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Cover photograph of gold medal winner Sara Corrigan: Australian Sports Commission

Issues for Members in the Twenty-first Century

By Gary Moorhead

For most Sports Medicine Australia members, a love of sport motivates their interest in sports medicine and science. For many, that love is also fueled by an ambition to work with the elite practitioners of sport. However, changes to elite sport – and the way elite sport is perceived in the wider community – will have implications for SMA members. A post-Olympic environment is probably an appropriate time to reflect on where elite sport is going and what that means for sports medicine and science.

There is no doubt that elite sport is moving very rapidly towards becoming "entertainment". What is the difference between Guy Sebastian and Ian Thorpe? (apart from the hair) Both are products of exhaustive talent searches supplemented by intensive specialised training to sharpen skills, maximise their potential – and make money. Thorpe marks his successes with gold medals; Sebastian his successes with gold records – and both with money.

Much of sport, like many areas of entertainment is becoming dominated by a "winner take all" ethos. In popular music, the rewards go almost entirely to those at the very top of the profession – there are superstars and then daylight. Sport is trending rapidly in this direction.

What is the significance of elite sport becoming more of an "entertainment" for sports medicine and science practitioners?

One probable outcome is greater public awareness of the role of the "team behind the team" and a consequent greater degree of public exposure and scrutiny of actions. The day of the anonymous team doctor in the three piece suit is very much part of the last millennium. But will everyone be comfortable with this greater level of scrutiny – especially as it is unlikely to be entirely free of bias and sensation?

Consequences of sport as entertainment

Another trait of the entertainment business is substantial earnings for those at the top while they are at the top. In sport, if an athlete can make in five years the same income an average person takes a lifetime to earn, what compromises or sacrifices are "reasonable"? This question becomes even more pointed when the compromise can extend a career for another high-earning year, or make the difference between making or missing out on the elite squad. Team medical staff are at the pointy end of these decision-making processes which are fraught with potentially difficult consequences.

One example here is the impact of a growing body of research pointing to a link between high performance sport, sports injury and Osteoarthritis (OA) or degenerative joint disease in later life1. Most modern elite athletes would probably think the potential rewards outweigh these future risks, but they do pose a moral dilemma for those with a duty of care.

Further, in team sports, the presence or absence of a star player can often determine the result of a crucial game. Sports medicine practitioners need to brace themselves for increased criticism of their player maintenance practices and game day decisions.

Sports medicine and science is becoming an increasingly "sexy" field for journalism. Sporting pages in daily newspapers not only carry large features detailing the injuries to players, but also predictions of likely recovery rates and chapter and verse on treatments. Jana Pitman's knee and the mid-race collapse of rower Sally Robbins were bigger Olympic stories than most gold medals. An essential part of television and radio coverage of Australian Football League matches is regular expert commentary from boundary-riding senior sports physicians.

Peer and public scrutiny

Levels of peer and public scrutiny are high and will only get higher. A thick skin and tolerance for comment and criticism of clinical decisions and practices made under pressure and on the fly will be an essential part of the qualification for elite sports medicine practice.

Another certainty is criticism from community sport for the "bad example" set at the elite level.

How many members have had recovery times questioned by patients who point to the quick return to play of elite athletes such as Jana Pitman and Shane Webcke and ask why this can't work for them.

My dentist also services an elite football team. Apparently it makes no sense to attempt long term dental treatment of players until their playing days are over – for the obvious reason that while playing, the risk of further dental injury is always present. (A risk exacerbated by the low levels of mouthguard use, especially in training sessions.2) However, elite players have the affordable option of substantial corrective surgery at the

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Does competition really work?

By Dr J

Coming in to a Federal election campaign, we are reminded how much emphasis is placed on both the economy and health care. Bill Clinton's campaign slogan was "It's the economy, stupid", whereas the 2004 Australian election seems to be as much about auctioning off greater Medicare benefits than about economic management. Medicare is almost directly analogous to taxation from a government publicity viewpoint. With tax, you let bracket creep slowly increase the amount that Treasury is taking in and then you give parts of it back in one hit (accompanied by a large announcement suggesting this is a 'tax cut'). With Medicare, you let the rebate fall way behind not only health inflation but general inflation, and then in one hit you miraculously 'give' a billion extra dollars to Medicare.

Despite both parties claiming they are going to spend unbelievable amounts on Medicare and health care, we still seem to have a health system that is performing no better than it was five years ago. It is also frustrating for many professionals working in the health care sector how hard the work is for limited money, when there seem to be nearby examples of others who might be working equally hard but earning a lot more cash.

Why do some practitioners do so much better financially than others? By this I don't mean more experienced and/or popular clinicians within the same discipline. I am asking the fundamental question about why an average surgeon makes 20 times the income of an average physiotherapist, even though both of them (nowadays) probably were equally academically talented and studied just as hard as each other at school and university. I'd like to continue the analogy between surgeons and physiotherapists, whilst recognising that surgery is one of the most demanding and critical areas of health care that I don't wish to devalue. I merely want to point out something that surgeons have in common with podiatrists, dentists, bankers and mechanics, which contrasts them with physiotherapists, physicians, psychologists, nurses and dieticians.

One answer that a surgeon might give to justify his (let's not waste time with his or her in this situation, as we know how many females the College of Surgeons actually lets on the program) much higher income than that of a physiotherapist is the response, "surgeons actually make an important difference to patients, whereas many physios just hook patients up to machines". Yes, it's true that there are physios around who don't listen to their patients and just hook them up to electrotherapy. I would call these 'bad' physios. There are also bad surgeons around. Bad surgeons perform surgery that isn't needed, or use techniques that are outdated, or offer to do procedures that they aren't doing regularly when there are other surgeons nearby who are more proficient in that procedure. Bad surgeons don't examine patients, and when the results aren't good they blame the patient and then refuse to follow them up. Just because there are some bad surgeons around, doesn't mean there aren't plenty of good surgeons, and that these good surgeons shouldn't make a very high income for being good at what they do in a very important field.

My complaint here is that surgery is a very lucrative field for good and bad surgeons alike. The worst surgeon in any given city is still probably making more than twice as much as the best physiotherapist, even though the excellent physiotherapist is doing far more good for his or her patients. The excellent physiotherapist is probably curing most of his or her patellofemoral pain patients, and referring the ones with meniscal tears on to the best knee surgeons around, whereas the terrible surgeon is probably operating on his patellofemoral pain patients and making them worse, but getting by on the fact that he gets a few meniscal tear patients a reasonable result (even though his success rates might be worse than his colleagues).

The next answer that a surgeon might give you as to why his field is so lucrative is that we live in a capitalist society and it is market forces that show how much people value surgery as opposed to physiotherapy. I think this is actually the correct answer, but it is slightly incomplete. Market forces are the darling of right-wing economists, but I believe that the market actually forces prices down in some professions and forces prices up in others.

Let be begin to illustrate with an anecdote from fifteen years ago, when I first visited the USA (the country most in love with 'free' market forces) and rented my first car. I was travelling on a student budget, so when I arrived at LA airport at 5pm I was looking around for fairly cheap car rental options. I saw a bus drive past with the slogan painted on it, "RENTAL CARS - $7 per day". This was 15 years ago, of course, but it still seemed dirt cheap at the time. I thought the cars might be bombs and there might be some fine print, but I

thought it was a good start. I got on the bus and was driven a long way to the car rental office in a different suburb.

Guess what, if you wanted a car that actually had locks in it (and they didn't recommend driving around LA in a car where the locks didn't work) you had to move up to the $30 per day base price. If you wanted a car that took regular petrol and not LPG (which was only available at a few gas stations) the price went up further. If you wanted an automatic (and, guess what, the gear boxes on their stick-shifts weren't too flash), extra money. If you wanted the car to start with a full tank of gas, rather than on empty, more money. If you wanted insurance, it was more money still, and there were 4 types of insurance, for the 4 different types of person who could sue you. "We recommend getting the top type of insurance in the States, as our lawyers are pretty fierce". Then of course there was a type of GST which hadn't been included in the quoted price. And I was expected to tip the dude who drove me to the rental office.

By the time I had asked all the questions and had been presented with all of the options, it was a minimum of $70 per day to rent the cheapest car that I could actually drive out of the yard, almost exactly ten times what I thought I was going to pay. It was also now getting dark and there were angry black dudes walking the street outside the car rental place. I signed up for $70 per day.

Just to show that despite this lesson I was completely powerless to stop something similar happening to me in 2004, I put my car in for routine service (with nothing wrong with it) during the State of Origin series this year (when I was even more ridiculously busy than I normally am) and was quoted a price of $200-300 for the service (including the $30 fee for a roadworthy inspection). I finished up paying $1300.

I didn't notice anything different with my car when I finally got it back, three visits later, but they had itemised 7 pages worth of stuff that they had to do to parts of my car that I didn't consider had anything wrong with them, but which weren't included in the original quote. The $30 roadworthy inspection fee was their ammunition to list compulsory service items that amounted to about $1000. I was rude and looked very pissed off but I was too busy to take the car elsewhere and go through the process of being ripped off by a different company in the same industry.

There are some industries that don't rip you off: airlines, for example. You can go online and find a $49 fare from Sydney to Melbourne and that is all you will pay to get there. (Just like when you visit a physiotherapist where you only pay for the quoted visit amount….). In an industry that isn't based on hidden extras, you only actually need two competitors (Qantas and Virgin) to create a market that is a fantastic environment for the consumer.

In a different industry, say banking, you can have dozens of different competitors, and they can all manage to rip you off. How much do you pay in bank fees, and would you pay any less by changing to a different bank? Wouldn't have a clue and wouldn't have a clue are my two answers to these two questions, and I'm sure they are yours as well. Your bank is doing beautifully, and they are slowly sucking enough money out of your account to keep the industry as one of the most lucrative there is. The reason why is that there are so many different ways that a bank can charge you a fee, that the average consumer is never any chance to price compare two different bank accounts.

Buy bank shares, they will just keep going up, and you can feel better about the fact that they rip you off when you are a consumer. Just make sure you never buy airline shares: you won't make any money, and it will destroy the buzz you get from travelling from Sydney to Melbourne for $49.

So how do surgeons make all of their money? Obviously part of this is by doing a very important job, but have you ever had to pay for surgery? If you have, you probably struggled, and you are probably someone who knows the health system pretty well. What does the average patient do? After waiting a few weeks to finally get an appointment, he or she is told that surgery is required.

How much is it going to cost? Well we can give you the surgeon's fee, which is $xxx, and which is $yyy above all of the insurance rebates. However, if we have to do something different when we get inside, then the fees could be more. Also, you will need to speak to the anaesthetist and the assistant surgeon, and the pathologist and the radiologist to find out what their fees are going to be.

The funny thing is that the anaesthetist will tell you approximately what the charge might be, but will say that it will depend on the surgeon, depending on how long he takes for the operation. The pathologist can't give you a quote at all, because he or she doesn't know what tests the surgeon is going to order, and at this stage neither does the surgeon. Your health insurance company may tell you that certain parts or braces from the surgery may not be covered under the plan you are on but that, since they don't know what the surgeon is going to do, they can't tell you whether you will have to pay any of these extras.

At the end of all of this, you either just decide you are going to cop a massive set of bills or you go back to your GP, ask for a referral to a different surgeon, wait another few weeks to see the new surgeon, and get told exactly the same story. Which surgeon is going to be cheaper? You don't know and you don't care, you just decide you will pay whatever it takes to get the operation done. If the surgeon ended up doing a good job, you don't care that that you ended up a few thousand out of pocket on top of your private health premiums.

After the saga is finished, you decide you are spending too much on health care. To cut back, you are going to change GPs from the one that charged you $40 to write the referral to the surgeon (which Medicare only gave you $25 back from) to a different one down the road who bulk bills. However, the bulk-billing GP down the road will refer you to a bad surgeon next time, who will do a worse job on the surgery, but due to the beautiful system that we have for paying surgical fees, will be living in a house on the same street as the good surgeon and driving the same expensive car. He'll get sued a few more times that the good surgeon, but he is paying exactly the same malpractice premium. And there are plenty of bulk-billing GPs out there who are too busy to listen to their patients, so they aren't going to stop referring to him.

