low-impact cardiovascular exercises can usually be incorporated towards the end of this phase, including swimming and low-resistance cycle ergometer exercise, which can also be useful in facilitating ankle range of motion.

Phase 3 (once resistance and the number of repetitions equal those of the uninjured leg) – restore proprioception using balance boards, single-leg balance tasks and instability exercises. Complexity can be increased by reducing the base of support, having the eyes closed, increasing the instability of the surface or performing other tasks while balancing.

Phase 4 – return to running, starting with jogging and increasing speed and agility requirements, then adding change of direction tasks and finally jumping and landing tasks. Once all sport-specific tasks can be undertaken pain free and with little to no instability the athlete can be cleared for return to play. Bracing of the ankle is suggested until strength and proprioception have been normalised.

Groin pain

Groin pain is associated with a number of athletic injuries to structures surrounding the pubis (pubic bone); it is often referred to as 'sports hernia' but more accurately termed athletic pubalgia. Symptoms generally include disabling groin pain that intensifies with increasing activity. The muscles attaching around the pubis provide stability to and prevent the overextension and over-rotation of the pelvis.[5] If not properly diagnosed and managed, these injuries can be career ending.

It should be noted that other, non-musculoskeletal problems can also lead to groin and abdominal pain and should be ruled out, for which diagnostic MRI can be helpful as well as identify comorbidities. Owing to the wide variety of causative injuries, it is important that the primary injury is identified and corrected in order to prevent the recurrence of pain and dysfunction.

MRI has been found to be the most useful diagnostic tool, allowing sports physicians to decide between operative and non-operative approaches to treatment.

Prevention-directed core stability and flexibility training has been developed. Many athletic movements such as pitching, changing direction and kicking result in large amounts of torque applied through the pelvis area, so injuries to the muscles tasked with maintaining stability and preventing excessive rotation and extension are understandable, particularly if strength imbalances are apparent in this area.

Multiple injuries to these pelvic muscles and within the hip joint are often apparent. The more common of the injuries grouped into this class are: tears or microtears of the rectus abdominis muscle or tendon where it inserts onto the pubis; tears to the attachments of the adductors to the pubis; and in extreme cases completedetachment. Tearing can also occur to the sartorius (more commonly in females), gracilis and pectineus muscles. Labral tears of the hip joint are often seenat the same time.

Owing to the multifactorial nature of this type of injury, treatment, rehabilitation and return-to-play considerations need to be individualised to theathlete, the specific muscles involved and the severity of the problem.

Surgical treatment appears to be relatively successful, with athletes returning to full sports activity within varying time periods that are often associated with the magnitude of the surgery performed.

Adductor and hip flexor strength and hip joint range of motion should be baseline tested in sports where groin pain has been identified as problematic (e.g. soccer) and the results used to determine return to play when strength is 10-15% of the baseline value.

Hamstring injuries

Hamstring injuries are a common injury reported in sport. They are graded based on their severity, from a strain or minor tear (Grade I) to a complete rupture (Grade III). Previous hamstring injuries increase the risk of recurrence by two to six times, with previous injury being the greatest risk factor. More than a third of hamstring injuries are reported to recur within a year of return to play, and the subsequent injury is generally worse than the original.

Symptoms include a sudden onset of pain in the back of the tigh, generally associated with high-speed running or movements requiring extreme hip flexion and knee extension (e.g. kicking, dancing). The mechanism of injury and the tissues involved have been shown to be associated with the rehabilitation time required to return to pre-injury activity levels.

High-speed running tends to result in injury to the long head of the biceps femoris (a double-headed muscle located at the back of the thigh), with a secondary involvement of the semitendinosus (one of three hamstring muscles that are located at the back of

the thigh). Injury occurs at the aponeurosis tendons and adjacent muscle fibres. These injuries result in weaker for straight-leg raises and knee flexion compared with the uninjured limb, but have short rehabilitation times. In comparison, hamstring injuries from kicking movements are generally located in the semimembronous proximal tendon or musculotendinous junction and have lesser strength deficits but longer recovery times. Injuries to the muscle fibres, while presenting as more severe, rehabilitate more quickly than those involving the proximal free tendon. Injuries to the hamstring tendon take longer to rehabilitate (72 days) than injuries to the muscle (21 days).[6] There is some evidence to support the incorporation of core stability training to prevent re-injury.

