

The Australian Ballet

Injury Risk Management Program



Artists, Ako Kondo and Chengwu Guo. Photography: Justin Ridler

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Introduction

The Australian Ballet has formulated an Injury Risk Management Program aimed at promoting the health and wellbeing of dancers, prolonging their careers and minimising the risk of injury that may affect their quality of life after dance.

The Australian Ballet is committed to the health (physical and mental) and safety of its most precious asset, the dancers. This commitment stems from the Board and extends to all levels of the company. The Australian Ballet has facilitated a change in behaviour over many years that has directly influenced the culture from one that poses a high risk to health to one that embodies health and wellbeing. As a result, the company has experienced fewer injuries, dancers are recovering faster, and their dancing careers are longer.

Ballet is a physically and emotionally demanding art form, classified as a high-risk occupation. The dancers of The Australian Ballet also endure the pressure of a hectic national and international touring schedule.



Callum Linnane and Brett Chynoweth. Photographer: Justin Ridler

The Australian Ballet has adopted a broad multidisciplinary health and wellbeing approach by employing an Artistic Health Team of dance medicine and science specialists providing their services to the dancers onsite. This approach has proven to be extremely beneficial in a wide range of applications, from resolving minor complaints to complete resolution of injuries and successful injury prevention.

The Artistic Health Team has refined the principles of dance medicine and science at The Australian Ballet. The concepts and practices of the Artistic Health Team are now at a stage where dancers, and therefore the company, are realising the benefits of this extremely effective program. The company has successfully managed to reverse high injury trends with a profound reduction in injuries to high-risk areas such as the ankle, foot and hip.

The highly specialised Artistic Health Team's planning, training, research and development have evolved into a documented 'Injury Risk Management Program', so that the benefits The Australian Ballet has experienced can now be shared with other ballet companies and dance organisations across the world.

The Multidisciplinary Approach

From its inception, The Australian Ballet had a degree of medical support through minimal part-time in-house specialists, who did not tour with the company. The dancers were referred to various therapists in whatever city they were performing; thus, treatment was mostly external, difficult to track, of varying quality and not at all centralised.

In 1984, Dr Ken Crichton, a Sports Physician, commenced with the company and was keen to apply a multidisciplinary sports medicine approach to The Australian Ballet. The multidisciplinary model, which in previous years had been applied predominantly to the sporting community, was also very appropriate to a ballet company made up of athletic artists. Hence there was a shift towards establishing full-time, centralised, multidisciplinary care, as well as increasing communication between Artistic Health and Ballet Staff. There was an emphasis on both healthcare and prevention in this model.



Chengwu Guo and Robyn Hendricks.
Photographer: Jess Bialek

The most significant move towards implementing this centralised model was the appointment of a full-time in-house touring physiotherapist, Dr Susan Mayes, in 1997. This was then extended into a fully-fledged risk management program following the appointment of the current Artistic Director, David McAllister, in 2001 and a second full-time physiotherapist in 2002.

A multidisciplinary approach to managing a dancer's injury involves consultation amongst team members with the aim of complete recovery and an understanding of measures to prevent recurrence.

An example of the **multidisciplinary approach** is in the case of an injured dancer, where typically the steps to full injury recovery would be:

1. An accurate injury diagnosis is achieved through Medical &/or Physiotherapy consultation and appropriate investigations if required.
2. Short and long-term goals are set with consultation between the Dancer, Artistic Director, Artistic Health Team and Ballet Staff
3. Management of the injury is achieved with appropriate Physiotherapy and Myotherapy treatment. Only in rare cases is surgery required. Management may also involve modified workload or cessation of training or performance.
4. The Rehabilitation Physiotherapist and Strength and Conditioning Coach work together in consultation with the dancer, to devise a ballet-specific exercise program.
5. The Ballet Rehabilitation Facilitator works with the dancer in the studio in preparation for a return to class, rehearsal and performances.
6. A dancer would consult with the Welfare and Development Co-ordinator to explore career and personal development opportunities and resources and referrals to support wellbeing
7. The Psychologist may work with the dancer to deal with any issues relate to mental health or performance that could facilitate returning to work and provide education about self-management techniques.
8. The dancer would have access to the advice and support of company Doctors throughout the process.
9. The Artistic Health Team communicate with the Artistic Director and Ballet Staff to ensure dancers' workloads are appropriate to promote injury resolution.

The Artistic Health Team

The Australian Ballet has a highly skilled in-house Artistic Health Team specialising in dance medicine and science. The Physiotherapists and Myotherapist travel with the company throughout the year to ensure dancers are provided with consistent evidence-based care that is easily accessible. In addition, certain members of the team are former ballet dancers and bring with them experience that is invaluable to this specialised team. All team members keep abreast of dance medicine and science research and present at conferences as representatives of The Australian Ballet.

Over 25 years, The Artistic Health Team have become world-recognised as leaders in injury prevention and healthcare for professional ballet dancers.

The Artistic Health Team's VISION

To optimise artistic performance and support the health and wellbeing of our dancers by engaging in evidence-based, world-leading practices and research that are daring but respect tradition. Our innovations will be shared with the dance community, elite sport and the broader community globally.

