Institution:	University of Northumbria at Newcastle
Unit of Assessment:	26 – Sport and Exercise Sciences, Leisure and Tourism
Title of case study:	Exercise-induced asthma and inhalant allergy in athletes

1. Summary of the impact

Our research has highlighted that exercise-induced asthma (EIA) and allergies are poorly diagnosed and managed in athletes by physicians. We have shown that a quarter of undiagnosed athletes do in fact have EIA and conversely half of previously diagnosed athletes do not have EIA. This has implications for both performance and health of the athlete. These findings have resulted in several professional sports teams implementing EIA screening programmes for all their athletes. Furthermore, we have identified a high prevalence of untreated allergies in athletes, which is a known risk factor for EIA. This research formed the basis for the Healthy Airways programme implemented by the British Olympic team.

2. Underpinning research

Exercise-induced asthma (EIA) describes the narrowing of airways that occurs in association with physical exertion and allergy is the most significant risk factor in the development of EIA. Surprisingly, exercise-related respiratory symptoms have poor diagnostic predictive value for EIA and are likely to be as accurate as a coin toss. Therefore, objective bronchoprovocation testing is necessary to obtain a secure diagnosis of EIA.

In 2007 Dr Les Ansley (Reader, employed at Northumbria from Sept 2007) looked at the guideline recommendations for performing an objective laboratory exercise test to diagnose for EIA. Ansley concluded that the usefulness of the guidelines was limited because of their poor predictive value in determining the correct intensity at which to perform the exercise challenge. These findings were presented at the annual conference of the European Respiratory Society (2007) and received the Young Scientist Award. Ansley subsequently designed and validated a heart rate-based prediction equation for determining the target intensity during an exercise challenge. When this was presented at the 2010 annual congress for the European Academy of Allergy and Clinical Immunology it won the thematic session for “Asthma: exercise and management”.

Ansley also evaluated the efficacy of implementing a screening programme for EIA in athletes using objective testing by employing the standard framework used when evaluating any screening policy. Ansley concluded that the adoption of a standardised testing procedure is necessary for a successful widespread screening programme; however, focused screening of high-risk athlete populations is recommended (Reference 1). Ansley has subsequently shown that when a screening programme is implemented almost 25% of previously undiagnosed athletes have airway dysfunction that could compromise their training and competition. These data are being presented at the 2012 annual meeting of the American Thoracic Society, which is the largest respiratory conference in the United States for respiratory physicians.

In 2008/9 Ansley conducted the first ever audit into how physicians in England diagnosed EIA. 257 GPs were surveyed via an online questionnaire with built-in logic steps, which assessed the diagnosis and treatment algorithm adopted. Rather worryingly, it was found that the most frequently employed tests were those with poor diagnostic value and that 85% of GPs had no access to the recommended bronchoprovocation tests (Reference 2). Indeed, when Ansley conducted objective bronchoprovocation testing on 65 elite athletes who all had a GP symptom-diagnosis of EIA he found that almost half (49%) had been misdiagnosed and were using medication unnecessarily (Reference 3). Previous research had only ever looked at under-diagnosis, not over-diagnosis, for EIA.

On the basis of the association between exercise-induced asthma and elite athletes Ansley recently published a paper (Reference 4) proposing that exercise-induced asthma might be classed as an occupational lung disease. A change in the status of EIA would have major implications for clubs and teams in terms of duty of care towards their athletes.

It is well known that the development of EIA is strongly predicted by allergy (the "allergic march") so in 2009 Ansley and Robson-Ansley (Professor) looked at the prevalence of allergy in 210 competitors of the London Marathon. They found 40% of runners had allergy but in over three-quarters of these athletes their allergies were poorly managed (Reference 5). Unmanaged allergy can have also potentially deleterious effects on cognitive and physical task performance. Often poorly managed allergy is due to lack of awareness of best practice. Therefore, Robson-Ansley co-authored a resource paper (Reference 6) to inform on current recommendations in the treatment of allergy in athletes.