Assessment

Injuries need to be evaluated as soon as possible using **D.R.A.B.C.** (Danger, Response, Airway, Breathing, Circulation).

Danger refers to ensuring that a person does not put themselves in danger when responding to an injury.

Response means seeing if the injured player can respond to a question on whether they can hear. This enables the use of communication when assessing the injury. If there is no response, it is important to check that the airway is clear and that the player is breathing before moving on to assess their circulation.

The central nervous system should be assessed before any attempts to move the player. If a neck injury is suspected, they should not be moved until their neck is immobilised. If a concussion is suspected, they should be removed from play and if possible assessed for concussion on the sideline or in a private room. The current best-practice sideline concussion analysis tool is SCAT3 or Child-SCAT3. All concussions need to be monitored for the next 24 hours for worsening of conditions, and if necessary the players sent for neurological testing and examination at an emergency department. Follow the ACC Sport Concussion Guidelines.

Once central nervous system injuries have been ruled out, the injury assessment should include neurovascular risk. If the player has lost sensation beyond the injury site or if the injury could cause neurovascular compromise, such as fractures of the long bones or pelvic injuries, the player should be immobilised before being removed from the field of play.

If an experienced medical professional is available, a reduction of a dislocation can be attempted. However, if it fails the first time, repeated attempts should be avoided.

The severity of the injury should be assessed. If the player is unable to perform any movements that are important for sport performance they should be removed from play for at least the remainder of the day. These movements may include weight bearing and full range of motion of the ankle, knee, hip, shoulder, neck or lower back.

If emergency treatment is not needed, **T.O.T.A.P.S**. (Talk, Observe, Touch, Active Movement, Passive Movement, Skill Test) is an effective tool for further assessment:

Keyword	Action
Talk	▪ Ask the player what happened. ▪ Where does it hurt? ▪ What kind of pain is it?
Observe	▪ Look at the affected area for redness or swelling. ▪ Is the injured side different from the other side?
Touch	▪ Touch indicates warmth for inflammation, and also assesses pain.
Active movement	▪ Ask the injured player to move the injured part without any help.
Passive movement	▪ If the player can move the injured part, ask them to try to move it through its full range of motion.
Skill test	▪ Did the active and passive movements produce pain? If not, can the player stand and demonstrate some of the skills from the game carefully? ▪ If an injury is identified, remove the player from the activity immediately.

Injury management

Injury management involves identifying, treating and recovering from an injury. The sooner an injured player rests and treats their injury, the less time they will be in pain or discomfort, and the sooner they will be able to return to their activity.

A soft tissue injury such as a sprain, strain or bruise (identified using T.O.T.A.P.S.) should immediately be treated with the R.I.C.E.D. (Rest, Ice, Compression, Elevation, Diagnosis) procedure. The player should avoid the H.A.R.M. (Heat, Alcohol, Running, Massage) factors for 72 hours after the injury.

The **R.I.C.E.D.** method of injury treatment can relieve pain, limit swelling and protect the injured tissue, all of which help to speed healing.

Keyword	Action
Rest	▪ Rest reduces further damage – stop activity as soon as the injury occurs . ▪ The player should avoid as much movement as possible to limit further injury. ▪ The player should not put any weight on the injured part of the body.
Ice	▪ Ice cools the tissue and reduces pain, swelling and bleeding. ▪ Place ice (wrapped in a damp towel) onto the injured area. Do not put ice directly onto bare skin. ▪ Hold the ice pack firmly in place with a bandage. ▪ The player should keep ice on the injury for 20 minutes every two hours, for the first 48 hours.
Compression	▪ Compression helps to reduce bleeding and swelling. ▪ Ensure that bandaging is not so tight that it cuts off circulation or causes tingling or pain past the bandage. ▪ Bandage the injury between ice treatments.
Elevation	▪ Elevation helps to stop bleeding and reduce swelling. ▪ Raise the injured area on a pillow for comfort and support. ▪ Keep the injured area raised as much as possible.
Diagnosis	▪ Consult a healthcare professional (such as a doctor or physiotherapist) especially if you are worried about the injury, the pain or swelling gets worse, or the pain or swelling has not reduced significantly within 48 hours. ▪ An accurate diagnosis is essential for proper rehabilitation of moderate to severe injuries.