The Artistic Health Team comprises:

In-house

Director of Artistic Health

Duties include:

- Lead the Artistic Health Team – to enthuse, encourage, empower, achieve.
- Provide or arrange provision of relevant and ongoing professional development of the Artistic Health Team.
- Prepare the annual Artistic Health budget for the forthcoming year in accordance with agreed guidelines and timeframe.
- Oversee the La Trobe Research partnership and supervise all student researchers
- Analyse data, write reports and papers for journal publications.
- Prepare and deliver presentations for philanthropy events, La Trobe University professional development sessions and any other conferences required.
- Collaborate with external organisations to build relationships and knowledge share
- Manage all board meetings and annual reports.
- Communicate with Human Resources (HR) in relation to workers compensation claims and status of dancers.
- Arrange for 'preferred supplier status' for allied therapists interstate.
- The Director of Artistic Health also performs Physiotherapy duties as the Principal Physiotherapist.

Artistic Health Administrator

Duties include:

- Organise and coordinate all casual physiotherapists, myotherapists and exercise instructors.
- Manage appointment availability in online booking system.
- Assist administration of athlete management system (AMS).

Order supplies for Ballet Centre and ensure that all supplies are organised to be packed for the theatre and for all tours.

Organise gym and theatre access for staff.

Support Director of Artistic Health with preparing monthly and annual board reports.

Coordinate team meetings and professional development activities.

Support Director of Artistic Health with team budget.

Work with finance to pay all invoices for the Artistic Health Team.

Answer external enquiries from the public and health professionals or redirect as appropriate.

Physiotherapists

Duties include:

Assessing and managing all injuries sustained by the dancers.

Utilising manual skills such as joint mobilisation, soft-tissue massage techniques.

Support the Rehabilitation Physiotherapist by monitoring exercise programs and communicating recommendations in response to changes in clinical presentation.

Perform musculoskeletal profiling for all new dancers.

Assist in monitoring a dancer's overall workload and healthcare.

Communicating regularly with the Artistic Health Team and Artistic Staff regarding prevention and ongoing management of dancers' injuries.

Maintaining clinical notes in the Athletic Management System (AMS) and assist in preparing reports: weekly status; injury reports for annual Artistic Health meetings and Board meetings.

Liaising with and referring to appropriate external health professionals as necessary

Develop and update clinical and dance/sports science knowledge to ensure delivery of evidence-based care.

Rehabilitation Physiotherapist

Duties include:

Managing and reviewing the musculoskeletal profiling for all dancers.

Prescribing evidence-based exercise programs for all dancers that are designed to include dance specific and functional exercises.

Implementing risk reduction exercise programs.

Prescribing graduated rehabilitation programs for injured dancers that ensures a dancer's full recovery and to minimise recurrence.

Applying knowledge of dance technique to rehabilitation programs.

Managing the exercise program workload of dancers using principles of periodisation and taking into account performance and training loads.

Maintaining up to date records and programs in the AMS.

The Rehabilitation Physiotherapist also performs Physiotherapy duties.

Develop and update clinical and dance/sports science knowledge to ensure delivery of evidence-based care.

Myotherapists

Duties include:

Assessing the injured dancer's condition.

Treating and preventing injuries through the provision of soft tissue techniques, including performance enhancing, rehabilitation and relaxation massage.

Utilising other specialised skills such as taping and dry needling.

Providing rehabilitation advice to promote full recovering and minimise recurrence.

Supervising the dancers' gym programs in consultation with the Artistic Health Team.

Communicating regularly with the Artistic Health Team and Artistic Staff about prevention and ongoing management of dancers' injuries

Develop and update clinical and dance/sports science knowledge to ensure delivery of evidence-based care

Assist in packing crates for touring.

Providing Manual Lymphatic Drainage (MLD) for post-performance and rehearsal recovery.

Strength and Conditioning Coach

Duties include:

Designing and implementing risk management exercise programs

Under the guidance of the Rehabilitation Physiotherapist, design and progress exercise programs for all dancers

Collaborating with the Artistic Health Team and Artistic Staff to develop or modify exercises to suit individual dancers' physical needs or company repertoire

Observing, monitoring and documenting dancers' progress

Educating users of appropriate use of conditioning equipment

Monitoring and maintaining gym and exercise equipment

Assist packing of touring crates and distribution of exercise equipment at theatres

Develop and update dance/sports science knowledge to ensure delivery of evidence-based care.

Sports & Exercise Physician

A Sports Physician consults on-site in Melbourne twice a week to provide injured dancers with the required centralised medical assessment, review and/or advice to aid recovery. The primary role of the Sports & Exercise Physician is to monitor the health and progress of injured dancers, liaise with the Artistic Health Team about any medical issues, treatments, rehabilitation and return-to-work planning and the Human Relations team regarding managing workers compensation claims. Liaising with all key stakeholders including the dancers facilitates a forum for open communication and informed decision-making. The Sports & Exercise Physician performs musculoskeletal profiling all new dancers prior to commencement of their employment.