Without wanting to repeat myself too much, let me stress that I don't think that good surgeons are charging too little or not earning enough. Actually by international standards our surgeons are quite cheap. I just think that the reason why they can successfully maintain high charges in a so-called 'free' market is that no one can price compare.

The average person who, say, called up a physiotherapist's office and got told it was $220 for the initial consult is going to say that this is a rip off and that they would shop around for a physio with more reasonable charges, and this fact is going to keep physios' prices down forever. The same average person who calls up a surgeon's office or a car mechanic is rarely going to get a straight and simple quote about the total service price, making it impossible to price compare and making the same so-called 'free' market very much a seller's one.

If you don't believe me that it is fair to compare the value of physiotherapists to surgeons, do you really think that a physiotherapist should earn a lot less per year than a car mechanic? Are there fewer dodgy physios around than dodgy car mechanics? Who is doing a more difficult and/or more important job?

There are plenty of other ways to rip people off and defy what are meant to be the pure free-market forces of capitalism. Kickbacks are another good way (ask your accountant about this one). Restrictions on licensing are another (if you don't want to ask your surgeon about this, try your pharmacist). But having a complicated billing system seems to be just about the best way possible. It explains why podiatrists can do better than physiotherapists ("you wanted padding on your orthotic, that will be a bit extra?") and why lawyers can do better than just about anyone (it was 50 cents a sheet for the paper in the photocopying, and the labour time of an article clerk, who is worth $220 an hour, to pass the pile of sheets on to a secretary, who is worth $30 an hour, and then there were the phone calls between the junior solicitor, who is worth $300 an hour, and the partner, who is worth $500 an hour, yada yada yada, your bill for the case is $30,000).

The last point: no matter how well you write or speak, there is very little money in straight publishing and/or broadcasting. Cash-for-comment, now that's a different matter. If you want me to get up at a dinner and talk about this issue, I'd be yours for a good bottle of wine. If you wanted Alan Jones as your after-dinner speaker, he would set you back $5000. That's market forces. His time is worth more than mine. I don't get thousands of dollars to endorse products under the guise of editorial, so my time isn't worth as much. I'm Dr. J.

ATHENS 2004

The team behind the golden team

Athens 2004 was Australia's most successful Games. And one of the most-asked questions of the team behind the Olympic team was "How do you do it?"

We consider some answers to the question on the following pages in this post-Olympic special section.

We also present with pride the honour roll of SMA members who were part of the Olympic Team Administration.

And we introduce timely books by two former SMA Presidents and foundation members of the sports medicine and sports science community. John Bloomfield and Brian Corrigan both demonstrate in their different ways how sports medicine and sports science have provided the platform for the remarkable development of Australian sport since Montreal.

ATHENS 2004: The SMA Honour Roll

SMA proudly salutes the 54 members and formers members in the team behind our most successful Olympic team:

Bernd Adolph
Peter Baquie
Timothy Barbour
Peter Blanch
Timothy Brown
Grace Bryant
Louise Burke
Scott Burne
Jennifer Cooke
Barry Cooper
Narelle Davis
Vicki De Prazer
Peter Eckhardt
Stephen Evans
Susan Everett
Keren Faulkner
Edward Fitzgerald
Peter Fricker
Andrew Gardner
Carmel Goodman
Lesley Gelis
Kingsley Gibson
Peter Harcourt
Gordon Hepburn
Stuart Hinds
Brad Hiskins
Ivan Hooper
James Ilic
Patricia Jenkins
Andrew Jowett
Donald Kuah
Shane Lemcke
Kelly Linaker
Neil McLean
Berthy May
Simon Mole
Andrea Mosler
Damian Oldmeadow
Bruce Rawson
Bruno Rizzo
Darien Roach
Julian Russell-Jones
Nicholas Sanders
Brian Sando
Denny Shearwood
Jeni Saunders
Ros Smith
Karin Stephens
Jim Stevanovski
Mark Stokes
Annette Tonkin
Clare Walsh
Donna White
Robert Yarrow

How did we do it?

Athlete+Coach+Science+Technology

Like "synergy" and "synchronicity", the word "convergence" is one of those modern buzzwords with a high-tech feel. Certainly not the sort of word one usually associates with the sweat and grind of sport or the glory of Olympic gold, silver and bronze.

It does however neatly capture the modern ethos of the Australian Institute of Sport, currently basking -- though not reclining -- in the reflected glory of Athens 2004, Australia's most successful Olympic games.

For the sporting record, Australia won a total of 49 medals, 17 gold, 16 silver and 16 bronze.

Of those medals, some 65 per cent, including 10 of the 17 golds, went to current and former AIS scholarship holders who claimed 289 places in the 482-strong Australian Olympic team.

Behind all those numbers, are more numbers – of people (coaches, trainers, administrative staff, physiotherapists, doctors, biomechanists, psychologists, physiologists, software and hardware designers, nutritionists, performance analysts) and dollars (over $14 million dollars).

And behind the numbers are networks and relationships – including high speed-digital networks and the old fashioned personal kind that have always existed in the somewhat obsessive Australian sporting community.

More than any other factor, Australia's sporting success in the 23 years since the AIS opened its doors can be put down to the latter – the relationships spawned and fostered by the AIS with the various State- and Territory-based Institutes and Academies of Sport, the national sporting organisations (NSOs), sports scientists and academics and individual coaches and support staff.

While those relationships are two-way, few would argue that the repository and leadership of knowledge and technical skill forged within the AIS headquarters in Canberra and the dissemination of that knowledge has been the key to providing Australia's sporting elite with the proverbial edge that allows us to compete and succeed where other more populous and better funded sporting systems fail.

Senior staff from the Australian Sports Commission and the AIS who were in Athens for the Games will attest that the "How do you do it?" question was frequently asked in the various meetings with sports officials from a wide range of nations.

Those personal relationships and networks, built and maintained by the AIS, will remain crucial to Australia's continuing sporting success and, as anyone involved in sport knows, the key element to success is the coach and the athlete. All the science in the world is unlikely to produce an elite athlete from scratch, despite what the prophets of the new genetics claim.

But the science and technology are becoming more important to gaining that winning edge -- which brings us back to "convergence."

It is the melding of new high-speed digital networks, new software and hardware, including nano-technology, and their convergence with traditional coaching, training, performance analysis and talent identification that is ringing the changes.

Within the bowels of the Sports Science and Medicine building at the AIS's Bruce Campus, an array of scientific specialists and computer boffins have been quietly transforming the way athletes train, acquire skills and techniques, are physically tested, have their performances monitored and analysed, recover from training and have injuries treated.

There's little doubt that Beijing 2008 will be the most high tech games to date, which is fitting in a country that is embracing and producing modern technology at an unprecedented rate as part of the transformation of an economy that was almost entirely agrarian-based less than 40 years ago.

But before tackling Beijing 2008, another look at Athens 2004: it is not widely known that the sports in which Australia won most medals in Athens – swimming, cycling, diving and rowing – are the ones which have most fully embraced new and emerging technologies.

Cycling is and will continue to be a huge beneficiary of the digital revolution, and the experience and human guile of AIS staff, cycling coaches and some cyclists.

Last August, a team of Australian cyclists, coaches and AIS staff turned up unannounced in Athens which was hosting the European road racing championships on what would become the Athens Olympic course. This was a one-off opportunity to access a course that is normally grid locked on any normal day.

Equipped with small cameras mounted on their instrumented bicycles and tracked by a van full of AIS boffins with more cameras, the four cyclists filmed the entire course from a number of angles.

Back in Canberra, that footage and data were digitised and made into a virtual

reality "game" which AIS cyclists were able to "ride" in front of a screen in a special "heat tent" which replicated the temperature and humidity in Athens in August.

At the same time, AIS physiologists monitored power output, core body temperature and experimented with the new AIS/RMIT developed cooling vest, a vast improvement on the old ice-based vests used in previous games.

It's rumoured that some of the AIS/RMIT jackets, which use a secret phase/change polymer, mysteriously appeared track and roadside in Athens.

The cooling vest was only the tip of a technological iceberg increasingly available for a range of sports.

Track cycling coach Martin Barass had at his disposal a specially-developed "stop watch" on a hand-held computer, which told him immediately whether a track cyclist had broken a personal best "split" or had performed badly.

Depending on that information, he was able to adjust his motivational coaching advice to the specific athlete. Software for this was developed by the AIS's dedicated software specialist Col Macintosh.

Cycling coaches from the track and road disciplines also had with them a video database "hard drive", connected to a laptop computer, with recordings of every performance by their rivals over the past four years allowing them instantly to analyse strengths and weaknesses in particular situations.

This database is part of the revolutionary work being carried out by the AIS's Peformance Analysis Unit (PAU) headed by Dr Keith Lyons.

Dr Lyons has spent more than 20 years working in this area with coaches and athletes. He was previously Director of Research and Enterprise at the Centre for Performance and Analysis at the University of Wales Institute in Cardiff.

In a recent interview published in an internal Australian Sports Commission journal, he explained the scope of his work. "Advances in digital technology have made it possible for suppliers to provide powerful software for game analysis and technical analysis.

"The PAU aims to match a coach's identified needs for analysis with the commercially available products to ensure cost and time effective solutions," he said.

"The PAU uses a range of software and provides support to coaches who use both PC and Apple computers. Coaches are currently using software packages from Australia, Italy, New Zealand, Switzerland, United Kingdom and United States of America.

"Some coaches' needs are so specialised that the PAU commissions specifically written software for them. This software can be written in house or by commercial developers."

Dr Lyons pointed out that there is a flourishing group of sport software developers in Australia that provide an outstanding resource for Australian coaches.

By far the most advanced and potentially revolutionary project, being driven by the AIS and Dr Lyon, is tapping into existing high speed digital transfer networks for use by a range of sports.

The AIS and ASC have formed a partnership with Australian Swimming Incorporated (ASI), the Australian National University (ANU), the high-speed network provider GrangeNet, and the private technology company Visionbytes.

Australian Swimming Incorporated (ASI), has a video archive containing hundreds of hours of performances by Australia's finest swimmers and will supply the material to coaches and athletes around the country for analysis and discussion.

Much of this material will emanate from work undertaken in Queensland and Victoria. ASI will also provide the membership data to help index metadata to the video content from its centralised registration database.

GrangeNet connects Australian universities with a high-speed broadband grid. Identified centres in Brisbane, Sydney, Canberra, Melbourne and Perth will be the initial recipients and providers of the high quality digital video files and race/stroke analysis.

Once downloaded, this high quality video will be analysed on local machines with swimming-specific video analysis software. The initial analysis can also be shared via the same method enabling a sports scientist at one of the identified centres to do much of the time intensive analysis of the video for the coaches.

The ASC and the AIS believe that the use of innovative technologies is especially important in a huge country with a small population like Australia and that they offer Australian sport an opportunity to sustain that competitive edge.

The system concept, once fully operational, will be expanded to a wider range of sports for use by coaches and athletes in the lead-up to the Beijing Olympics in 2008.

When it comes to scientific innovation and potential for massive change in sport, the collaborative venture between the ASC/AIS and the Cooperative Research Centre (CRC) for microTechnology is creating enormous excitement in the sporting community.

Since the AIS began back in 1981 coaches have been asking their sport scientists practical but difficult questions about training and competition, like:

- Is my athlete tired?
- Does my athlete have what it takes to be a champion?
- Is my athlete responding to a taper?
- Should I push the athlete harder or does he/she need a break?

Professor Allan Hahn, Head of the Department of Physiology at the AIS, has been attempting to answer these very practical questions for more than 20 years.

Historically, the collection of physiological and biomechanical data from athletes has occurred primarily in laboratory settings, because the equipment is not easily transferable to the field.

After a meeting in 1999 with Clive Davenport, the CEO of the CRC for microTechnology, Professor Hahn could immediately see how helpful small accurate microsensors could be for monitoring elite athletes in the field.

A close relationship has been established between the CRC and the AIS that has recently resulted in the development of a number of prototype athlete monitoring devices under the auspices of CRC Project 2.5 – the 'AIS Project'.