The player should avoid these **H.A.R.M.** factors for 72 hours after the injury.

Factor	Reason to avoid
Heat	Heat increases the bleeding at the injury site. The player should avoid hot baths and showers, saunas, hot water bottles, heat packs and liniments.
Alcohol	Alcohol increases bleeding and swelling at the injury site, and delays healing. It can also mask the pain of the injury and its possible severity, which may result in the player not seeking treatment as early as they should.
Running	Running or any form of exercise will cause further damage. The player should not resume exercise within 72 hours of the injury unless a healthcare professional says it is all right to exercise.
Massage	Massage causes an increase in bleeding and swelling, and should be avoided within 72 hours of the injury. If the injury is massaged within the first 72 hours, it may take longer to heal.

Rehabilitation focuses on restoring the player's sport-specific abilities to prevent re-injury and encourage the best possible performance. The rehabilitation time and extent depend on the severity of the injury.

Rehabilitation generally has four phases: acute/rest, rehabilitation, sport-specific development, and return to play:

Phase 1 – acute/rest aims to control and reduce the symptoms of the injury (pain, swelling, bleeding) by following the R.I.C.E.D. procedure and avoiding any H.A.R.M. factors.

- Players with concussion should have a period of rest in which all visual and cognitive stimuli are reduced, including television, computers, reading and school or work.
- Sprains and strains may require support in order to protect the damaged tissues, which could include strapping, bracing, booting or unloading with crutches. Complete non-weight-bearing should be avoided as far as possible

Phase 2 – rehabilitation aims for the player to restore and maintain:

- range of motion (stretching, mobilisation, manual manipulation)
- strength (starting with reduced resistance, bands, low weights and body weight and building up gradually)
- muscular endurance (starting with low weight and high repetitions)
- cardiovascular fitness (generally starting with low-impact, low-intensity exercises and building up slowly).

During this phase the aim is to strengthen the injured tissues and supporting tissues that may have been important in the mechanism of injury. All progression should be determined by pain, with any pain and swelling resulting in a period of rest or reduced load and/or repetitions

Phase 3 – sport specific development. Once the strength and endurance of the damaged tissue and surrounding supporting tissues have been returned to normal (more than 85% of baseline, or the uninjured limb is considered sufficient), the athlete can start incorporating sport-specific movements such as speed and agility work, then change-of-direction tasks, then jumping and landing tasks and throwing and kicking tasks. A neuromuscular training programme and/or core/stability/balance programme is often incorporated at this point to help in developing proprioception that may have been lost during the injury. Athletes should be able to perform all sport-specific tasks with good movement integrity and without pain before they are cleared for return to play

Phase 4 – return to play should be graduated, with a slower progression for more severe injuries or prolonged rehabilitation. The player should be able to participate in full training sessions before participating in competition, and time in competition should gradually be increased.

Some injuries, such as dislocations and sprains, may benefit from bracing. Shoulder injuries are difficult to brace as the range of motion is often severely limited. There is some evidence that strapping or soft-shell braces may help with proprioception and therefore may have some benefits. Depending on the requirements of the sport knee and ankle, bracing that prevents medial/lateral motion may be beneficial in preventing a recurrence of injury.

Other considerations for concussion management include keeping track of the number of concussions sustained by the player and the severity of each concussion. Even sub-concussive head impacts can cause cumulative damage. If the athlete shows signs of increasingly severe concussions from small or minor head impacts, retirement from the sport should be considered.

Reporting injury

Reporting on why and how an injury occurs helps in identifying ways to prevent injuries happening again. Coaches should record injuries as they happen. This will enable them to see whether a pattern of injury emerges over a season, and to assess whether any introduced injury prevention measures make a difference.

Which injuries to report?

Standardised reporting allows an analysis of injury trends over time. There should be a basic standard form, which can then be added to with specifics on a particular sport. Deciding which injuries to record will depend on the objectives of the sports organisation. For example, information may be collected on injuries that require a player to:

- receive treatment
- miss part or all of a practice session or game
- miss part or all of the next practice session or game.

What information to collect?

Use an injury report form to record a player's injuries, either manually or electronically.

What to do with the information collected?

The reporting system will be influenced by the sports organisation's objectives and the resources (funds, people and equipment) that can be committed to its operation.