General Practitioners

Advice and management relating to all aspects of general health and well-being is available. There is a focus on nutrition and mental health, with growth and bone development a special concern for younger dancers. Off-site referrals for specialist advice are provided. General health checks are undertaken for all new dancers prior to commencement of employment. Immunisation and preventive education are provided both for general health and overseas travel needs.

Welfare and Development Co-ordinator

Duties include:

Preparing, facilitating, co-ordinating and monitoring personal development plans that capture the dancers' well-being, career and educational needs.

Completing Individual Career Development Plans with dancers, offering accurate guidance and support that will enable dancers to look at life beyond ballet.

Promoting personal development, i.e. both as a person (life skills and values) and a dancer (e.g. 1st year guidance, standards and values).

Organising high-performance networks targeted at improving artistic performance.

Acting as a conduit between dancers and appropriate professional development and well-being programs and services.

Providing appropriate first incident response to dancers who present with professional and personal issues.

Guidance and support on wellbeing related issues in a professional and confidential manner. Implementing educational programs aligned with The Australian Ballet's vision for dancer development.

Provision and co-ordination of mental health and well-being programs for individuals and small groups.

Maintain communication between Artistic Health Team, HR, Company Management and Philanthropy to ensure support services and mentoring opportunities are utilised efficiently and effectively.

Maintain timely and accurate reporting including monthly de-identified status reports to the Artistic Director and Director of Artist Health.

Psychologists

The mental health issues related to a dance career have previously been underestimated and not prioritised. Dancers who perform at an elite level are exposed to high expectations of performing at their best to hundreds of people. In addition to the physical and production demands that are constant throughout the career of a dancer, performance anxiety is not uncommon. The Psychologists provide either onsite or offsite consultations and may guide the Artistic Health Team and Artistic Staff in supporting the dancer's mental health needs while maintaining complete confidentiality.

External

Most commonly these include specialist Musculoskeletal Radiologists, Podiatrists and Dieticians, although all areas of medical expertise may be required depending on the medical condition involved.

The Artistic Team

An integral part of the multidisciplinary approach, the Artistic Team acts as a "branch" of the Artistic Health Team within the Injury Management and Prevention Program. Without the support and involvement of the Artistic Team that has evolved over the years, the program cannot work. Being former dancers themselves, they understand the particular needs, difficulties and rewards of a dance career. The Artistic Team comprises:

Artistic Director

The Artistic Director is closely involved with the program and actively supports it. This support is essential for the success of the program. Regular communication with the Artistic Health Team informs the Artistic Director's decision-making about a wide variety of issues, from repertoire and scheduling to weekly management of dancers' workloads. The Artistic Director upholds the notion of workload modification as a means of preventing serious or prolonged injury to the dancer and allowing effective rehabilitation when an injury occurs.

Ballet Staff

The Ballet Staff teach company class and repertoire, and coach individual dancers as required. Being responsible for planning and teaching class each week and warm-up barre during the performance season, they have an active and essential role in implementing the risk management programs devised by the Artistic Health Team. Their daily contact with dancers also places them in an ideal position to monitor the progress of each dancer and report back to the Artistic Health Team.

Ballet Rehabilitation Specialist

The Ballet Rehabilitation Specialist works one-on-one with dancers who are experiencing discomfort, have sustained an injury or require specific coaching for their technique. They act as the interface between the Artistic Staff and Artistic Health teams, and the main functions of this role are:



David Hallberg &
Megan Connelly

Collaborating with the dancer, the Artistic Health Team and Ballet Staff, to set short and long-term goals and manage a dancers' workload.

Assessing a dancer's ballet technique to identify key areas of focus and direction

Designing and implementing individual graduated ballet programs for injured dancers, to support them in returning to full capacity.

Applying pedagogical knowledge to the rehabilitation setting, in consultation with the Artistic Health Team.

Communicating with Rehabilitation Physiotherapist and Strength and Conditioning Coach to ensure ballet program and exercise program are developing symbiotically.

Providing both one-on-one sessions and regular group coaching classes.

Coaching dancers in performance repertoire for a full return to the stage.

Managing and updating weekly coaching schedule.

Providing pastoral care and mentorship to dancers.

Preparing weekly progress reports for Ballet Staff and Artistic Health Team.

Dancers

The success of The Australian Ballet's Injury Risk Management Program relies on the commitment and involvement of the Dancers. Though The Australian Ballet has demonstrated full support to the Dancers in maximising their wellbeing, it is expected that the Dancers also take responsibility for ensuring they are physically and mentally fit and resilient to perform optimally.

A Culture For Success

A Reporting Culture

The Australian Ballet has successfully facilitated a shift in culture to early reporting of all complaints. A key to injury risk management is early attention to minor musculoskeletal

complaints such as cramp, fatigue, stiffness or low-grade discomfort. Early intervention for these minor complaints has led to a marked reduction in our injury rate.

The early reporting practice is taught to dancers at The Australian Ballet School (8 to 17 years), the importance of which is further reinforced at The Australian Ballet during the annual induction process, which is compulsory for all dancers, new and existing. Early reporting is encouraged and supported by both the ballet staff and the Artistic Health team. Early intervention is the primary means to preventing injury and/or minimising time off work, both aspects being extremely appealing to ambitious and highly driven ballet dancers.