The cutting edge research and development work is made possible by drawing on the knowledge and core competencies from the CRC's many other projects that aim to develop a toolbox of micro- and nano-scale techniques:

- rowing performance (a.k.a. "Rover");
- swimming performance (a.k.a. "Traqua");
- tracking team sports;
- boxing scoring and safety, and
- athlete performance through force shoe monitoring.

"Rover" is the most advanced project and is being lauded by rowing coaches and athletes alike for the quality of real time information provided.

These are just a few examples of how technological innovation is changing sport. Add to that:

- the world's most advanced swimming analysis (instrumented) 50-metre.pool being built at the AIS in the next two years;
- software designed by former AIS staff and being trialled in the AIS gym that allows coaches to monitor and fine-tune strength and conditioning programs over the internet;
- a project that could allow more prece judging of sports that involve precise human movement, such as gymnastics and diving;
- Virtual reality "games" being designed in association with the AIS Performance Psychology Department to improve skill acquisition and decision making; and
- a host of other projects that AIS won't talk about because loose lips sink medals.

And you can see that "convergence" is a rapidly evolving reality that sports will ignore at their peril.

There's science behind australia's sporting success – but there are challenges ahead

by John Bloomfield

Dr John Bloomfield has not only been an active and definitive actor in sports medicine and sports science issues. He has also been an extraordinary influence on the development of government support for and involvement in a process which has led Australia to its present status in world sport. In this extract from his book "Australia's Sporting Success: The Inside Story", he discusses the role of sports science and sports medicine in this success and offers suggestions for the way this role can be developed.

Australia is generally seen across the board as one of the top half dozen nations in the world in the field of sports science. This is particularly so in two areas: the methodology for infusing sports science into coaching techniques; and the efficiency with which Australian sports scientists have been able to identify talent and monitor training. This country is therefore seen as being able to apply sports science knowledge to sport performance, and this has been invaluable to its elite performers.

However, Australia has been less successful in contributing to the international body of knowledge in sports science. There is a general research malaise in Australia and sports science is only one of many fields which have been neglected.

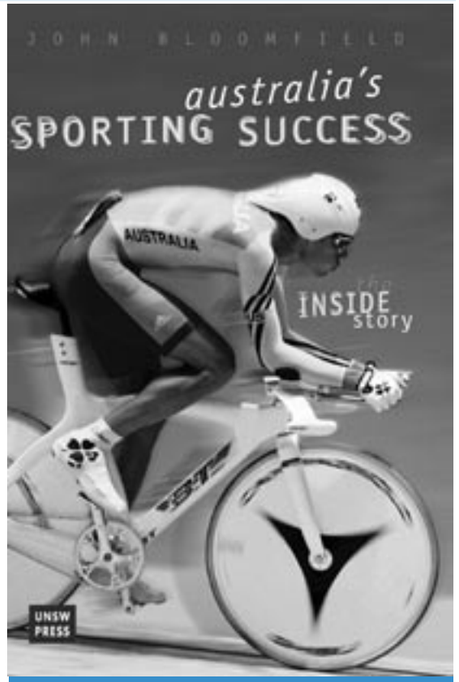
A reasonable level of funding is required to significantly improve research output and better coordination is needed between the various groups which contribute to the field.

This could be remedied by the establishment of an independent National Sports Science and Medicine Research Council, which would be best located in Canberra at the AIS. It could then act as a coordinating body with the AIS, the state and territory institutes or academies of sport, and the various university schools of human movement and exercise science, as well as with industry.

Australia's closest sporting competitors in Europe are already allocating at least 5% of their sports budgets to research and development, which is two to three times more than Australia currently spends.

(The Council) must lobby hard to develop the field of microtechnology in sport. This new technology measures biological and mechanical variables using instruments that are so small they can be worn very comfortably by the athlete, and which can monitor the above parameters during training or low-level competition without impeding performance.

Even though many of the above technologies will be developed in partnership with microtechnology companies, a reasonable level of funding and scientifically-trained personnel will be required to trial and adapt the micro-equipment to the point where it can be of value in sport. If funding is not attended to shortly, Australia will miss the boat and wallow helplessly in the wake of its competitors.



Australia's Sporting Success: The Inside Story

John Bloomfield
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The Australian Coaching Accreditation Scheme (has been said to be "an outstanding example of the cooperation which is possible between government and sport". With around a quarter of a million coaches trained in Australia over the last 24 years, both young and not so young athletes are in good hands. This is largely because many of Australia's better coaches have a sound understanding of the biological and social science base which now underpins modern coaching.

The overall effect (of the AIS coaches in its first four years) was very positive. The national sporting organisations were so impressed with the improvement of their athletes and the input of the AIS coaches that they began to lobby the Federal Government to provide not only national coaches but also national directors of coaching, with the task of coaching the coaches. In very strong sports, the states with better-developed sports systems also started to press their state governments to assist with fulltime professional coaching.

Sports medicine

Sports medicine in Australia has a very good international reputation, and this has resulted from the way in which knowledge in this field has been skillfully applied to Australian sportsmen and women, as Australian doctors practising in sports medicine are regarded as very competent practitioners.

However, sports medicine must not rest on its laurels, as it is not enough to only apply existing knowledge to the field. Little systematic research has been done in Australia, apart from the AIS Sports Science and Medicine Centre, The University of Western Australia, where Professors Fitch and Morton have been very productive, and Monash University, where Dr Barry Oakes has conducted some high-quality research. SMA needs to lobby the powers that be to improve Australia's research output and to rectify this situation as soon as possible.

During the last 40 years, SMA has been a very positive contributor to the development of the Australian sports system. In its short history, its members have strongly supported many health initiatives and given caring treatment to a large number of Australians. SMA's status in this country has never been higher and its lobbying capacity never greater. It is time therefore to strike while the iron is hot in order to implement the following initiatives:

- to lobby the Federal Government to establish a National Sports and Medicine Research Council;
- to approach the major entities who comprise the Australian sports system to enlist their help in lobbying the appropriate government agencies, with a view to establishing a full medical specialty in sports medicine.

If SMA continues to perform as well as it has in its short history and if the above goals can be gradually achieved, it will provide a more informed body of knowledge which will improve performance and participation levels in sport throughout Australia. In addition, it will produce more highly-qualified sports medicine doctors, who will ultimately improve patient care in this country.

Strategies for the future

It is important to acknowledge that the vast majority of the sports system's current programs are functioning efficiently. Many of them have been in place for a long time and have served sport well; therefore, they should not be tampered with.

There are social developments (eg, changes in family structures, declining birth rate, decline in voluntary participation, increasing litigation, etc) which might lead to a decrease in performance and participation levels in the future. However, if the following recommendations are introduced, they may counter these trends.

- Some children, because of their family structure, do not have as much access to sport as other young Australians. The federal and state governments should develop introductory programs through their sports organisations to help these children to experience both recreational and competitive sport.
- The reasons which have been given for the declining number of volunteers in sport (such as referees and umpires) have included: busy lifestyles; Australia's ageing population; fear of abusive players and lack of insurance cover in case of litigation. Affirmative action will need to be taken, as the system cannot afford to lose coaches and officials at the current rate. Anecdotal evidence indicates that both these groups require more education and support so as to feel secure and confident to perform their roles. They also need to be covered by public risk insurance in case of litigation, which is becoming much more common.
- Another issue is the number of sports administrators who have dropped out of sport, particularly since the introduction of the GST. It has been stated that not only are former club treasurers having problems with the complexity of the system but that secretaries have reported an increase in paperwork from regulatory bodies for the completion of more complex returns. Affirmative action is needed to streamline accounting procedures and offer more sophisticated training courses fopr potential treasurers and amateur sporting club officeholders.
- Recent migrants are not yet joining junior sports clubs at the same rate as other young Australians, even though some of them are already

being steadily inculcated into the Australian way of life. Affirmative action is needed to motivate young migrant children to participate in sport and to assist their successful young athletes to become role models for their local communities

Low fitness – high obesity

Australia has still not address in a systematic way the steady decline in fitness levels or the increase in obesity among the Australian population. Politicians, physical educators and some members of the medical profession have discussed this topic for at least 30 years, but no sustained educational program for children or adults has yet been established in an effort to counteract these trends.

There are two possible solutions to this problem:

- State education departments should all be strongly encouraged to upgrade primary school health and physical education programs by providing trained health and physical education teachers in this specialist field. The debate as to whether this is possible or not from a financial viewpoint should cease, because Australian cannot afford not to have it. With the rapidly escalating healthcare costs in recent years, the Federal Government must immediately act as a catalyst with the states to develop this preventive medical program.
- The Federaland State governments should develop a community health and fitness program which targets youth and adults and which is modelled on the successful *Life Be In It* program of the last 1970s.

Future funding

In order to increase funding to cater for the fine-tuning of existing programs and to establish others mentioned earlier, additional sources of finance will need to be found. Unlike the Western European countries, Australia has never had a national lottery to assist in the funding of sport and culture, because state rights currently preclude this. The establishment of such a source of revenue would be a good solution, but is not a viable option for the immediate future. Therefore, urgent action should be taken to raise additional funding for various needy areas within the system. The total federal and state sport and fitness budgets must be topped up to a level which will enable Australia to function on equal terms with other Western democracies.

The way forward?

By and large, this nation's sports system is running reasonably smoothly. However, Australia cannot rest on its laurels and needs to act to shore up some of the small cracks which are starting to appear in the structure. The structural modifications and the additional funding mentioned above would improve the current system and would lead to the evolution of the next stage of the Australian sports system.

It is important to remember that Australian sport has undergone a transformation over the past 200 years from a single localised amateur system to a highly centralised and professional one which is basically responsible for new performance standards in this country. Its development has become more complex as integrated its policies at both the federal and state levels. Australia's sports system is now both widely admired and increasingly copied.

However, nothing ever stands still, especially when a more democratic process is embarked upon. In the future many new initiatives will evolve, bringing greater devolution, decentralisation and democracy to Australian sport. More responsibility and authority will be vested in the national sports organisations as well as the state or territory sport entities and there will be a greater focus on new ways to build grassroots participation. The next phase of the sports system's evolution will be a more complex network of resources and expertise combined with a high degree of autonomy, but with a strong commitment to high standards.

This evolution should not be construed as a swing of the pendulum back to the unstructured amateur approach of the past. Nor is it about abandoning the gains this country has already made in terms of its investment in sport. Rather, the new way forward will be for the Federal Government, through the Australian Sports Commission, to play the role of a catalyst. What does this really mean? It means retaining a role not so much as a driver or controller of the system, but rather as a smart and strategic investor in it.

If Australia adopts the above approach, young Australians will continue to achieve at the elite level and, at the same time, the citizens of this nation will be able to use sport as a pathway to better personal health and wellbeing.

Drugs and Sport – and the genie in the bottle

By Brian Corrigan

Those involved in sport for a generation will tell you that Brian Corrigan is Dr Sport: doctor to Richie Benaud's 1961 team, to Rale Rasic's 1974 World Cup team, to five Olympic teams. In "The Life of Brian: Confessions of an Olympic Doctor", he tells amazing tales of 30 years as a sports doctor at the elite level – and along the way shows why he has such a huge army of friends and admirers in all kinds of sport. I this extract, he discusses one of his great passions: the menace of doping in sport.

The Life Of Brian: Confessions Of An Olympic Doctor

Brian Corrigan
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By far the greatest problem facing the Olympic Movement is undoubtedly that of drugs in sport. They are banned for two very good reasons. One is the harm done as a result of their side effects. The second is that taking performance-enhancing drugs is a form of deliberate cheating, and contrary to the spirit and purpose of fair competition.

Sport was surely never intended to be a competition between guinea pigs who are being doped by various pharmaceutical agents.

Gene therapy: genie in the bottle

The key to the future of many of the issues, such as the limits of human performance and the problems of drugs in sport, is linked to genetics.

Recent advances in knowledge about genes and gene therapy have occurred at an unbelievable rate, and are revolutionising the future of medicine.

The huge scientific program known as the Human Genome Project was completed in the year 2000, five years ahead of schedule. The next big step is to develop a better understanding of, first, how the necessary instructions of genes work and, second, gene therapy.

Gene therapy is certainly the pathway to the future. Its importance in the field of medicine is that a normal gene may be substituted for an abnormal, faulty gene, so that some 4000 different diseases could potentially be cured.