Issues to be addressed	Examples
What is the population whose information you are recording?	▪ Elite players only. ▪ All grades.
For what period is the data to be collected?	▪ Club season. ▪ Whole year.
How will the data be collected?	▪ Questionnaire completed at time of injury and posted to national office. ▪ Postal survey at end of season.
Who will provide the data?	▪ Individual players. ▪ Referees. ▪ Team medics.
Where will the data be collated and stored?	▪ Club. ▪ Regional organisation. ▪ National office.
How will the data be analysed?	▪ Statistical package. ▪ External analyst.
How will the findings be distributed?	▪ Annual report to administrators. ▪ Monthly reports to clubs.
How will data confidentiality be protected?	▪ Policy on identifying individuals. ▪ Storage.

Two major surveys of rugby players in New Zealand used results from player injury reporting. **The surveys aimed to find out:**

- what injuries were occurring in rugby
- how many injuries were occurring
- what factors were contributing to the injuries.

The first survey found that:

- more injuries occurred in higher grades
- most of the injuries occurred in tackles
- many injuries were caused by foul play
- players with previous injuries were more likely to have another
- training in the off-season reduced the risk of injury during the season.

As a result of the survey, **new policies were implemented** such as:

- compulsory wearing of mouthguards
- changes to the rules of the game, e.g. scrum engagement
- teaching correct tackling techniques.

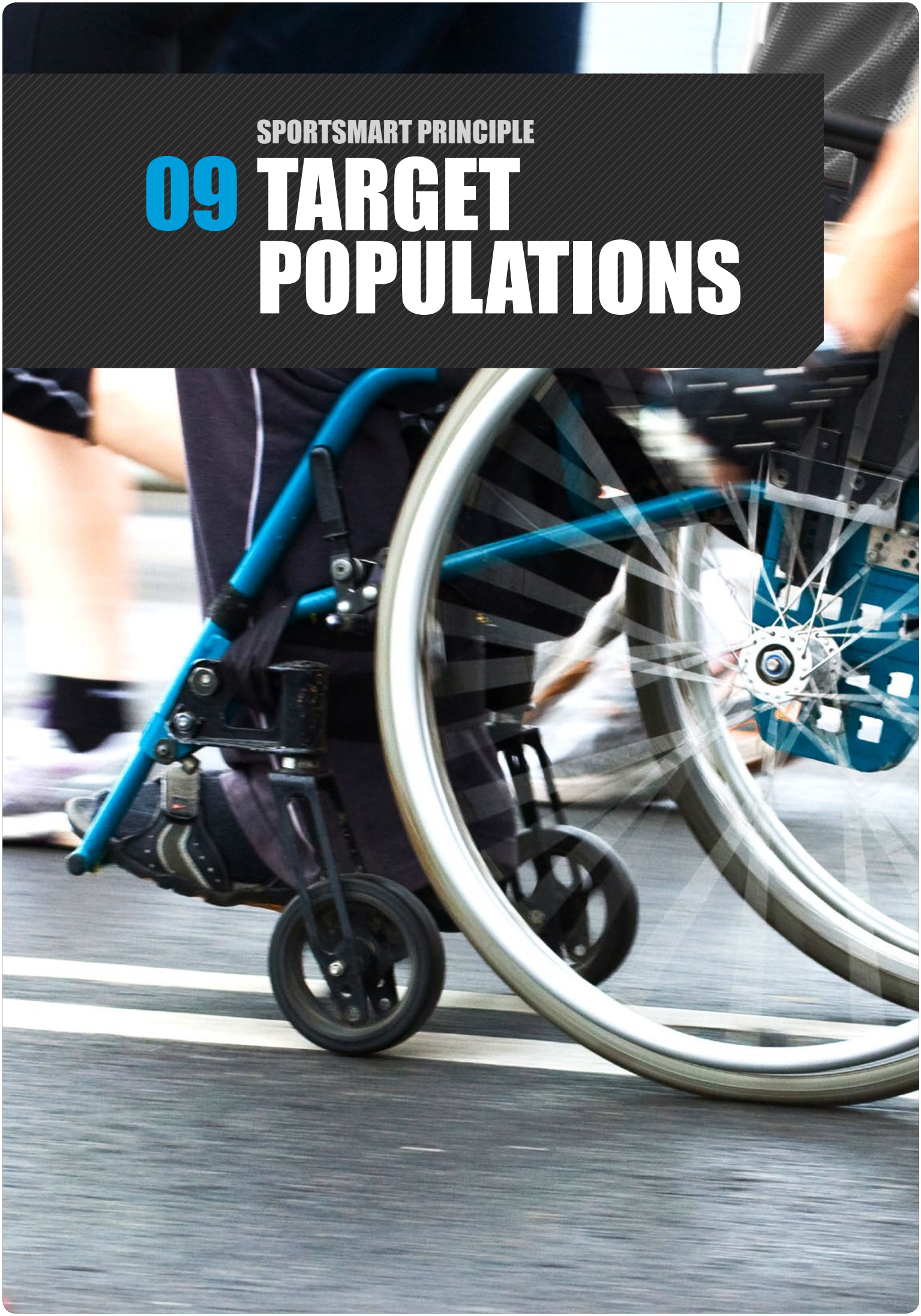
The second survey revealed a reduction in rugby injuries, indicating that the measures put in place to reduce injury had actually worked.