A Consultative Culture

Consultation between members of the Artistic Health Team, Artistic Staff and Dancers is frequent and open, and it takes various forms:

Often a dancer receives treatment from multiple practitioners within the Artistic Health Team, in which case all practitioners liaise with each other about the future treatment and progress of the dancer. The dancer is consulted at each stage throughout the management process. While the dancers' contracts allow for discussion regarding musculoskeletal injury between various members of staff, high standards of confidentiality are maintained.

All the stakeholders in the injury risk management program, including the dancers, are consulted on policy matters that relate directly to their health, safety and wellbeing.

The dancers have a forum for consultation about general health and safety matters, other than those specifically related to dance, via their EHS Representatives, who have an active role within the EHS Committee.

A Just Culture

The Australian Ballet fosters a culture that is supportive of the dancers' physical and mental needs. Support of injured dancers by the Artistic Staff and Artistic Health Team stems from their understanding of a dancer's concerns and needs; therefore, injured dancers are managed until they are completely recovered.

In the past, dancers were reluctant to report injuries so as not to jeopardise performance opportunities. The Australian Ballet has demonstrated to the dancers that reporting injuries does not disadvantage them in any way; on the contrary, everything is done to ensure that dancers casting and rank in the company are not negatively impacted by injury.

Body Image

Ballet dancers are elite athletes often compared to professional football players and Olympic gymnasts, who are required to perform at an exceptional level. To accomplish this, they must have high levels of fitness, strong muscles and healthy bones, consume a balanced, nutritious diet and have mental resilience.

The Australian Ballet has formulated a 'Body Image and Fitness Support Policy'. The purpose of the policy is to provide a formal and transparent mechanism to deal with dancers who may have eating disorders. The policy was formulated in consultation with a Psychologist, the Artistic Health and Artistic teams and Dancer representatives.

The policy stipulates that any concern for a dancer is initially reported to a member of the Artistic Staff, which effectively initiates the support process. A confidential meeting is arranged with the Artistic Director, an Artistic Staff member and the dancer to discuss the concerns and offer support to the affected dancer.

Following this meeting the dancer will be referred to the company's General Practitioner for assessment and to formulate a plan for a positive outcome in consultation with the dancer. This doctor may refer the dancer to a dietitian, psychologist and/or ballet coach to provide additional professional assistance. The doctor will continue to monitor the dancer until she/he has completely recovered and achieved the goals outlined during the initial consultation.



Andrew Wright and Dimity Azoury. Photographer: Jess Busby

Injury Risk Management Program

Dancers are exposed to multiple risks in every production. There are approximately nine productions and 180 performances per year. The company tours for five months of the year, both nationally and overseas. Few other dance companies tour for as long as The Australian Ballet, nor are they required to travel as far. The company employs 79 dancers who range in age from 18 to 40 years.

Dancers experience an ever-changing workload as each production presents new roles and physical demands. Additional risks are posed by the differing workplaces and performance conditions present at each venue.

To meet these challenges and minimise the risk of injury, The Australian Ballet has developed a comprehensive Injury Risk Management Program. Its key elements are: Dancer profiling, risk analysis, injury risk management programs, communication and on-site facilities.

Dancer profiling

All new dancers undergo various forms of profiling:

- Medical by the Sports Physician and General Practitioner

- Musculoskeletal by the Physiotherapists

- Muscle Capacity by the Strength and Conditioning Coach

The purpose of profiling is to develop rapport with the dancers and educate the dancers on their physical capacity and how they can best manage their individual physiques to promote a long and healthy career. Profiling also provides the Artistic Health Team with data that becomes the basis for developing individual treatment plans, exercise programs and education that aims to help reduce the risk of injury and improves a dancers' potential to cope with the workload.

This information is maintained within the athlete management system and taken into consideration as they take on different roles. Additional periodic profiling may also occur during the course of a dancer's career with the company.



Natasha Kusen, Photographer: Justin Smith

Risk Analysis

Many risk factors are associated with performing ballet at an elite level and they are continually analysed with a view to developing appropriate strategies to minimise risk of injury. This includes analysis of the choreographic and technical elements of a production as well as the schedule and repertoire allocated for the year ahead. There is also retrospective analysis through injury data stored on the Athletic Management System (AMS).

Choreographic Risk Assessment

Analysis of choreographic elements, schedule and repertoire is undertaken by the Artistic Health Team and Artistic Staff and is used to develop injury risk management strategies. Such strategies include:

- Appropriate training on optimal ballet technique and exercise programs

- Adequate treatment –Physiotherapy and Myotherapy

Encouragement of early reporting of any complaints.

Adequate rehearsal time allocated to ensure familiarisation with safe work practices

Monitoring and evaluation – the Artistic Health Team and Artistic Staff are constantly monitoring dancers during rehearsals and performance for any signs of fatigue/injury. Concerns are communicated at the weekly Artistic Health meeting.