Ansley and Robson-Ansley's main research collaborators are Hull and Dickinson. Hull was Ansley's PhD student and is now a respiratory consultant at The Royal Brompton Hospital, London; Dickinson is a senior lecturer at Canterbury Christ University. Ansley and Robson-Ansley were the principal investigators on all the collaborative projects.

3. References to the research

1. Hull, J.K., **Ansley, L.**, Garrod, R., Dickinson, J.W. (2007). Exercise induced bronchoconstriction in athletes - should we screen? *Medicine and Science in Sports and Exercise*. **39**: 2117-2124. DOI: 10.1249/mss.0b013e3181578db2
2. Hull, J.K., Hull, P.J., Parsons, J.P., Dickinson, J.W., **Ansley, L.** (2009) Approach to the diagnosis and management of exercise-induced bronchoconstriction in primary care in the UK. *BMC Pulmonary Medicine* **15**;9:29. DOI: 10.1186/1471-2466-9-29
3. **Ansley, L.**, Kippelen, P., Dickinson, J., Hull, J.H. (2012). Misdiagnosis of exercise-induced bronchoconstriction in professional soccer players. *Allergy* **67**: 390-395. OI: 10.1111/j.1398-9995.2011.02762.x
4. Price, O.J., **Ansley, L.**, Menzies-Gow, A., Cullinan, P., Hull, J.H. (2013) Airway dysfunction in elite athletes – an occupational lung disease? *Allergy* (Online) DOI: 10.1111/all.12265
5. **Robson-Ansley, P.**, Howatson, G., Tallent, J; Mitcheson, K., Walshe, I., Toms, C., Du Toit, G., Smith, M., **Ansley, L.** (2011) Prevalence of allergy and upper respiratory tract symptoms in runners of London marathon. *Medicine and Science in Sports and Exercise* **44**: 999-1004. OI: 10.1249/MSS.0b013e318243253d
6. Dijkstra, P., **Robson-Ansley, P.** (2011) The prevalence and current opinion of treatment of allergic rhinitis in elite athletes. *Current Opinion in Allergy & Clinical Immunology* **11**: 103–108. DOI: 10.1097/ACI.0b013e3283445852

4. Details of the impact

Following the publication of our screening paper (Reference 1) Ansley was invited, along with Hull and Dickinson, by the Medical Officer at UK Anti-Doping to convene a therapeutic use exemption (TUE) consultation committee with the remit to advise UK Sport on their policies and procedures relating to the approval of asthma medication in athletes. Together, the TUE committee developed guidelines and a diagnostic algorithm for the TUE process (Sources 1 and 4) that was adopted by the UK National Anti-Doping Agency and used as the framework for medical practitioners in the diagnosis of EIA.

The early studies (References 1 and 2) and work on the TUE committee highlighted the lack of access or availability of centres that provided objective bronchoprovocation testing. So Ansley and Robson-Ansley started Sport Asthma (www.sportasthma.co.uk), which is a consultancy service that runs out of Northumbria University. Sport Asthma offers eucapnic voluntary hyperpnea (EVH) and allergy testing to athletes and referral service for physicians; EVH is the bronchoprovocation test recommended by the International Olympic Committee due to its high sensitivity and specificity. Sport Asthma is a UK Sport recommended testing centre in England (http://www.ukad.org.uk/support-personnel/asthma/) and is endorsed by Allergy UK (email from Clinical Director of Allergy UK, 30/04/2009) (Source 6). Sport Asthma has tested nearly 100 symptomatic athletes from various sports (swimming, athletics, cricket, rugby and football) and to

date Sport Asthma has identified 27 athletes misdiagnosed with EIA who were using asthma medication unnecessarily. The interpretation of the results provided in our reports to medical practitioners has guided subsequent treatment and management of athletes with exercise-induced respiratory symptoms (Source 3).