Further information and resources

accsportsmart.co.nz/concussion

SPORTSMART PRINCIPLE

09 TARGET POPULATIONS



TARGET POPULATIONS
KEY POINTS

What	⏩	Athlete target populations include those with prosthetic limbs, those with hearing impairments or who are deaf, those who are visually impaired/functionally one-eyed, and those who have diabetes or heart conditions. Children are also considered a target population given the growth and development issues that need to be considered.
Why	⏩	To enable access to sport for target population athletes, improve their performance and reduce their injury risk.
How	⏩	Athlete target populations need special consideration, with improved knowledge and technologies helping to improve their access and safe participation.
Important Points	⏩	In the spirit of fair play and sportsmanship it is important that athletes with disabilities are accommodated within the sports of their choice to the fullest extent possible.

"THE INFORMATION ON CHILDREN AND ADOLESCENTS ON PAGE 95 HAS HELPED ME THINK OUTSIDE THE SQUARE IN MY PE CLASSES."

Jay, PE teacher.

What are athlete target populations?

In the spirit of fair play and sportsmanship it is important that athletes with disabilities are accommodated within the sports of their choice to the fullest extent possible.

However, it is understood that special considerations apply in relation to the safety of these athletes and in some cases the safety of other players. The target populations for these special considerations are those with prosthetic limbs, those with hearing impairments or who are deaf, those who are visually impaired/functionally one-eyed, those with diabetes and those with heart conditions. Children are also considered a target population given the growth and development issues that need to be considered.

Why consider athlete target populations?

Athlete target populations need to be considered so that they are able to access sport, improve their performance and reduce their injury risks. Improved knowledge and technologies are helping to improve this access and safe participation.

Children are not just mini adults when it comes to sport and injury prevention. They require special consideration in relation to their growth and development. Passive changes, such as changing the size of the field of play or surface, require little input from the child or parent but can have a large impact on reducing injuries in children. Active interventions, on the other hand, require some thought or activity by the child and/or parent, such as wearing, or requiring children to wear, helmets during cycling. It is important that everyone involved in sport, from the child or athlete to the government, takes responsibility for preventing injuries, with each level of the hierarchy having its part to play and influence.

How to improve participation by athlete target populations

Corrective eyewear for visual impairments

While eye-related injuries are relatively uncommon in most sports, their consequences can be severe and lead to long-term impairment. The literature reports cases of serious eye injuries in rugby union, resulting from both deliberate foul play and accidental contact. For such reasons sports organisations should consider amending their rules to permit the use of approved protective eyewear, particularly to help protect at-risk populations. These might include players at youth level and functionally one-eyed players.

Sports that are specifically contraindicated for functionally one-eyed athletes are boxing and full-contact martial arts. This reflects the relative risks and catastrophic consequences of serious eye injury and the fact that eye protection is not used during these activities.[7] In the absence of approved proective eyewear it is conceivable that rugby football codes could be added to this list of contraindicated sports. In the interests of inclusion, sports organisations should consider providingapproved corrective and protective eyewear to allow participation for these individuals.

The application of visual correction and protective eyewear in collision sports does pose certain logistical challenges. Equally, advances in technology and materials science have made this more viable than ever.