Technical Risk Assessment

This is managed by the OH & S Coordinator and commences at the design concept stage for new productions. Sets, lighting, props, costumes and floor surfaces are considered and risk assessment is reinforced by a design policy, the purpose of which is to minimise risks as early as possible.

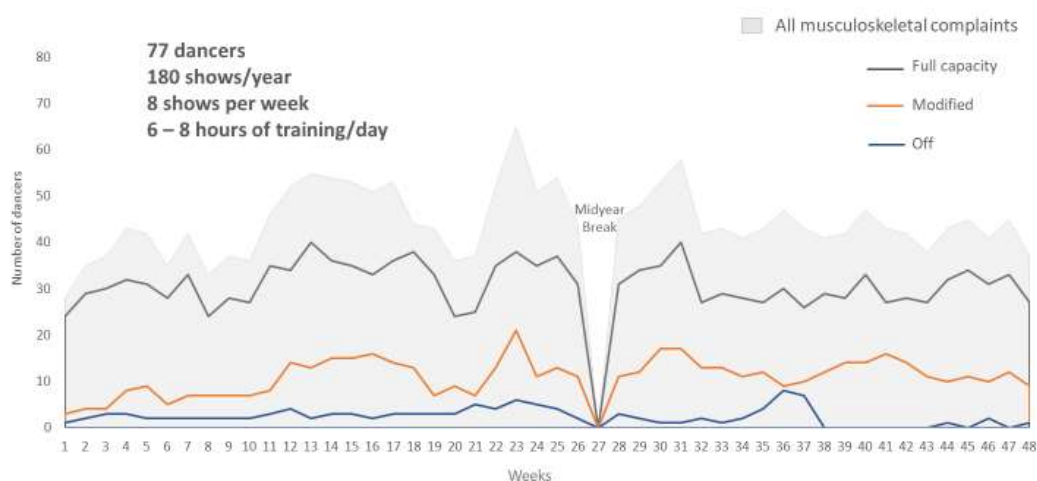
Further risk assessment is conducted following design presentation and during construction and rehearsal phases to ascertain any additional hazards and develop strategies for control. The assessment is reviewed, and modified as necessary, once performances have commenced and prior to the production transferring to a new venue.

Data Collection

Injury data informs the injury risk management strategies and guides the company's quest for continual improvement. Whenever a dancer presents with a condition, whether a minor complaint or more serious injury, it is recorded by the Physiotherapists. This data is stored on the athletic management system and collated annually for presentation at the annual artistic health meeting. It provides a useful picture of both injury trends and areas to target in the future, and as the system has been in place for many years, it also allows comparison with earlier repertoire and seasons. The data can demonstrate the effectiveness of injury risk management strategies. De-identified injury data is also presented to the Dancers at their annual education session and to the Board of Directors.



Level of participation in ballet class in 2019



Injury Risk Management Programs

Following on from risk analysis is the development of programs designed to address specific issues. This can range from site-specific (e.g. calf endurance program) to group-specific (e.g. young male partnering skills and strengthening) to repertoire-specific.

The La Bayadere Act 2 Shades 'Back program' was devised to tackle the repetitive arabesque requirements of the opening scene. An education session took place to prepare dancers physically and mentally for the repertoire. The session not only outlined the potential risks of the choreography, but also provided risk management strategies by the way of pre-rehearsal, post-rehearsal, pre-performance and post-performance programs. The success of this program was verified by the fact that there were no time-loss back injuries during the production. An added bonus was the increased confidence and empowerment of dancers, who experienced the tangible benefits of this type of intervention.



Artists of The Australian Ballet in Marius Petipa's *La Bayadere*, Act 2 "Shades"
Photograph: Branco Gaica

Injury prevention exercise programs are devised by the Artistic Health Team and are implemented by the Strength and Conditioning Coach in a session with the dancers at the beginning of the rehearsal period.

Other prevention programs include the annual graduated return-to-work program as well as post-performance, in-flight and post-flight recovery strategies as well as managing the demands of long bus trips on regional touring and preventing DVT.

Graduated Return-to-Work Program

The graduated return-to-work program has been in effect since 1994. The program was initially devised by the Artistic Health Team to address the high incidence of stress fractures that occurred at the beginning of each year due to the sudden workload increase following the annual holiday break.

Prior to going on annual leave, the dancers are instructed on a home exercise program that has been developed for them by the Artistic Health Team. The aim is to ensure that general fitness is maintained during the holidays as a measure to minimise injuries during the return to work period.

In the three days prior to the company's first day back at work, optional modified ballet classes are offered to all dancers. The first two weeks of the return-to-work period are then structured carefully to minimise the likelihood of injury.

During the first three days of Week One:

- A full class of low intensity is offered to those dancers who continued to work over the break

- A modified class is offered to the majority who rested

- Up to an hour is then available for marking rehearsal, followed by an hour of learning repertoire

- After lunch there are another two hours allocated for marking rehearsals, the last seventy-five minutes are used for learning repertoire from visual aids and education sessions

During days four and five of Week One:

- Full or modified classes are offered

- Rehearsals are still relatively short, but of slightly higher intensity

- The end of the day is set aside for non-physical activities as at the start of the week

During the first two days of Week Two:

- A full class including grand allegro is available to all dancers, although they are encouraged to work at their own pace

- Rehearsals are longer and more intense

- Non-physical activities are scheduled at the end of the day

By the end of the second week, dancers have gradually increased the hours and intensity of their workload to a full day of class and rehearsals.