Sadly, gene therapy is also very much the sports drug of the future, although the problem in sport is really not so much gene therapy as gene doping. It is the greatest problem facing sports medicine today, rendering drug testing as we know it obsolete. It will take many millions, maybe billions, of dollars to provide the technology to combat it. Even then testers will be playing catch-up with drug abusers.

Gene therapy could determine or alter the type of muscle fibres, increasing muscle bulk, with a large increase in muscular development and strength. Genetically modified fast twitch fibres in individual leg muscles could be targeted for use by sprinters. Distance runners could inject a different series of genes to increase the amount of oxygen carried in their blood, and so may improve their times by a large amount.

Blood boosting is another good example. A difficult and cumbersome method to use, athletes found they could obtain the same effect by using EPO, injected three times a week. Better still, the gene responsible for EPO production, already identified by the Human Genome Project, can be injected and the body could become a factory churning out extra EPO. In addition, it will be undetectable by any means now known, as the EPO from the introduced gene will be identical to natural EPO. Other, indirect methods could possibly allow its detection but not the EPO gene itself.

Treatment of injuries will also be revolutionised. New ligaments and tendons could be grown and then made available for immediate treatment by replacing a ruptured one. But there is no truth in the rumour that ligaments or tendons ruptured in a match could be replaced at half-time and the player sent back on the field for the second half.

Gene therapy is going to play a major role in the future, probably even more than many people recognise. There will be dangers with its use.

How long before gene therapy becomes a major problem in sport? Within a few years at best for there are some athletes out there now experimenting with gene therapy. What should happen is that properly conducted scientific studies be carried out to determine how effective this treatment is and find out what the risk factors and side effects are.

Many people from different medical and sport medical backgrounds, and also those with a background in law and ethics, will be needed to sort out these questions, not the least being "Who will fund it?" Already experts are calling it the death of sport as we know it and gene doping is now prohibited in the Olympics.

The problem has become not so much the genie in the bottle. It's whether we are too late and the gene genie has already escaped.

THG: the latest menace

Just when some scientists thought that maybe, just maybe, they had got the scourge of anabolic steroids under control, along came THG (tetrahydrogestrinone). The whole furore exploded in 2000. In June, the US Anti-Drugs Agency (USADA) received an anonymous tip from a track coach that several top athletes were using an undetectable anabolic steroid. To prove his point, he mailed a syringe containing THG.

THG is a designer steroid almost certainly used by elite sportsmen able to pay the excessive prices being charged on the black market. It was created from two other known steroids – trenbolone and gestrinone. The chemical modifications made THG undetectable in the usual tests for steroids. Cheating sports stars were able to take the steroid in liquid form by placing it under the tongue, allowing it to be quickly absorbed. This made it a lot more toxic on the liver than injectable anabolic steroids.

It wasn't long before the drug cheats were uncovered.

By mid-November 2003, four American athletes tested positive taken in samples at the US National Championships four months before. European 100 metres champion Dwain Chambers of Britain also tested positive. And four players from the Oakland Raiders in the NFL were caught in the net, but they were not suspended. Incredibly, NFL Commissioner Paul Tagliabue explained, 'You don't go around changing the traffic sign after I pass. It was a yield sign when I passed, not a stop sign'. Of course, Tagliabue has highlighted the very touchy ethical problem of whether or not retrospective drug tests should be allowed.

The last has not been heard of this latest drug problem and its wider implications for the future. The discovery that sportsmen were using THG only happened because someone gave the authorities the drug. Not only does no one know if it works, but no one knows who is going to die. The problems are unknown. the possible side effects of so many drugs that athletes are taking terrify me.

By sports' very nature, we're always playing catch-up, and we always will be. We don't know how many other drugs are out there. No one knows.

As a medical student at Sydney University, I had come directly in contact with Professor Frank Cotton, the professor of physiology. He had formed a group consisting mainly of students that became known as the 'guinea pigs'. Professor Cotton was dubbed 'The Father of Sports Science' by the future Olympic swimming coach Forbes Carlile. After all, the Professor was the first person in Australia to take any interest in what we now know as sports medicine – although it was pretty basic stuff back then in the 1940s.

Cotton had been a top-class swimmer, who had narrowly missed out on selection in the 4 x 200-metre relay team for the 1924 Paris Olympics. It was a great disappointment for Cotton because he was originally in the side but lost his spot when officials ordered a second selection swim. The team, headed by swimming legend Boy Charlton, won a silver medal./

The Professor was an interesting character, often regarded as eccentric, a real boffin. He worked out of a small, rudimentary laboratory, with very basic equipment.

But in so many respects, Frank Cotton was way before his time. He pioneered early attempts to introduce scientific methods into the pursuit of elite physical performances in sport, and especially in rowing and swimming. He also tried to devise methods to test fitness. Sadly, he was often perceived as doing little more than taking someone's pulse. And he had some rather weird ideas. I remember him one day asking me to increase my pulse rate.

'How can I do that?' I asked innocently.

'Pretend you're in a swimming pool and a hungry shark is coming for you,' he suggested. Come again!

There was another incident I clearly recall. Cotton handed me a text book and noted, 'There are a lot of mistakes in this book. Find out what they are. That's the way you'll learn what's right'

I often wonder what would have happened if I didn't find the mistakes.

The speciality of sports medicine, linking my two great loves, did not exist in Australia when I first started out as a young doctor in 1953. It had a long tradition in Europe but did not commence here until the 1956 Melbourne Olympics, at which time the International Olympic Committee insisted such an organisation be formed. It was the forerunner of the Australian Sports Medicine Federation but based then only in the Victorian capital.

A small band of the enthusiasts included Les Cotton, nephew of Frank and a real chip off the old block, and myself started a sports medicine group in Sydney in 1957. It was later to join with the Melbourne organisation. Little did I know at the time what an enormous impact this would have on my life. Back then, however, we simply realised that doctors would eventually have to go overseas and study sports medicine, and I planned accordingly.

I planned my first visit to England to coincide with the 1961 Ashes cricket tour of the team led by Richie Benaud. By that time I had become quite involved with the NSW Sheffield Shield players in Sydney.

This all came about by sheer luck. I had returned to my old country practice for a reunion one weekend in 1957. The visit coincided with a country cricket final. I was there watching the game. It was very hot and I was dressed only in a pair of shorts and sandals. The NSW Sheffield Shield selectors were there too, and I was asked if I could give them a lift back to their hotel. They were quite surprised when I told them I was studying to be a sports medicine specialist as I hardly look the part in my casual gear. But I got on well with them and they invited me along to a Sheffield Shield match in Sydney the following week. I wore a jacket and tie this time.

The selectors eventually asked if I could do something about the fitness of the NSW players. That's how my involvement with cricket at an elite level began.

ACSMS 2004

Hot Topics from the Red Centre

SportHealth continues its foretaste of topics and happenings at the **Australian Conference of Science and Medicine in Sport**. In this Spring issue, more highlights from the speakers' and symposia programs.

Dead Men Walking???

by Simon Bartold

So what is going on in the wonderful world of feet, lower limbs and human movement? Well since I now spend a large part of my life in airports travelling to sports medicine and biomechanics conferences around the world, maybe I can highlight some of the more interesting research from around the globe relating to the lower limb, as well as some thoughts on current projects with which I am involved.

From a podiatry and lower limb biomechanics point of view, there is intense interest in the functioning of athletic footwear and orthotic devices. Podiatry in particular is being forced to make some pretty rapid adjustments to old paradigms that clearly are not holding up to scientific scrutiny.

For many years, sports podiatrists have clung to a particular theory explaining the functioning of the foot and lower limb, and outlining a criterion for "normalcy" of lower limb biomechanics. This theory was based on the work of three US based podiatrists, Root, Weed and Orien, and their thoughts, first published in the 1970s, were rapidly to become the cornerstone on which a million orthoses were built.

It is really important to not diminish the theories of Root, Weed and Orien, because their work was and remains extremely important to this day. But it is equally important to recognise that a theory is all it is and, today, basing treatment protocols on a theory is maybe not good enough.

Root theory, as it has become known, (no sniggering please) has provided an excellent basis for further research, and it from these early concepts we are now achieving a much better understanding of foot and leg function, which ultimately will present better and more varied treatment options for lower limb biomechanical deficits.

Orthoses: how do they work?

There is little question at all that orthotic devices work. The big and as yet unanswered question is… how do they work? Further question in relation to orthotic therapy are 'What kind of orthoses offers the athlete the best result?' and 'Are custom-built orthoses, fabricated from a cast of the athlete's foot, any better than prefabricated devices?'

Well, the jury is out, but there is some compelling evidence to suggest that prefab devices may function just as effectively as cast orthoses (Payne et al, AJPM 2001;36,1:7-12, Landorf J Sci Med Sport 2003; 6,4: 103).

How do orthoses function? Well, again we do not know but the presumed mechanical action of an orthotic device may not be as important as we first thought. It seems very likely that orthoses are able to offer mechanical support to a biomechanically-challenged foot. Perhaps they are even able to effect joint position, or more importantly joint moments. However, the proprioceptive effect of orthoses has been underemphasised and under-researched. Likewise, the ability of orthoses to influence psychophysical feedback loops, muscle vibration harmonics (working on the assumption that, like almost everything that vibrates, muscle has a harmonic at which it will function normally and a harmonic or frequency at which it may contribute to injury), and lower limb stiffness are all under-investigated.

So what is being done to quantify these vexatious issues? Some of the most innovative research is coming out of a collaborative study from the University of Salford in the UK and Iowa State University in the US (near to where the potatoes come from).

"Dead men walking"

In a project with the rather macabre working title of "Dead men walking', the team has for the first time been able to describe the movements of the individual bones of the foot using a cadaver foot and leg that literally walks across a room!

This ingenious model is used to measure the kinematics of all five metatarsals and three cuneiforms, plus the navicular, cuboid, calcaneus, talus and tibia during the same walking cycle. The somewhat bizarre spectacle of a cadaver foot and leg moving across a room, apparently under its own steam, is achieved via forces applied to nine leg muscle using motors. In this way, the simulation data very closely resemble that collected during in vivo trials. Research of this calibre allows us to look at segmental foot and leg movement, as well as bone and joint movement, plus kinetics under the physiologic load of gait.

This along with in vivo bone pin studies, which ethically are only permitted in Sweden, is the gold standard in understanding the function of the foot during gait. As this research progresses, it seems likely a clear understanding of orthotic effect on joint and segment position will become possible, which is great news for athlete and practitioner alike.

There are some remarkable parallels between new concepts in orthotic therapy and recent trends in athletic footwear.

The most significant directional change in the design of technical athletic footwear, especially running shoes, is a strong swing toward lightweight and flexible shoes. There is also a quiet revolution in materials technology, which is rapidly driving some of the more innovative companies toward the real possibility of "smart" customised footwear.

The thought behind the shift towards more flexible and lightweight footwear is based on what the science tells us. For the last 20 years, pathological overpronators have been prescribed a bland diet of heavy and very stiff athletic footwear in the hope that this combination would "control" motion and help reduce the overuse injuries associated with this biomechanical profile. Straight lasts, antipronation blocks, inflexible midsoles and stiff heel counters became the mainstay of the so-called 'motion control' genre.

And sure enough, these shoes did appear to slow down contact phase pronation and block off the perceived abnormal motion.

But there was a problem: the science was telling us that contact phase pronation was normal, in fact that contact phase pronation was important, and an essential part of the shock attenuation process at heel strike. The science was telling us that, to block off this normal motion, to control this motion, was not only extremely difficult but also highly counterproductive. The heavy and inflexible midsole also interfered with windlass mechanics and made efficient propulsion that much more difficult. In addition, the research told us that, for efficient and injury free running, it was essential that the messages from the tiny nerve endings on the sole of the foot be transmitted uninterrupted to the brain, in the process we call proprioception.

And all along, the athlete identified as an overpronater was enduring a shoe offering a jerky, inflexible and harsh ride. Contact phase pronation was negated at the cost of reduced shock attenuation; proprioception was blanketed by excessively heavy and inflexible footwear.

The ride suffered, the science suffered…. The athlete suffered.