There are special cases, such as functionally one-eyed individuals for whom participation would not be recommended without eye protection.

For the many players who wear contact lenses, optometrists recommend certain practical measures to guard against harming the eye and potential infection when replacing lost lenses on the field:

- A member of the support or coaching staff should carry spare lenses for these players.
- A nominated member of the support team (who is suitably practised for the role) should take charge of inserting replacement contact lenses for players if they lose them during a match or training session, rather than the players fitting the lenses themselves. This helps to maintain hygiene and avoid foreign bodies entering the eyes from dirty hands.

Hearing aids for hearing impaired

Existing guidelines and safety standards for the design and manufacture of hearing aids stipulate that they must not compromise the clinical condition or safety of the wearer or other people.

The use of standard hearing aids in contact sports such as rugby union would not fall under the list of conditions or purposes that constitute ‘normal use’. However, the successful use of assistive devices under extreme environments has been documented.

For example, a case study in the literature reports on the successful use of two types of cochlear implant by a scuba diver in a number of dives to a depth of 43 metres, with no adverse effects on function.[8]

While there are logistical challenges, the technological advances and range of options available[9] mean there is more scope than ever for the potential use of assistive hearing devices in contact sports such as rugby. However, some modifications to those that are commercially available may be required to make this viable and to meet the specific demands of adapting this technology for use in contact sports. A practical and

straightforward approach might be to combine them with the use of worn protection (approved headgear) to help cover and protect the equipment.

The findings in the literature appear to be positive about the potential use of headgear for these purposes, as hearing function was reported to be well maintained while wearing the protective equipment.[10] Equally, some pilot testing is likely to be required to verify these findings when wearing the headgear in combination with hearing aid devices, and to investigate the modifications that might be necessary to optimise function.

Prostheses

There have been considerable advances in adaptive technology for running-specific prostheses. Revolutionary technology has also been developed for other sports, including winter sports.[11] Nevertheless, the development of specialised sports prostheses to accommodate the more varied and complex movement and manoeuvrability challenges posed by team sports is still in its infancy.

There is a need to safeguard amputee athletes by allowing them to achieve a level of function that enables them to negotiate the constraints on the field of play and the diverse activities of a match. In addition, any specialised adaptive equipment must allow athletes to play in different environmental conditions – a critical factor in terms of the interaction between the foot of a lower-limb prosthetic and the playing surface.

The development of new adaptive technology must also be validated with empirical data, as a particular design feature or technical modification may not necessary translate into improved function in real life. For example, a shock-absorbing pylon for lower-limb prostheses failed to deliver any consistent benefits over a standard rigid pylon design in terms of impact forces and loading rates recorded in amputee participants.[13]

In addition to overcoming the considerable design and technological challenges, any adapted sports prostheses suitable for team-sports players would require additional modifications to accommodate the elements of physical contact and collision that characterise contact sports. Much as there is a need to safeguard amputee athletes, there is equally a need to safeguard teammates and opponents during contact and collisions.

Diabetes

A 2007 position statement from the United States National Athletic Trainers' Association[14] suggested the following guidelines for managing diabetic athletes:

- Before starting a sport the athlete should construct a care plan with their coaching team, team physician and/or family members. The plan should include: testing times rates for training and competition; insulin therapy and standard nutrition details; specific nutrition prior to/during training and competition; specific signs and symptoms of hypoglycaemia and hyperglycaemia and how to respond; emergency contact details; and physician details. This should be a fluid document that is with the athlete/team at all times during training and competition.
- The athlete should wear a medic alert tag at all times.
- The athlete should have a specific training kit that contains the care plan, supplies for blood glucose testing and the disposal of sharps and test strips, supplies for treating hypoglycaemia (sugary drinks, sugary foods), and spare batteries.
- During the initial months of training and competition the athlete should keep a record of carbohydrate intake, blood glucose levels and type, and the intensity and duration of exercise. Smartphone apps may help with this. It may be noted that blood glucose levels dip lower than expected during competition due to increased stress levels altering glucose metabolism.
- Athletes with diabetes should have regular, three- or four-monthly glycosylated haemoglobin assays to assess their long-term blood glucose control, and at least once a year be screened for diabetic complications such as retinopathy, nephropathy and neuropathy as well as cardiovascular health.
- Nutritional guidelines should be discussed with the athlete's health professional and/or a dietician and signs and symptoms of, and strategies for dealing with, hypoglycaemic and hyperglycaemic incidents should be well known by everyone involved with the athlete, including coaching staff, healthcare professionals, team managers, especially in grassroots sports and other team members. If glucagon injection is part of this strategy, the above individuals should be coached in its administration.
- Trauma is known to increase the risk of hyperglycaemia, so any injury should be treated with increased blood glucose monitoring, and an individualised plan for adjusting insulin and diet should be developed with the athlete's health professional.
- In children and adolescents, a pump or multiple daily insulin injections may bethe best option for controlling blood glucose levels. They should not exercise if their blood glucose levels are higher than 250mg/dL; exercise should be postponed until ketones are cleared. If circulating insulin levels are high (i.e. the pre-exercise dose