The education sessions are an important part of this program, as they cover a variety of health topics. The sessions aim to increase dancers' appreciation of the importance of injury risk reduction measures and their understanding of current health and wellbeing management strategies. Topics include joint health, nutrition, stress management, and recovery strategies.

The program has been successful not only in dramatically reducing the incidence of stress fractures, but also in equipping dancers with self-management techniques to improve their wellbeing.

Post-performance Recovery Strategies

Recovery from rehearsal and performance is an integral part of optimising future performance. Both the mind and the body need to recover and there are many tools available to facilitate this process. The tools utilised at The Australian Ballet include: contrasting hot/cold showers; ice baths and compression garments. Relaxation and leisure pursuits are also encouraged to provide balance to the workload.



Artists of the Australian Ballet. Photography: Kate Longley

In-flight and Post-flight Recovery Strategies

Another initiative by the Artistic Health Team has been to address the adverse effects of air travel on the body. The principal issues covered by this latest strategy are: swelling of the limbs, immobility, hydration and scheduling.

Research has shown that graduated compression stockings reduce lower leg swelling and the incidence of Deep Vein Thrombosis (DVT). These stockings are provided to all members of the touring company and their use is strongly encouraged. In addition, heel rise foot pump exercises are taught to the dancers, as these exercises have proven to be most effective in activating the calf musculature while sitting, thus preventing pooling of fluid in the legs.

Prolonged immobility in-flight may cause stiffening of joints and adverse stress on the lower back. Dancers are encouraged to regularly walk in the cabin during flight and perform spinal mobilisation exercises to minimise this.

It is widely recognised that hydration should be maintained during flight, and excessive consumption of diuretic beverages such as coffee and alcohol is best avoided. Dancers are informed of the benefits of in-flight consumption of electrolyte and carbohydrate

beverages (such as commercially available sports drinks) to assist hydration and prevent blood thickening in the lower legs.

Smart scheduling is a key feature of our post-flight recovery program. Where possible, long-haul flights are scheduled to arrive during daylight to allow exposure to natural light and encourage adjustment to the day-night cycle at the destination. A reduced dance workload is undertaken on the first two days, and an optional light intensity ballet class is offered on the first day after the flight. During these days, light intensity exercise, especially in a pool, is encouraged to promote mobilisation and loosening of muscles, joints and ligaments.

Communication

Lines of communication are essential to ensure the effectiveness of The Australian Ballet's Injury Risk Reduction Program. Communication begins with daily liaison between the Artistic Health Team, Artistic Staff and dancers and a weekly injury report. This report becomes the basis for a weekly Artistic Health meeting between the Artistic Health Team, Artistic Director and Artistic Staff. The meetings, which are documented, are a forum for discussing the status of dancers and short, medium and long-term performance goals, including workload modification, treatment and injury risk reduction strategies.

The entire Artistic Health and Artistic teams meet annually to discuss injury data and trends, future injury risk reduction strategies as well as to monitor and evaluate the effectiveness of current measures. Senior management are involved in these meetings, including the Artistic Director, Executive Director and Director of Operations. This meeting looks beyond the short-term and is a forum for innovative solutions to issues that have arisen in the previous twelve months.

The EHS Committee meets quarterly and discusses a range of issues, including hazards within the dancers' working environment in the rehearsal room and onstage. From these discussions the committee develops safe working procedures and communicates them to all relevant personnel. The vision for the company's health and safety management system is "Speaking Up For Safety" and the EHS Committee is a key element in that line of communication.