Asic's revolutionary concept

Then in 2002, Asics introduced a revolutionary concept: that motion should not be controlled, but that athletic footwear should enhance normal foot function; that normal contact phase pronation should be encouraged; and that the messages from the foot to the brain must be transmitted with minimal interruption.

This new paradigm, 'motion enhancement rather than motion control', is now accepted by all the major footwear manufacturers and the consumer can expect to see a global swing toward much more responsive athletic footwear.

Technology is the other thing to watch out for:

- new materials that are very light, completely waterproof but completely breathable, ideal for wet-weather sports like Aussie Rules or rugby.
- 'smart' foams that are capable of contouring to the foot's morphology, improving fit and reducing friction but completely without memory;. that is, they completely reform to their original shape when not in use.
- finally, midsole technology that adapts to the individual touch-down position of the athlete, allowing a recognition of the variation from runner to runner and, especially, finally allowing for the differences in gait pattern between men and women.

So these are just a few of the exciting developments in lower limb biomechanics and technical athletic footwear.

There is much more to tell… but that is for next time.

Simon Bartold is Research Fellow, University of South Australia, and Asics International Research Coordinator

Sports Injury In Aboriginal And Torres Strait Islander Communities – a Priority Problem

by Caroline Finch

Sport and active recreation activities are an important component of Aboriginal and Torres Strait Islander (ATSI) communities. As with all Australians, participation in such activities has many benefits, but there can still be a risk of injury. The voices from ATSI communities tell us that safety during sporting activities is a concern for their members(1-3). These injuries do not just affect the individual concerned, but can have serious implications for the whole community. Injuries, such as those associated with sport, can have a ripple down effect, particularly if they occur to the main income provider. A loss of income can lead to poor self-esteem and individual stress that then translates into larger problems for ATSI communities.

As an injury epidemiologist, I am well aware of the excess burden that injuries place on ATSI communities. For example, the rate of road trauma is much higher in ATSI Australians, rather than in non-ATSI groups(4). There are also higher rates of intentional injuries, including suicides and homicides, in ATSI populations(5). This has led the Commonwealth Government(6 7), and many of the State Health Departments(eg, 8), to invest considerable efforts in understanding the nature of the injury problem in ATSI communities.

As a sports injury epidemiologist, I am often asked about how common sports injuries are in ATSI groups. This prompted me to look at the issue of ATSI sports injury in some detail and to propose a session on ATSI sport and injury for the 2004 Australian Conference of Science and Medicine in Sport.

Unfortunately, the quantification of sports injury risk in ATSI Australians does not come with a ready answer. There is very little, if any, empirical evidence to describe the incidence of sports injuries in ATSI populations in Australia. Part of this relates to the relative poor capabilities of existing data systems to identify aboriginality routinely. Another factor has been the inability of data systems based on ICD coding, at least until the recent introduction of ICD-10-AM codes, to identify specifically most sports injury cases. In this respect, the ATSI sports injury problem is the same as the non-ATSI one – severely underestimated because of the lack of available data.

There is very little, if any, empirical evidence to describe the incidence of sports injuries in ATSI populations in Australia.

In an extensive search of electronic bibliographic databases, I could only identify one study that specifically looked at adverse outcomes of sport participation in ATSI groups and this related to Aboriginal sportsmen and the incidence of sudden death due to ischaemic heart disease(9). The study found a rate of 19-24 ischaemic heart disease-related sudden cardiac deaths per 100,000 player years in Aboriginal Australian Football players in the Northern Territory, compared to a rate of 0.54/100,000 player years in Victoria. The authors recommended the development of culturally appropriate long-term strategies to prevent such incidents in the future.

It is to the ATSI communities themselves that we need to go to get the richest source of sports injury information. As noted by Clapham(7), sports safety is a concern recognised by local groups and one touted as requiring preventive actions.

However, only one sports injury intervention, the Northern Territory's Strong Indigenous Safer Sports Program, was identified by Clapham in her extensive review of ATSI injury prevention programs(7).

A number of recurrent themes emerge from ATSI groups(1-3). All recognise the problem as being particularly relevant to their male members and relate it to participation in contact sports, such as the football codes, and to other team sports such as netball. They also recognise the impact that alcohol use/abuse has on injury risk and general activities surrounding sports events, such as post-game drinking. In the words of a Shoalhaven Aboriginal community member: "alcohol consumption, often not by the injured party, contributes significantly to sport and leisure injuries"(3). This example serves to demonstrate that the factors surrounding any injury in an ATSI community can be complex and often interrelated to other factors such as alcohol use in the broader context of sport delivery and transport options.

A related issue is the broader socioeconomic context of ATSI communities, leading to inadequate resources (both financial and in terms of appropriate people power) being available to deliver safe sport. Few people can afford personal protective equipment or training programs to provide minimum standards of first aid treatment and coaching at games.

It would seem that the potential for injury risks associated with problems such as the volunteer nature of sport, the lack of trained personnel, poor quality sports facilities and sub-standard playing environments in rural Australia(10) are all heightened in ATSI populations, even in those residing in more urbanised areas.

The Mid North Coast Aboriginal Health Partnership tells us that their community members often have to play on substandard playing fields: "fields built on old tips with debris coming up through ground, hard compacted grounds, potholes, …"(2). There are few resources to fund coaches and other key personnel to help deliver sport to ATSI communities, and even less to maintain their ongoing involvement(1). This leads to much sport being played informally, as a leisure activity, and it is in this context that the majority of injuries occur(2).

The potential for injury risks associated with problems such as the volunteer nature of sport, the lack of trained personnel, poor quality sports facilities and sub-standard playing environments in rural Australia are all heightened in ATSI populations.

Further compounding the problem is a reluctance to seek treatment for sports injuries, with a resultant downplaying of their significance. It is possible that some ATSI community members are reluctant to seek treatment because of perceived racism, a fear of health services, mistrust of health care providers or simply inadequate access to treatment services, e.g due to distance. As sports medicine professionals well know, not seeking appropriate prompt treatment for sports injuries can acerbate injury problems and their long-term impacts.

Sports medicine professionals and injury prevention experts need to engage with ATSI communities to help them develop locally-appropriate strategies to ensure that sport is as safe as it can possibly be. After all, a number of our leading national football players have been Aboriginal and we need to ensure that the younger generations have the same chance of reaching their full sporting potentials, without being hampered by injury.

But there is an even more important reason to address sports safety in ATSI communities as a priority. Greater attention to sports safety will have significant benefits for ATSI peoples and will ensure that their communities adopt and sustain healthy and active lifestyles. This will lead to increased fitness, improved health and reduced morbidity in individuals. Importantly, it will also strengthen and improve community wellbeing, whilst continuing to build and maintain healthy ATSI communities.

Acknowledgements

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Sport and Osteoarthritis

by Peter Brukner and David Baxter

Osteoarthritis (OA) or degenerative joint disease is the progressive loss of the articular cartilage surface from bones within the joint space through wear and tear and inflammation). The loss of articular cartilage is accompanied by attempted repair, remodelling and subchondral bone sclerosis. Ultimately this leads to eburnation of the bone with the effect that movement of the joint is associated with bone rubbing on bone causing pain to the patient. These joint changes may be accompanied by osteophytic lipping, development of marginal osteophytes, bone cysts and oedema within bone, which can be imaged to some degree with plain x-ray and MRI.

Commonly, OA is divided into two classifications: primary and secondary OA. Whereas primary OA occurs insidiously with an idiopathic causation, secondary OA generally occurs in the presence of or response from some underlying causative factor, such as metabolic, anatomic, major trauma or surgery, or an inflammatory disorder. It is interesting to note that the presence of any of these factors is not indicative of future OA development, nor is it a requirement of established OA that the patient possess any of these comorbidities.

Clinical symptoms and signs include pain, restriction of range of motion (ROM), crepitus, joint effusions and deformity

Does sport lead to osteoarthritis? The answer to this question like so many issues in medicine is not simple and appears to vary among different populations and different sports. To try and find a way through the myriad of studies and conflicting results, it is helpful to divide the subject up into a number of categories based on the amount and type of exercise performed.

Running

There is little evidence that a moderate amounts of running leads to the development of osteoarthritis in those with normal joints.

Sutton and colleagues (2001) investigated knee OA in low to moderate physical activity through the Allied Dunbar National Fitness Survey. Inclusion criteria were set by way of diagnostic and symptomatic affirmatives, and age and sex matched controls were assigned. Despite the heavy possibility that male subjects may be over-represented based on increased participation in high impact sports, there appeared to be no significant difference in between the active and control subjects when it came to the development of OA.

Buckwalter (2003) documents several studies that assess 60-year old runners with age-matched controls who had exercised 180 minutes per week for 12 years. The results indicate no significant difference in the occurrence of OA.

In previous years, Konradsen et al (1990) and Panush and Brown (1987) both found no contributory evidence to suggest that running as an exercise and sport leads to OA later in life. Furthermore Panush and Brown report that normal activity in sport with the joint working through a normal ROM in the absence of joint abnormality even over many years need not lead to OA and joint injury. However, animal studies have demonstrated that sheep walking upon a concrete floor for four hours per day displayed signs and symptoms of OA in as little as nine months (Radin et al 1979, cited in Eichner 1989).

Substantial evidence that would suggest regular sports participation at a recreational level does not cause OA has been published by Lane and colleagues (1986, 1993, 1998). These papers document a prospective cohort of subjects from a distance running club. The level of activity differs from the elite running levels reported in many other papers. With 41 subjects, age ranging from 50-72 years old, cross matched with controls for several factors, Lane et al's results have demonstrated essentially no difference in OA progression in the knee across all follow-ups and all groups. The only predicator detected for disease progression was the baseline radiographic score and a faster running pace per mile.

But what about the more serious runner who is running faster and further?

One study by Marti (1989) compared the development of radiographic OA in long distance runners compared to bobsleigh riders and controls and found a 19% incidence in the runners and none in the two other groups. Spector (1996) found significantly higher rates of knee and hip OA in former elite female middle and long distance runners compared with elite female tennis players and controls.

High impact and torsional loading

The only causative requirement agreed upon is that excessive activity with high impact and torsional loading in the presence of an abnormally-aligned joint or with abnormal biomechanics may lead to joint degeneration and OA.

Several papers have assessed the occurrence of OA in elite male athletes who had represented Finland between 1920 and 1965. This cohort of subjects has offered a unique retrospective insight into the factors that may play a role in the aetiology of OA in the absence of any major

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sporting injury, trauma or surgery to the joint. The results demonstrated that relative risk of OA of the hip, knee and ankle was 2.37-2.68 across three sports classifications – endurance, mixed sports and power sports (Kujala, 1994).

Kettunen and colleagues (2001) propose a higher incidence in knee pain from team sports participants when compared with former track and field athletes. Other indicative factors for the development of OA include a positive correlation with increased BMI. Moreover, somewhat controversially, the participation in sport is related to an increased risk of knee OA, whereas sports participation appears to be protective against hip OA.

Drawer and Fuller (2001) conducted a self-administered questionnaire of 185 former English professional footballers. Retirement in nearly half of the respondents was due to either an acute or chronic injury. Interestingly, 59 (32%) subjects had been medically diagnosed with OA in at least one of the lower limb joints, with the knee joint achieving the highest incidence.

This number is in accordance with Turner et al (2000) where subjects were allocated into an OA group based upon self-reporting of a previous diagnosis. Turner and colleagues found 49% of respondents had received a diagnosis of OA, with the highest incidence being in the knee joints. Both these studies show significantly higher incidence than numbers acquired from the general population through the Royal College of General Practioners morbidity survey (1988). It has been purported by Drawer and Fuller that the higher levels of training required to participate as a professional footballer may account for the earlier age at which OA has been diagnosed. In any event these results from these two and other papers has raised alarm at the impact that a professional sporting career may have upon the public purse in years to come through the manifestation of OA.

Further findings by Turner et al (2000) concerned the increased likelihood that former professional footballers have a higher incidence of OA of the hip joint when compared with the general public. Moreover, the subjects with OA of the hip had no past history of acute injury or surgery to the joint.