has not decreased) and the athlete is planning strenuous or long-duration exercise, they should consume 1-1.5g of carbohydrate per kilogram of body weight per hour. They should consume sugar-free fluids during and after exercise and incorporate a meal high in carbohydrate as soon as possible after the exercise is complete.

- The athlete should be monitored for hypoglycaemia for up to 24 hours after exercise. Afternoon or evening exercise may require a reduction in bedtime insulin and should be monitored. Monitor for a rise in blood glucose levels after intense exercise; this can be countered with a small, fast-acting insulin bolus.

Heart conditions

Recent media attention has led to increased concern about Sudden Cardiac Death as a result of exercise in otherwise healthy, active individuals. There have been suggestions to ECG screen all athletes before allowing them to participate in competitive sports.

However, such a move comes with both financial and ethical burdens. While the risk of Sudden Cardiac Death is reported to be 2.8 times greater in adolescents and young adults involved in sporting activities than non-athletes, the incidence is less than one per 100,000 young athletes per year. It is suggested that it would be more beneficial to target high-risk individuals who are more likely to have the disease.

The other cardiac-related concern is the apparent rise in arrhythmia (irregular or abnormalheartbeats) in endurance athletes. Atrial fibrillation(the most common type of arrhythmia) appears to be quite common in competitive athletes, particularly those with a long history of endurance sports. Premature ventricular contraction (the heart skipping a beat) in athletes may be a manifestation of an underlying heart condition, but it does not have a poor prognosis if no underlying condition is found. In all cases, changes in heart function should be referred to a cardiologist for assessment to ensure that return-to-play decisions are in the best interests of the athlete.

Children and adolescents

Targeting adolescents and children for injury prevention messages is becoming more important. Changing injury prevention attitudes, knowledge and behaviours is more likely to be successful, and long lasting, if the messages are taken on at a younger age.

Growing children have a high risk of injury due to the biomechanics of their immature musculoskeletal structures. For example, muscle strength increases during growth but may not increase in proportion to limb inertial properties.[15] Understanding such a variability in growth can be important for predicting and preventing overuse injuries in young athletes.

Overuse injuries are common when a skeletally immature athlete is exposed to high training loads, especially during periods of rapid growth.[16] Growth plates (areas of cartilage located near the ends of bones) are unique to young athletes and include both 'epiphyseal growth plates' near the ends of long bones (which are mainly subjected to compression forces) and 'apophyseal growth plates' between tendon attachments and bone shafts (which are mainly subjected to traction/tension forces).

Epiphyseal growth plate injuries occur at the distal radial physis (wrist) and distal femoral physis (just above the knee), whereas Osgood-Schlatter's disease (tibial apophysitis in the lower leg, near the knee) and Sever's disease (calcaneal apophysitis in the foot) are common apophyseal growth plate injuries. Scoliosis (lateral curvature of the spine) is another condition thought to be exacerbated by overuse. Lower-extremity injuries with a gradual onset typically include ankle issues (from repetitive pointing of the foot), lower leg stress fractures and compartment syndromes (from the repetitive stress associated with landing), and patellofemoral knee problems (from biomechanically dysfunctional tracking movements of the patella).

Further information and resources

For further information on managing diabetic athletes, refer to the following articles:

- National Athletic Trainers' Association Position Statement: Management of the athlete with type 1 diabetes mellitus. Journal of Athletic Training[14]
- Fuelling the athlete with type 1 diabetes[17]
- Exercise in children and adolescents with diabetes[18]

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