On-site Facilities

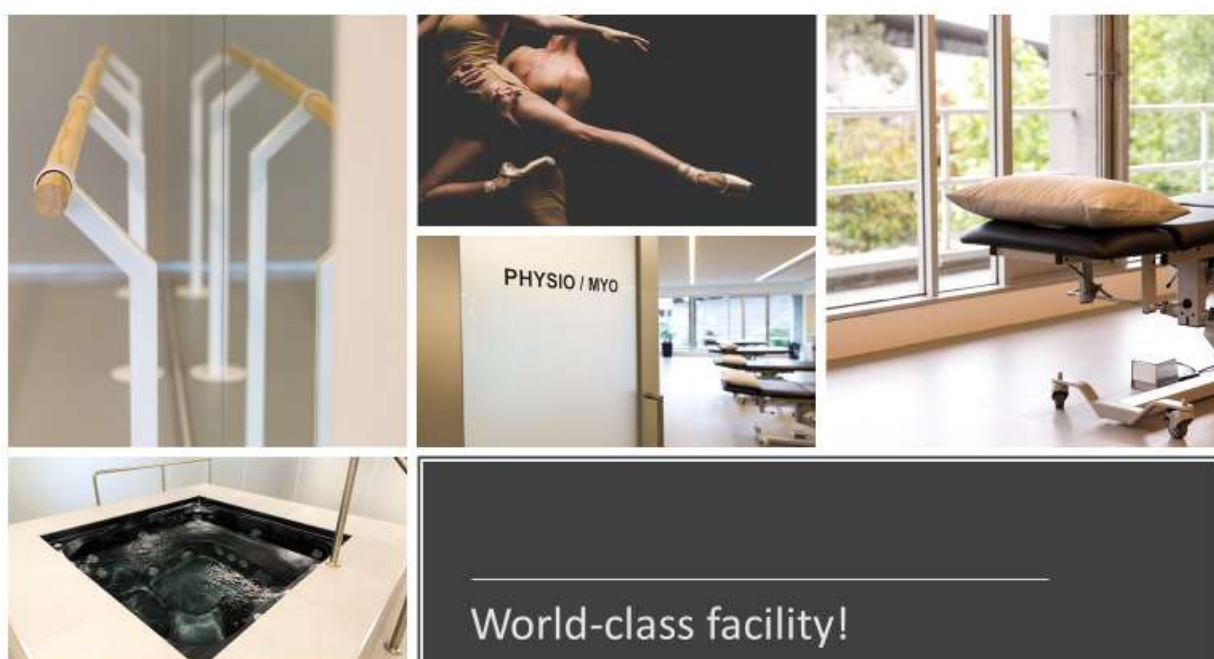
The Australian Ballet has world-class facilities that allows dancers to improve their fitness and manage injury efficiently and effectively. These facilities include: an exercise studio, gym, physiotherapy and myotherapy suite, two private consultations rooms for doctors and therapists, ice bath and the Artistic Health Team office. Exercise equipment and a variety of portable devices are located in and around the rehearsal studios. In addition, female dancers are provided with customised pointe shoe fittings.

Exercise Facilities

An exercise studio and gym at The Australian Ballet's Melbourne headquarters are available to dancers to ensure they have ready access to equipment so that they can improve or maintain their physical capacity to optimise artistic performance and minimise injury risk. Pilates reformers have been standard training equipment in a ballet company setting for many years and they continue to be utilised daily. Traditionally, only

men used gym equipment to strengthen the body for partnering the women. In the late 90's, our team started to emphasise the value of high resistance strengthening programs for men and women as a strategy to overcome injury. By 2006, high resistance strengthening was an important component of our injury prevention program. We now have a fully equipped gym that most dancers access daily to improve their physical capacity to cope with their heavy dancing workloads.

Exercise bikes are located outside rehearsal rooms or backstage for dancers to use between breaks and whilst waiting for rehearsals to begin. Mini-trampolines are set up backstage for dancers to warm up and keep muscles warm between Acts. These, along with other fitness equipment, are transported whenever the company tours interstate to assist dancers to support injury risk reduction. Other travelling equipment includes Swiss balls, Bosu balls, free weights, elastic bands and a Pilates© Reformer.



Primrose Potter Australian Ballet Centre. Photography: Kate Longley.

Customised Pointe Shoe Fittings

A great deal of attention is paid to the use of pointe shoes at The Australian Ballet, as incorrectly fitting pointe shoes have been identified as a contributing factor to injury. When a female dancer joins the company, she is fitted for pointe shoes by an expert, in consultation with the Artistic Assistant, Ballet Rehabilitation Facilitator, a Physiotherapist and the Artistic Staff. The shoes are then custom-made to specifications designed for maximum comfort and support and minimum risk of injury.

This process is reinforced through education of the dancer in pointe shoe modification and correct performance techniques. The dancers' use of shoes is monitored periodically to ensure that the shoes continue to conform with the company's high expectations for injury risk management.

Repertoire plays a significant role in the wear and tear of pointe shoes, but on average Principal Artists are allocated up to six pairs per week, Senior Artists and Soloists up to three pairs and the Corps de Ballet two pairs per week.

Research

The Australian Ballet is committed to supporting high quality clinical research that informs evidence-based management that optimises the health and welfare of our dancers. Professor Karim Kahn initiated such research in the 90's and since then the company has been involved in research that has been published in peer-reviewed journals (publication list - link) and shared world-wide at national and international conferences and workshops.

In 2017, The Australian Ballet partnered with La Trobe University and developed a dance research program led by Dr Susan Mayes and Professor Jill Cook. The research aims are to optimise joint health, dancer wellbeing, understand dance movement and investigate the impact of dance as a physical activity.

<https://www.latrobe.edu.au/industry-and-community/research-partnerships-with-industry/ballet>



Conclusion

The development of The Australian Ballet's Injury Risk Management Program has evolved over 25 years, involving all levels of the organisation. The success of the program extends both from the enthusiasm and commitment of all key stakeholders and the desire for continual improvement. The Artistic Health Team regularly formulates innovative ideas and solutions to maintain the health and well-being of the dancers and thereby enhances the company as a whole.