Injury

It seems clear that playing high impact torsional sports such as the various football codes is associated with an increased risk of developing OA. The next question is then whether this is due to the repetitive stresses on the joints or to the fact that these sports are associated with a high incidence of joint injuries, many of which may lead directly or indirectly to damage to the articular cartilage. Certainly there is ample evidence that meniscal and ACL injuries are associated with an increased incidence of OA.

Our own study (Deacon et al, 1997) looked at a group of 50 retired professional Australian footballers and compared their radiographic and functional scores to age-matched controls. While there was an increased risk of developing knee OA in the footballers, the risk was dramatically increased if the player had sustained a knee injury of any sort and particularly a meniscal or ACL injury.

Risk factors

Buckwalter (2003) contends that measureless variability between individuals may mean that those predisposed to degenerative joint disease through genetics, joint shape, congruence, stability, muscle strength, body mass, innervation and other factors may develop the disease after minimal participation in activity when compared with another subject.

Consideration of OA, being secondary to major joint trauma, injury or surgery, is potentially skewed due to the almost impossible task to diagnose and document injuries limited to the articular cartilage or subchondral bone. Bearing in mind that articular cartilage lacks pain innervation, unrecognised joint injury may account for some degree of the idiopathic aetiology of OA and the development of OA after a career in sport without the recollection or documentation of any significant joint injury.

Apart from injury, there are a number of other potential risk factors for the development of OA following sporting activity. These include genetically determined abnormalities of articular cartilage, biomechanical abnormalities, joint dysplasia, muscle weakness, neurologic deficits and increased weight.

Conclusion

In conclusion it is safe to say that moderate sporting activity in participants with normal joints and normal biomechanics does not lead to an increased incidence of OA. However repetitive torsional activities would appear to be associated with OA development, particularly if a significant joint injury involving damage to the articular cartilage occurs.

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3D anthropometry — applications to health and exercise science

By Tim Olds and Mike Rogers

Measurement of body size and shape in human movement has traditionally been done with girth tapes, anthropometers and skinfold calipers. In the late 1980s the first 3D whole-body scanners were developed. Today the availability of reliable 3D whole-body scanners and software-hardware suites capable of rapid measurement extraction and analysis has the potential to revolutionise surface anthropometry.

The main driver behind 3D scanning has been the apparel industry, envisaging the possibility of "garments on demand", tailored to fit each individual perfectly. 3D body scans are fed into software which extracts critical clothing dimensions, as it were "peeling the surface" of the 3D scans and laying it flat to form clothing patterns. Linked to computerised fabric cutters, the process has the potential to reduce costs and delivery time and to improve fit.

3D scanning has parallel applications in human factors, where humanoid "manikins" can be rescaled using measurements extracted from 3D scans and animated to interact with the built environment. These techniques are already being employed in military contexts and in the design of mass transportation and workspaces. A large project currently being undertaken by the University of South Australia, the Australian Sports Commission, the University of Ballarat and engineering firm Sinclair Knight Merz aims to scan RAAF aircrew and planes and rescale and animate manikins to see whether they can fit and perform critical tasks comfortably in crewstations.

In health research, 3D scanning has been used for craniofacial and reconstructive surgery and for prosthetic manufacture (where the undamaged limb is scanned and a mirror image produced for the damaged side). The same techniques have been applied to forensic and anthropological reconstruction based on skeletal remains and fossils. Graphic designers use 3D scanning to create computer "avatars", animated human-like figures in video games and simulation scenarios. Many of the special effects in the Terminator movies were created using the Cyberware whole-body scanner. Much work has been done on facial recognition and judgments of attractiveness using manipulated 3D facial scans.

However, very little work has been done using 3D scanner in sports science applications. The aim of our paper is to outline some possible applications of 3D scanning technology in exercise-related areas.

How 3D scanners work

Scanners use a variety of technical means to create 3D images. Most work by projecting straight lines or grids on to the human body. They are distorted by the curves and contours of the body. This disortion is captured by cameras and decoded to infer the 3D shape. 3D scanners produce a dense "point cloud" in three-dimensional space. A body scan usually consists of several hundred thousand points, each represented by an XYZ co-ordinate. Sometimes these points are joined to their near neighbours to form polygonal meshes (see Figure 1).

Figure 1. Human figure in a cycling posture. The file uses a polygonal mesh.

The tiny facets formed by the polygonal mesh can be shaded and smoothed, producing a "rendered" body (Figure 2; the metaphor is that of a plasterer smoothing render over a wire frame).

Figure 2. A rendered image.

Measurement extraction

In order to be able to take measurements from 3D scans, special software is required. Programs such as *ScanWorX*, *Digisize* and *NatickMsr* analyse 3D data and derive measurements for traditional bone lengths and breadths and fleshy girths. However, they can also measure contour distances (following the profile of the body), cross-sectional and surface areas and volumes, thus considerably expanding the range of possible sports science applications.

In order to be able to extract traditional measurements, software needs to be able to identify landmarks. There are three common landmarking systems used in 3D anthropometry:

- automatic landmark recognition (ALR), where the software identifies landmarks from the scan without human intervention
- digital landmark placement (DLP), where landmarks are located on a digital image by identifying surface features
- physical-digital landmark location (PDL), where landmarks are placed physically on the body and these landmarks are then digitally located on the scanned image.

ALR has proved to be unacceptably inaccurate, while DLP is often difficult on fat or very muscular subjects where underlying bony landmarks are difficult to locate. Therefore, we rely heavily on PDL, which has the disadvantage requiring more time and skill. Landmark sites are located by palpating underlying bony structures, such as the tip of the shoulder blade. A physical landmark is then attached to the located point, either as a coloured reflective disc (for scanners which identify colour or texture) or as a raised landmark (for scanners which do not recognise colour or texture).

Unfortunately, there are many different landmarking systems and a systematic, universally accepted syntax and semantics for measurements and landmarking are badly needed. Some of the common systems are

- ANSUR (US Army Anthropometric Survey 1987-1988; Clauser et al, 1988)
- CAESAR (Civilian American and European Surface Anthropometry Resource; Blackwell et al, 2002)
- IBP (International Biological Program; Weiner & Lourie, 1969)
- ISAK (International Society for the Advancement of Kinanthropometry; ISAK, 2001)
- ISO (International Standards Organisation).

Manipulating 3D data

The great advances in 3D scanning in the last 10 years have arisen not so much from hardware developments as from software techniques. Some specific techniques are of particular interest to sports science, because they invite new applications. "Morphing" involves combining images, so that the resultant image is a mix of the two in different proportions. "Averaging" involves creating an image which is a composite of a number of images, to create a topical or average body. "Caricaturisation" involves quantifying the difference between two bodies (or composite bodies) and exaggerating them. If, for example, one person has longer legs than average, the caricaturised form of his body will have extremely long legs. "Anti-caricatures" work the opposite way — they reduce the differences between two bodies or composite bodies.

Applications to sports science

The possibility of digitising the body shapes of athletes' bodies offers some interesting new potentialities for sports science. This section outlines some examples.

Projected frontal area

Projected frontal area (Ap) is the plane area a cyclist, swimmer or runner presents perpendicular to his or her direction of motion. It is the major determinant of air resistance, and hence the major source of resistance to forward motion, at typical movement speeds. If Ap can be minimised, the athlete will be able to move faster. Ap is usually measured by taking photographs beside a reference dimension and using manual planimetry. For each new body position and orientation, the athlete has to be repositioned and photographed again. By representing an athlete's body in a sports posture (Figure 1), either by scanning him in that posture or by rescaling a manikin in a modelling program, this process can be facilitated and refined. A cyclist can, for example, be tilted while maintaining the same posture, simulating the effect of changing the geometry of the bicycle frame. The effect on Ap can be measured at each angle. In an animation program, posture can also be modified. 3D models of cyclists and other athletes moving through a fluid medium (swimmers, runners, etc) can also be used to model flow dynamics and hence reduce air resistance in other ways.

Volumes

The calculation of limb volumes and partial volumes has been important in sports science to calculate moments of inertia for biomechanics research and to estimate muscle mass in relation to power output in sprint cyclists and the like. In the past, limb volumes have been estimated by plethysmography (immersion in fluid, usually water, and measuring displacement), or by taking surface measurements and using a simplified model (eg, assuming that limb cross-sectional areas are elliptical. 3D anthropometry allows a much more precise calculation of limb volumes, because cross-sectional areas (CSAs) and volumes can be calculated.

An extension of the use of 3D analysis to calculate volumes is to use it to calculate whole-body volume and hence to estimate percentage body fat. If we know the mass of the subject and the volume estimated by 3D scanning, we can calculate the whole-body density and hence estimate percentage body fat. To our knowledge, no study has yet looked at the accuracy and precision of using 3D scans to predict percentage body fat, measured against a criterion standard such as DXA or hydrostatic weighing. However, the US Soldier Center at Natick has reported that 3D scans yield accurate estimates of whole-body surface area.

3D characterisation of athletes

There has been extensive research into how athletes differ morphologically (ie, in body shape) from their source populations (the populations from which they are recruited; Norton, Olds, Olive and Craig, 1996). Averaging can be used to characterise body shapes from the general population, and from sports groups. The variability in the location, shape and size of body parts can then be calculated. Caricaturisation techniques help us to visualise and understand the three-dimensional distinctiveness of sporting bodies. These differences can then be statistically analysed to see which represent significant variability and those which may be due to typical inter-subject variation. These results can then be used for talent identification and recruitment.

Statistical techniques such as clustering analysis and Principal Components Analysis, coupled with shape-analysis (or "morphometric") strategies, are being used to develop general human shape classifications, more refined and more soundly based than traditional somatotypes.

Body changes due to growth, maturation, dietary and training interventions

3D scanning can be used to visualise (perhaps using morphing) and better quantify size and shape changes that occur due to ageing and training. These may be used to monitor athletic groups, but also to quantify shape changes(for example in abdominal adiposity) with ageing.

Conclusion

For a long time, anthropometry has been in the doldrums. After the post-war revival of sports anthropometry by researchers such as Lindsay Carter, there has been a long period of stagnation, as evidenced by declining publications, particularly in key journals. 3D scanning offers the opportunity to renew and revitalise sports anthropometry.

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end of their playing days – even to the extent of having many, if not all teeth replaced with implants. This is not an option for many community-level players. There is a concern that the availability of such "fix-up" options may lead to a more cavalier approach to dental safety at the elite level.

The most extreme manifestation of the negative story, and like the entertainment business, those that get the most publicity, are those about athletes and coaches resorting to illegal performance-enhancing substances – drug scandals.

Allegations of this kind made about some members of the Australian Olympic cycling team received massive publicity just prior to the Games. All involved must still feel shaken by the experience. And this despite subsequent exoneration and gold medal triumphs. How much publicity did the Anderson Report and its subsequent exoneration of the team members, finding the accuser's word could not "be safely accepted or acted upon"3 actually receive? Compared to the initial accusations, virtually none.

Such stories get far more publicity than positive stories about how science and medicine are used legitimately to get the best out of an athlete. The article from the AIS in this edition of Sport Health is a rare example of the latter.

Sensation and scandal are the bread and butter of the entertainment business. It is a given that information about reduced injury rates and improved recovery regimes will get nothing like the same publicity.

1 Brukner P. Sport Health, Spring, 2004.

2 Banky J. JSMS, 2:1; 68.

3 Hon Robert Anderson QC. Report to the ASC and Cycling Australia, P15.

What is the best final 8 system?

by John Orchard

The Final 8 concept is uniquely Australian. Just as our favourite horse race, the Melbourne Cup, is a handicap event with a premium on a close finish, our football competitions are obsessed with providing entertainment value in the finals rather than necessarily selecting the best team of the year.

The Australian approach to football finals lies somewhere between the contrasting perspectives taken by the British and American systems.

In the UK, the major football competition, Premier League Soccer, is decided by a simple first past the post system, with the team having the most number of points being declared the winner without finals being required. An exception to the status quo in England is the Rugby Super League, which has a final six that is somewhat similar to Australian systems.

Soccer in Europe has a variety of alternative knockout type finals systems, with the final 8 sorting themselves out in knockout quarter finals, in a similar fashion to tennis.