Sport Asthma has worked closely with two regional professional football teams (Newcastle United Football Club and Sunderland Association Football Club) to implement a screening programme for all their players. This has been very successful and through this programme with 49 asymptomatic players screened so far, and 17 (34%) players have been diagnosed with EIA and are now receiving appropriate treatment (Source 3). The treatment efficacy of a correct diagnosis is currently being assessed in a study that evaluates the effective use of inhaler technique by athletes who use asthma medication.

The consultancy work with professional athletes has generated significant interest from the media. Most notable was the involvement in a documentary commissioned by the British Medical Journal (BMJ), which explored EIA. The film is posted on the BMJ website as part of their continuing education programme and provides a resource for clinicians (http://www.bmj.com/multimedia/video/2012/04/25/exercise-induced-asthma). Other press exposure included two feature articles in Running Fitness (August 2009 and May 2010), a national magazine with a monthly circulation of 34,000, and an article in The Journal newspaper (11 September 2009), which has a daily readership of over 26,000. An article on Sport Asthma that appeared on the website of an Internet business magazine (https://bdaily.co.uk/opinion/07-10-2011/dr-les-ansley-from-sport-asthma-and-northumbria-university-talks-exercise-induced-asthma/) has been picked up by the international community and has over 200 separate Google entries. In order to educate the public on lung health Ansley encouraged the MSc Clinical Exercise Physiology students to organise a Healthy Lung Awareness Day at the university. The students measured lung function and provided advice and feedback to over 300 staff and students.
In addition to informing the general public about EIA and allergy in athletes Ansley and Robson-Ansley have given invited presentations to clinicians at conferences (e.g. Royal Society of Medicine 2012; EAACI Annual Congress, 2013) and workshops (e.g. EAACI Asthma Summer School 2010 and 2012).

In 2009 Ansley and Robson-Ansley obtained funding from Phadia Diagnostics (£16,000) to look at allergy in athletes. The results from this study were published in a high-ranking journal (Reference 4). The finding from the study of a 40% prevalence in allergy generated interest from the Chief Medical Officer for the British Olympic Team and the team doctor for UK Athletics. This has resulted in the implementation of a Healthy Airways programme for the Olympic athletes in the lead up to the London Olympic Games. The programme aims to identify “at risk” athletes and develop appropriate treatment and management plans. Ansley and Robson-Ansley formulated the screening process, which involved Robson-Ansley training up the sport federations’ doctors in allergy skin-prick testing and Ansley authoring the asthma section in the Athlete Health Guide that was given to all the British Olympic track and field athletes prior to the London Olympic Games.
As part of the Sport Asthma consultancy Ansley designed a novel EVH testing device that is five times more cost-effective than the traditional equipment and easily portable in a briefcase allowing testing at sports clubs and training facilities, unlike the old method, which requires testing to be conducted in a laboratory. Ansley has sold four EVH devices; to Exeter University, Liverpool John Moore’s University, St George’s University Hospital London and Gloucester University. There have also been enquiries from international institutions in Poland and the US. Professor Kai-Håken Carlsen, the former President of the European Respiratory Society, has also recommended the EVH device to the European Respiratory Society Task Force for Asthma in Exercise.

5. Sources to corroborate the impact

1. Evidence that the UK Anti-Doping Agency’s policy and process for therapeutic use exemption of asthma medication was influenced. http://www.ukad.org.uk/resources/document-download/asthma-screening-tue-form/
2. Evidence of the range of clients supported following research Sport Asthma website:

www.sportasthma.co.uk

3. Evidence of introduction of a screening programme - Club Doctor, Sunderland Association Football Club - testimonial
4. Evidence of influence on policy and procedure - Medical Co-ordinator, UK Anti-Doping Agency - testimonial
5. Rower and Sport Asthma client corroborating the benefits of correct diagnosis.
6. Clinical Director of Allergy UK - email endorsing Sports Asthma