Publications by current and past team members

1. Hip joint cartilage defects in professional ballet dancers: a 5-year longitudinal study. Mayes et al. Clin J Sport Med. 2020. [Epub ahead of print]
2. Patient-reported outcome measures for hip-related pain: a review of the available evidence and a consensus statement from the International Hip-related Pain Research Network, Zurich 2018. Impellizzeri FM et al. Br J Sports Med. Published Online First: 17 February 2020. doi: 10.1136/bjsports-2019-101456
3. Consensus recommendations on the classification, definition and diagnostic criteria of hip-related pain in young and middle-aged active adults from the International Hip-related Pain Research Network, Zurich 2018. Reiman et al. Br J Sports Med. 2020 Jan 20. pii: bjsports-2019-101453. doi: 10.1136/bjsports-2019-101453. [Epub ahead of print]
4. Standardised measurement of physical capacity in young and middle-aged active adults with hip-related pain: recommendations from the first International Hip-related Pain Research Network (IHiPRN) meeting, Zurich, 2018. Mosler et al. Br J Sports Med. 2019 Dec 19. pii: bjsports-2019-101457. doi: 10.1136/bjsports-2019-101457. [Epub ahead of print]
5. Physiotherapist-led treatment for young to middle-aged active adults with hip-related pain: consensus recommendations from the International Hip-related Pain Research Network, Zurich 2018. Kemp et al. Br J Sports Med. 2019 Nov 15. pii: bjsports-2019-101458. doi: 10.1136/bjsports-2019-101458. [Epub ahead of print]
6. Is exercise therapy for femoroacetabular impingement in or out of FASHIoN? We need to talk about current best practice for the non-surgical management of FAI syndrome. Kemp et al. Br J Sports Med. 2019 Oct;53(19):1204-1205. doi: 10.1136/bjsports-2018-100173. Epub 2019 Jan 9.
7. Hip flexor muscle size in ballet dancers compared to athletes, and relationship to hip pain. Emery S, Cook J, Ferris AR, Smith P, Mayes S. Physical Therapy in Sport. 2019. doi.org/10.1016/j.ptsp.2019.05.003

8. Obturator externus was larger, while obturator internus size was similar in ballet dancers compared to nondancing athletes. Mayes S, Ferris AR, Smith P, Cook J. *J Phys Ther Sport*. 2018 Sep;33:1-6. doi: 10.1016/j.pts.2018.06.001. Epub 2018 Jun 2.
9. Hip joint effusion-synovitis is associated with hip pain and sports/recreation function in female professional ballet dancers. Mayes S, Ferris AR, Smith P, Garnham A, Cook J. *Clin J Sport Med*. 2018 Mar 23. doi: 10.1097/JSM.0000000000000595. [Epub ahead of print].
10. Impingement-type bony morphology was related to cartilage defects, but not pain in professional ballet dancers. Mayes S, Smith P, Cook J. *J Sci Med Sport*. 2018 Sep;21(9):905-909. doi: 10.1016/j.jsams.2018.02.014. Epub 2018 Mar 3
11. Bony morphology of the hip in professional ballet dancers compared to athletes. Mayes S, Ferris AR, Smith P, Garnham A, Cook J. *Eur Radiol*. 2017 Jul;27(7):3042-3049. doi: 10.1007/s00330-016-4667-x.
12. A case-control study investigating the relationship between 3-T MRI findings, bony morphology, and hip pain and function in professional ballet dancers and non-dancing athletes. Susan Mayes, Peter Smith, April-Rose Ferris, Jill Cook. *Br J Sports Med*. Feb 2017, 51 (4) 359; DOI: 10.1136/bjsports-2016-097372.190
13. Professional ballet dancers have a similar prevalence of articular cartilage defects compared to age- and sex-matched non-dancing athletes. Mayes S, Ferris AR, Smith P, Garnham A, Cook J. *Clin Rheumatol*. 2016 Dec;35(12):3037-3043.
14. Differentials in Turnout Among Professional Classical Ballet Dancers. Washington I, Mayes S, Ganderton C, Pizzari T. *Med Probl Perform Art*. 2016 Sep;31(3):160-5. doi: 10.21091/mpa.2016.3029.
15. Atraumatic tears of the ligamentum teres are more frequent in professional ballet dancers than a sporting population. Mayes S, Ferris AR, Smith P, Garnham A, Cook J. *Skeletal Radiol*. 2016 Jul;45(7):959-67.
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17. The impact of extreme loading on the hip joint in ballet. Mayes S. *JSAMS* 19S (2015) e57-e87 (abstract)
18. Heel pain: a practical approach. Rio E, Mayes S, Cook J. *Aust Fam Physician*. 2015;44(3) 96-101.
19. Ultrasound Imaging is a Valid Method of Measuring the Cross-Sectional Area of the Quadratus Femoris Muscle. Mayes SJ, Baird-Colt PH, Cook JL. *J Dance Med Sci*. 2015 Mar;19(1):3-10.
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23. The influence of second toe and metatarsal length on stress fractures at the base of the second metatarsal in classical dancers. Davidson G, Pizzari T, Mayes S. *Foot Ankle Int*. 2007 Oct;28(10):1082-6.
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