All of the major American sports also follow the knockout quarter final approach to their last 8, although it is worth noting that baseball, basketball and ice hockey all have multi-game playoffs, which reduces the likelihood that a poor team can knock out a superior one with a single upset win. The NFL has close to the most brutal (but perhaps therefore the most exciting) of all playoff systems in the football world, with a 16 match regular season being decided by a knockout finals system with no double chance, meaning that a team could be undefeated in the regular season but fail to make the final four if they lost one playoff game.

The major Australian football competitions – the NRL and AFL – will both persist with a final 8 playoff system in the foreseeable future, because both of them need the revenue and the TV product, and for the side effect of making the home and away seasons more exciting. Although the NRL currently has 15 teams and the AFL 16 teams, both have a compromised home and away season in which teams do not have a balanced set of fixtures against all opponents. In the NRL, stand-downs associated with the State of Origin series further compromises the fairness of the regular season. Therefore both AFL and NRL administrators would be justified in wanting to have a fairly 'open' finals series to allow for the inconsistencies of the home and away seasons.

SYSTEM	QUARTER FINALS	MCINTYRE (NRL SYSTEM)	DOUBLE FOUR SYSTEM (AFL)	WARREN RYAN SYSTEM	WILDCARD SYSTEM
Relative advantage to minor Premiers	None (0/5)	Moderate (although not much advantage over team 2) (3/5)	Small (teams 1-4 all have similar situation) (1/5)	Large (4/5)	Very large (5/5)
Guaranteed double chance after week 1	No teams (0/5)	Teams 1 and 2 only (3/5)	Teams 1-4 (4/5)	Teams 1-5 (4/5)	Teams 1-3 (5/5)
Double chance later in finals	No teams (3/5)	No teams (3/5)	No teams (3/5)	No teams (3/5)	Team 1 can lose in week 2 and still progress (4/5)
Results of other games can influence a team's fate	No (5/5)	Yes (2/5)	No (5/5)	Yes (3/5)	No (5/5)
Simplicity	Yes (5/5)	No (2/5)	Yes (4/5)	No (1/5)	No (0/5)
Possibility of redundant results (both winner and loser have same fate)	No (5/5)	Yes (3/5)	No (5/5)	Yes (0/5), with teams 4 and 5 having a guaranteed redundant result in week 1.	No (5/5)
Number of games	7 (3/5)	9 (5/5)	9 (5/5)	10 (5/5)	8 or 9 (3/5)
Number of weeks	3 (4/5)	4 (5/5)	4 (5/5)	4 (5/5)	4 (5/5)
Final score	25/40	26/40	32/40	25/40	32/40
Overall comment	Very cutthroat	Exciting but random	Rewards the top four	Week one is a bit redundant	The fairest but most complicated

The NRL currently uses the McIntyre Final 8 system, designed by Victorian lawyer Ken McIntyre, who is also credited with designing the original VFL final 4 system (as a student in the 1930s), final 5 system (in the early 1970s) and final 6 system (in the early 1990s).

All of his systems have been tiered so that the higher finishing teams have had an advantage over those beneath them (including receiving a 'double chance' after a loss early in the finals). However, in his final 8 system the double chance from the first week for teams 3-6 depends on the results of other games. This anomaly led to the AFL abandoning the system in the year 2000, although to be fair to the McIntyre system, some of the perceived injustices of the system were caused by the AFL's contract with the MCG that a certain number of finals must be played at this ground.

The most notable bizarre outcome under the McIntyre system in the AFL was the Adelaide Crows winning the Premiership in 1998 after they finished fifth and were thrashed in the first week (and after which they probably didn't deserve, but did receive a 'double chance'). Personally I feel the most glaring let-down under the McIntyre system in the AFL was the fact that Essendon were clearly the dominant team of the 1999 season, but they lost a knockout Preliminary Final by a point to Carlton and didn't even get to reach the Grand Final. This anomaly could still occur under the new AFL finals system, by the way.

The NRL now uses the McIntyre system, although there is constant debate that this system may be shelved in favour of the AFL system, which although it bears no specific name is actually a double-final four system (based on the original Page-McIntyre design). The NRL has also looked at an alternate system submitted by media commentator Warren Ryan, which is included in this review. I don't think the Warren Ryan system is a viable one, as teams 4 and 5 both play a match in week 1 (not against each other) and irrespective of any results, both progress to a knockout semi in week 2, which would give them no incentive to try to win their week 1 match. Also included in this review is a system designated the 'Wildcard' system, which differs from the alternatives in that it more highly favours the minor premiers. Although an interesting concept, the Wildcard system is unlikely ever to be adopted because of its complexity.

A further point of note regarding the AFL and NRL finals systems is the importance of home ground advantage. In the NRL system currently, home ground advantage is only offered to higher placed teams during the first week of the finals. In the AFL, home ground advantage is offered in theory during the first three weeks, although the AFL must reserve the right to rescind home ground advantage on occasion in order to fulfil a contract it holds with the MCC.

Studies of home ground advantage show that it definitely exists and is mainly influenced by crowd support. It is controversial as to whether referee bias (due to crowd reaction) is a major component, or whether the home crowd vocal support lifts the players without major help from the umpires. In situations where teams must travel across multiple time zones, jet lag may also influence home ground advantage, but this is unlikely to be relevant in Australian competitions.

Specifically, local ground knowledge and short-haul travel are not considered to be nearly as important as crowd support. The evidence for this is mainly based on the American national competitions, where home field advantage is greatest in basketball and least in baseball. In basketball, the court conditions are exactly the same in every stadium, but the crowd noise is massive due to small enclosed conditions. In baseball, the field size, grass types, stadium conditions all vary significantly, and the home team is given the advantage of batting last, but the crowd influence is less than other sports because the seats are further away from the players.

Therefore, although the NRL and AFL Grand Finals are played in Sydney and Melbourne respectively, there is very little home ground advantage as both are played in front of sellout crowds with many neutral supporters who would be willing to support an underdog. Early finals between two teams from different states would have the potential to lead to a significant home ground advantage. However, the advantage would vary depending on the amount of support the away team has in the foreign city and even the stadium configuration. For example, the Sydney Swans would probably have a greater home ground advantage at the SCG, where the fans are closer to the players and the noise is retained more, than Telstra Stadium, where the fans are more distant.

A comparison chart is also provided listing the likelihood that each team will win the competition, based on a theoretical 60% winning likelihood for the highest placed teams in week 1, and then a 50% winning likelihood (for simplicity) for all games after week 1. From the comparisons provided, the 'fairest' finals system is the Wildcard system, but it suffers from complexity.

The AFL system is probably the next best and fairest and has the major advantage of simplicity. Its major disadvantage is that it doesn't reward team 1 enough. The McIntyre system exchanges fairness with a week 1 lottery that is highly exciting and, if that is the way that administrators want to flavour their finals, it is a reasonable option. I don't like the way that a team must rely on other results to avoid elimination in week 1, but it does keep everyone on the edge of their seats. The Warren Ryan system is an attempt to make the McIntyre system fairer, but it devalues the week 1 games far too much.

Despite the debates, it is likely that both the AFL and NRL will continue with their current systems, and both competitions probably like the fact that more publicity is created by the debate over which is the best system.

AFL INJURY REPORT

Quarter Finals system:

WEEK 1	WEEK 2	WEEK 3
QF1: Team 1 v Team 8	SF1: Winner QF1 v Winner QF4	GF: Winner SF1 v Winner SF2
QF2: Team 2 v Team 7		
QF3: Team 3 v Team 6	SF2: Winner QF 2 v Winner QF3	
QF4: Team 4 v Team 5		

McIntyre Final 8 System:

WEEK 1	WEEK 2	WEEK 3	WEEK 4
QF1: Team 4 v Team 5	SF1: 3rd highest ranking winner v highest ranking loser	PF1: Highest ranking winner (from week 1) v winner SF2	GF: Winner PF1 v Winner PF2
QF2: Team 3 v Team 6			
QF3: Team 2 v Team 7	SF2: 4th highest ranking winner v 2nd highest ranking loser	PF2: 2nd highest ranking winner (from week 1) v winner SF1	
QF4: Team 1 v Team 8			

Double Final Four (AFL) System:

WEEK 1	WEEK 2	WEEK 3	WEEK 4
QF1: Team 1 v Team 4	SF1: Loser QF1 v Winner EF1	PF1: Winner QF1 v Winner SF2	GF: Winner PF1 v Winner PF2
QF2: Team 2 v Team 3			
EF1: Team 5 v Team 8	SF2: Loser QF2 v Winner EF2	PF2: Winner QF2 v Winner SF1	
EF2: Team 6 v Team 7			

Warren Ryan System:

WEEK 1	WEEK 2	WEEK 3	WEEK 4
QF1: Team 5 v Team 8	SF1: top-4 highest loser v bottom-4 lowest winner	PF1: highest winner week 1 v lowest winner week 2	GF: Winner PF1 v Winner PF2
QF2: Team 6 v Team 7	SF2: top-4 lowest loser v bottom-4 highest winner		
QF3: Team 1 v Team 4	SF3: top-4 2nd highest winner v bottom-4 highest loser	PF2: highest winner week 2 v 2nd highest winner week 2	
QF4: Team 2 v Team 3			

Wildcard System:

WEEK 1	WEEK 2	WEEK 3	WEEK 4
EF1: Team 4 v Team 7	SF1: Winner EF1 v Winner EF2	PF1: Winner QF1 v Winner SF1	GF: Winner PF1 v Winner PF2
EF2: Team 5 v Team 6			
QF1: Team 2 v Team 3	SF2: Winner QF2 v Loser QF1	PF2: Team 1 v Winner SF2 (if Team 1 is winner of SF1 then it progresses through to GF without playing in week 3)	
QF2: Team 1 v Team 8			

Comparison of winning percentages:

SYSTEM	QUARTER FINALS	MCINTYRE (NRL SYSTEM)	DOUBLE FOUR SYSTEM (AFL)	WARREN RYAN SYSTEM	WILDCARD SYSTEM
Team 1	15%	20%	20%	20%	32%
Team 2	15%	20%	20%	17%	20%
Team 3	15%	18%	17%	15%	17%
Team 4	15%	14%	17%	13%	8%
Team 5	10%	10%	8%	13%	8%
Team 6	10%	8%	8%	10%	5%
Team 7	10%	5%	5%	8%	5%
Team 8	10%	5%	5%	5%	5%
Conclusion	Too even	Good distribution but random outcomes	Good reward for top 4 but huge gap between teams 4 and 5.	Very fair distribution but week 1 games are devalued	Best reward for team one.

The effects of health-related physical activity and exercise on psychological health and wellbeing

Chief Author: Kerry Mummery

The latter half of the 20th century witnessed significant changes in the causes of death and disease in Australia. The declining incidence of infectious communicable disease and coinciding rising incidence of chronic disease has led to an increased focus on the behavioural determinants of health and wellbeing. Substantive evidence now exists to support a generally positive role for physical activity and exercise in the reduction of morbidity and mortality at a population level.

Mental health and wellbeing is a major area of emphasis when studying the overall health of the population. Currently in Australia, nearly 30% of the non-fatal burden of disease can be attributed to poor mental health and subjective wellbeing (Mathers, Vos, & Stevenson, 1999). Affective disorders account for 33% of the burden of mental disorders, with anxiety disorders accounting for an additional 23% of the national mental health burden (Commonwealth Department of Health and Aged Care and Australian Institute of Health and Welfare, 1999).

Recent review and meta-analytic evidence suggests that people who are more active exhibit lower levels of anxiety and depression (Craft and Landers, 1998; Dunn, Trivedi and O'Neal, 2001; Paluska and Schwenk, 2000; Salmon, 2001). The dose-response effects of physical activity on depression and anxiety remain equivocal. Although a direct dose-response seems likely, inadequate randomised controlled trials exist to provide sufficient evidence to support such an effect.

Just as health is more than simply the absence of disease, psychological health goes beyond morbidity and mortality measures. Physical activity and exercise play a role in establishing and maintaining positive mood (Hansem, Stevens and Coast, 2001; Steinberg et al, 1998), may enhance some aspects of cognitive functioning in older adults (Emery, Schein, Hauck and MacIntyre, 1998; Kramer et al, 1999) assist in the development of positive self-concept and self-esteem (McAuley, Blissmer, Katula, Duncan and Mihalko, 2000; McAuley, Mihalko and Bane, 1997), and improve perceptions of overall quality of life (Rejeski and Mihalko, 2001).

Although current evidence generally supports the positive role of physical activity and exercise in depression, anxiety reduction, mood, self esteem, cognitive function and quality of life, this relationship is likely both curvilinear and contextual. Research in athletic populations has shown depressed mood and psychological distress may result from high volumes and/or intensity of training (Armstrong and VanHeest, 2002; Filaire, Bernain, Sagnol and Lac, 2001; O'Connor, Morgan, Raglin, Barksdale and Kalin, 1989). In terms of activity context, there is recent evidence to show that people exercising in a competitive setting report less favourable affective responses than do people completing their exercise in a non-competitive setting (Masters, Lacaille and Shearer, 2003). Of course, energy expenditure in the context of sport participation has vast implications for psychological health and wellbeing – potentially either positive or negative – that is beyond the scope of this brief review.

A major challenge for the health profession is to increase physical activity among the inactive majority of the population. There is, however, a small portion of the population that display an unhealthy dependency on physical activity. This addictive behaviour can cause individuals to exercise at the cost of injury, loss of interpersonal relationships and detrimental work performance (Coen and Ogles, 1993; Yates, 1987). Although sometimes serious at the individual level, it is generally considered that the benefits of physical activity at the population level far outweigh the possible detrimental effects of its potentially addictive nature (Sallis and Owen, 1999).

In conclusion, evidence generally supports the positive contribution of moderate levels of physical activity and exercise, conducted in the proper context, to psychological health and well-being. There is an ongoing need for more research involving randomised controlled trials to establish the dose-response effect of physical activity on the various areas of psychological health and wellbeing.

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Professor Kerry Mummery is at the School of Health and Human Performance, Central Queensland University.

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A great stride forward for JSMS

The **Journal of Science and Medicine in Sport** now has an impact factor. In this edited extract from the latest issue of the Journal, Editor Caroline Finch and Assistant Editor John Orchard explain what this means and what its implications are:

In July 2004, the 2003 data for the *Journal Citation Reports* (JCR) appeared on the Web. The JCR can be used by authors to compare and evaluate the relative performance of scientific and other journals, on a number of scales. According to the website (http://isi6.isiknowledge.com) : "It is an essential, comprehensive, and unique resource tool for journal evaluation, using citation data drawn from over 8,400 journals from over 3,000 publishers in 60 nations."

for the first time, JSMS now appears in the Sports Science category. This is a major achievement for a journal such as ours. Whilst the exact relevance and interpretation of impact factors and other measures have been debated over recent years, it is a 'club' of which we are proud to have membership.

Despite the widely discussed limitations of indices such as the impact factor (1-3), these measures are still used by academic bureaucracies as one of the major objective means of assessing a journal's reputation.

the impact factor is the measure of the frequency with which the "average article" in a journal has been cited in a particular year. As such, a comparison of impact factors across journals can help to evaluate a journal's relative importance. It is calculated by dividing the number of current citations to articles published in the two previous years by the total number of articles published in the two previous years.

The inaugural impact factor for the JSMS is 0.693 which ranks it as the 41st highest ranked journal out of a group of 71 rated by the JCR. Overall, this is quite a good ranking for a journal in its first appearance in this list.

Our aim is to increase the readership of the Journal and increase the quality and relevance of the papers published, all of which should contribute to increasing our impact factor in the future. On the other hand, we are moving away from lengthy 'thesis-like' review articles to publishing more original short-reports and punchy opinion pieces and we are also slowly trying to move away from dry pure science papers to topics with more clinical and public health relevance, both of which may reduce the Journal's impact factor but will hopefully satisfy our readers more and make larger real contributions to the field.

Notwithstanding its limitations, monitoring of annual trends in the impact factor lists will enable us to consider the effects of our evolving editorial policies and the increasing quality of the papers that are being submitted.

Making Australian Sport Safer Sport

The Sports Trainer Page

Produced for Sport Health by Chris Murray RN (SMA, NT Branch)

Skin Care in the Tropics

While millions of fans and sports trainers are gearing up for the AFL finals in the southern states, the sport medicine team in the Northern Territory are gearing up for the start of the Top End season. The season starts early October and continues through until late March.

The treatment and prevention of injuries that occur in AFL are similar in the NT to every other State. We experience our fair share of meniscus tears, pulled hamstrings and quad muscles, etc. What differs in the NT is our incidence, and very often treatment, of skin wounds (be they mosquito bites, scratches, cuts or lacerations).

The care of wounds arguably requires greater attention in the NT then anywhere else in Australia. The high humidity, hard football grounds and often inexperience in wound management care all play a role in a small insect bite or scratch developing into a large festering wound requiring IV antibiotics (a not unusual occurrent in the NT). Consequently, wound management is a large part of the sport medicine work in the NT. It is imperative that sport trainers understand the effect the NT climate has on a wound, and the important role they must play in ensuring that the wound is managed and consequently heals quickly.

From October to late May the tropics have two distinct seasons. The "Build Up" occurs between October and December each year. Then comes the "Wet Season". During the "Build Up" high humidity levels produce an environment that is not only hot and sticky, but is ideal for rapid bacteria growth.

During the early part of the season

The playing surfaces can be extremely hard with poor grass cover, leading to the majority of the wounds presenting as lacerations. As the season progresses and the rains come, leading to extreme wet surfaces, more injuries are sustained through direct body contact resulting in head wounds and cuts.

Some of the most common skin conditions seen during the season are as a result of bites from mosquitos and sand flies. These wounds can be very painful and itchy and very quickly lead to inflammation/infection and cellulites requiring medical intervention (CDC Fact Sheet Mosquitoes).

The sport trainer role in treating these conditions is to prevent infection, ensure adequate cover to the infected area, and educate players on the care of what may appear to be a simple wound or bite in the tropical north.

The sports medicine professional must be aware that small cuts can lead to a person developing Melioidosis. "Melioidosis is a Disease caused by a bacteria know as Burkholderia Pseudomallei. The bacteria live below the soil surface during the dry season but after the rains are found in surface water and mud" (CDC Fact Sheet Melioidosis).

Wound Dressing

There is a large choice of dressing available to the SMP to choose from.

One must be aware of the main principles of wound dressing. A dressing must:

- encourage wound healing,
- protect the wound,
- promote ideal wound environment, and
- be cost effective.

The dressing must allow the player to continue to play sport, and not restrict movement All wounds should be cleaned with normal saline or clean tap water and the surrounding area dried well.

If superficial, a simple adhesive dressing will do and can be left intact for seven days. Dressing the wound has the added advantage of preventing the player from scratching, encourages optimal wound environment and allows the wound to breath while at the same time protecting it.

Larger wounds will be accessed and referred to medical personnel for suturing. But all wounds should be covered during play. Sutured wounds can be left uncovered when not playing.

Skin Care

Players should be educated on looking after their skin especially in the hot humid environment of the north. They are encouraged to use anti-mosquito spray during early morning and twilight hours. These can be purchased from local pharmacies.

Information on Melioidosis is also given out as this can be a potentially dangerous infection and is contacted via broken skin. The wearing of correct footwear and clothes is recommended especially when walking or playing in muddy water.

Wearing protective clothing during the heat of the day is a good idea as sunburn can be a problem.

Covering sunburn with non-adhesive dressing

If they have blisters a medical officer should first access them.

At the beginning of the season it is important that players are given strategies on looking after their skin. In the humidity of the tropics it is recommended that players have at least two showers a day and ensure that when they dry themselves they pay particular attention to areas where skin meets skin as in groins and under arms. It has being found that if players wear bike shorts this helps to alleviate the problem of groin rash.

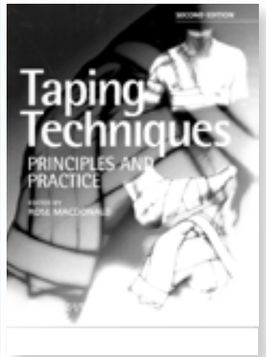
Encouraging sport personnel to follow simple skin care, can prevent lots of problems during the season and ensures that both players and sports medicine professionals have an enjoyable time in the tropics.

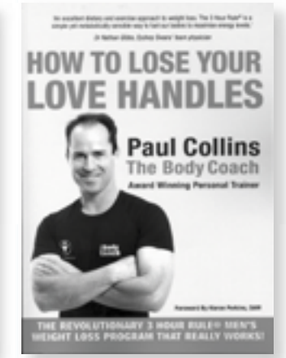
Resources

Sport Medicine Level One Manual

Centre for Disease Control NT fact sheet Melioidosis/ Mosquitoes www.nt.gov.au/health/cdc

For your Library





Taping Techniques: Principles and Practice (2nd Ed)

Rose Macdonald (Ed)
Published by Butterworth-Heinemann, distributed in Australia by Elsevier Australia
ISBN 0 7506 4150 9

The new edition has been revised, with contributions from Australia, New Zealand and Europe. The new contents include descriptions of new proprioceptive taping techniques. a new chapter explaining the theory and principles behind unloading painful structures and stabilisation techniques, and an updated chapter on podiatry.

Australia's Health 2004

AIHW Cat. No AUS-44; ABS Cat. No. 8903.0

The latest in this series contains a section on injuries. Copies can be downloaded from **www.aihw.gov.au/publications/index.cfm/title/10014** or a printed version from CanPrint on 1300 889 873, by fax on 02-6293-8333 or by email at **sales@infoservices.com.au**

Health system expenditure on disease in Australia, 2000-01

AIHW Cat. No. HWE-26

This edition estimates expenditure classified by disease or injury group, age and sex. Estimates are available by area of expenditure: hospitals, high level residential aged care, medical services, other professional services, pharmaceuticals and research. Copies can be downloaded from **www.aihw.gov.au/publications/index.cfm/find/health%20system%20expenditure** or a printed version from CanPrint on 1300 889 873, by fax on 02-6293-8333 or by email at **sales@infoservices.com.au**

How To Lose Your Love Handles

Paul Collins
Published by Allen & Unwin
ISBN 1 74114 445 0

Paul Collins is a strength and conditioning coach and nutrition adviser with a number of sports and athletes, including Kieren Perkins and Cameron Delaney. He contributes to various fitness publications, including Inside Sport. His book contains eating and workout plans aimed basically at middle-aged men with problem waistlines.

Bronwyn moves on

After three and a half years at the helm, SMA Queensland Executive Officer Bronwyn Marshall is moving on to ruin her own business.

The big change takes place with effect from the end of October.

SMA Member Benefits

The SMA Member Benefits team has selected four benefits for September/October that we believe will be of special interest to members.

- Win a free website package
- Reduce your telephone spend with corporate priced plans
- Fleet like discounts and more on purchasing a new vehicle
- Get more rewards out of your credit card

Win a FREE Website for your Business

We are keen to help our small business members to increase their profile and potentially their revenue. If you do not currently have a website presence, why not go into a draw to win a free total website package to get you on line at nil cost. This package will include:

- A 5 page website designed to suit your business
- Your own ".com" domain name
- Hosting of your site for 6 months

To enter this draw, please email your details to us by Friday 29 October. The winning member will be notified on Monday 1 November.

Let us help you reduce your business telecommunication costs

People Telecom will provide you with corporate pricing plans to suit your business needs. Members with small to medium sized businesses will benefit from call plans normally reserved for larger corporates and corporates will benefit from extremely competitive plans. An additional 5% discount has been arranged for all new members.

People Telecom will also provide you with:

- Full suite of voice products (including capped calls)
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Take the pain out of buying a new or used vehicle

The Automotive Buying and Finance Service will save you valuable time and money by organising the purchase of your new or used car. All you need to decide on is the make, model and colour. They will also:

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- Deliver your new car to door to test drive in peace
- Make sure your used car is mechanically checked, detailed, roadworthied and comes with a warranty*
- Not charge you for using this service
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Special Offer – September 2004

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* Industry standard warranty periods apply

^ Offer ends 29th October 2004

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* Fees and charges apply. Terms and Conditions apply and are available upon request or see the Citibank brochure for further details. All Citibank standard credit card Annual Percentage Rates are variable and subject to change.

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