

Section A		
Institution: School of Health Sciences, Liverpool Hope University		
Unit of Assessment: 24		
Title of case study: The Health Benefits of Tennis		
Period when the underpinning research was undertaken: 2016 to 2017		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Dr Matthew Jackson	Lecturer in Sport & Health Science	2016-present
Prof Omid Khaiyat	Professor of Musculoskeletal Physiology & Health	2013-present
Dr Farzad Amirabdollahian	Associate Professor in Nutrition	2011-present
Dr Denise Roche	Associate Professor in Exercise Physiology	2000-present
Dr Stefan Koehn	Lecturer in Sport Psychology	2015-present
Period when the claimed impact occurred: 2017 to 2020		
Is this case study continued from a case study submitted in 2014? N		
Section B		
1. Summary of the impact		
<p>The health benefits of physical activity are well documented and yet much of the population remain sedentary. Therefore, alternatives to existing recommendations are needed. The current case study posited that the profound health benefits of tennis, warrant particular attention in government to help get more of the nation active. As a result, impact has been achieved to this end, including increased awareness and understanding of the health benefits of tennis; improved facilities and access for the sport; change of governing body health promotion activities; and greater emphasis of the economic benefits of sports research in government.</p>		
2. Underpinning research.		
<p>The health benefits of tennis research group at Liverpool Hope University has been led by Prof Khaiyat since 2015, in collaboration with Dr Amirabdollahian, Dr Roche and Dr Koehn. Through strategic links with local governance and physical activity initiatives, and the collective aim to make Liverpool the UK's most active city, a research project was designed to investigate tennis' potential as a superior form of physical activity. Funding was first sought and subsequently allocated, through the university's higher education innovation fund, for a postdoctoral fellow (Dr Jackson) to conduct the research. Following this appointment, data collection began in June 2016 and ended in April 2017.</p>		

Dissemination and impact generating activities then commenced and continued from June 2017 until December 2020.

The sport of tennis was chosen as the focus of this study due to its potential for global prescription independent of age and ability, coupled with its hypothesised numerous physical, mental and social benefits. Simultaneously, more realistic and ecologically valid solutions were needed to promote physical activity in our growing sedentary population, where many still fail to meet the government recommended amounts (150 minutes of moderate intensity or 75 minutes of vigorous intensity aerobic physical activity weekly, plus additional muscle strengthening activities on at least 2 days a week). Consequently, the present research sought to investigate whether regular tennis participation was more effective at enhancing cardiometabolic and musculoskeletal health than meeting the current government guidelines for physical activity.

A cross-sectional approach was chosen, due to the nature of the research question. 90 participants of mixed gender, aged 18 to 65 years completed the study; 43 recreational tennis players (18 m, 25 f), and 47 age-matched, healthy active non-players (26 m, 21 f). Health variables were collected in two main categories, cardio-metabolic and musculoskeletal data, and compared between tennis and non-tennis players by way of cluster analysis. Following previously published guidelines, selected variables from within their respective health dimensions were converted to standardised scores and grouped in clusters, providing a single score, representative of an individual's cardiometabolic risk or musculoskeletal function. Analysis of covariance, using age as a co-variate, was then employed to compare groups for each cluster.

Comparison of cardio-metabolic factors, including blood pressure, lipid profile, glycaemic control and body composition, revealed significant reductions in tennis players' vulnerability to cardiovascular and metabolic disease (Sec. 3, Ref. 2). Furthermore, clustering of musculoskeletal factors also revealed significant enhancements in tennis players when compared to their non-playing counterparts (Sec. 3, Ref. 1). Factors for clustering of musculoskeletal health included body composition, physical performance and strength data (both upper and lower body were used interchangeably). Importantly, both of these findings are independent of age, as this was used as a covariate in the analysis, suggesting tennis' health benefits can be reaped across the lifespan.

In summary, our findings support the conclusion that individuals who play regular tennis have markedly lower risk of developing cardiometabolic or musculoskeletal disease, suggesting that this sporting activity should be more commonly adopted nationwide.

3. References to the research

1. Jackson, M.J., Roche, D.M., Amirabdollahian, F., Koehn, S. & Khaiyat, O.A. (2020) Musculoskeletal health benefits of tennis. *Sports Health: A Multidisciplinary Approach*, 12: 80-87. doi: 10.1177/1941738119880862.
2. Roche, D.M., Jackson, M.J., Amirabdollahian, F., & Khaiyat, O.A. (2020) Clustered cardiometabolic risk and arterial stiffness in recreational adult tennis players. *The Journal of Sport Medicine and Physical Fitness*. [Online] Available at: <https://www.minervamedica.it/en/journals/sports-med-physical->

4. Details of the impact

Firstly, in order to increase the awareness and understanding of health benefits of tennis, a launch event was organised in combination with the Liverpool International Tennis Tournament, which is the largest tennis exhibition in Europe with 10,000 spectators and general media reach of approximately 25 million worldwide (Sec. 5, Source A). Former and current professional tennis players from the tournament visited the School of Health Sciences to discuss the aims of the research and demonstrate our testing procedures. The event was covered by various media, including BBC Radio Merseyside (Sec. 5, Source B) and the Liverpool Echo (Sec. 5, Source C), alongside the tournament's own media, combining to help generate an early interest in the research and increase awareness of the potential health promoting properties of tennis.

In support of this, once all data collection and analyses were complete, a press release summarising the study findings in non-scientific language was created to increase the scope of the research beyond the usual academic channels. As a result, the research was featured live on the BBC during their national breakfast television programme, to an audience in excess of six million viewers (Sec. 5, Source D). In turn, the footage and study findings were further broadcast on various other BBC services including, North West Tonight, Radio Merseyside, Coventry & Warwickshire and Humberside. This media attention was a key marker and example of the research's early impact on the understanding of the health benefits of tennis in the general population. Ultimately, this led to increased likelihood of new participants to physical activity choosing tennis to get active because of its superior health boosting properties.

In addition, expanded access and improved facilities for tennis has been another route to impact from the research conducted at the university. In collaboration, with the Liverpool and district tennis steering group (LDTSG), the research has been cited as compelling evidence to prioritise, and secure valuable funding needed to develop new and existing facilities and opportunities for tennis in the city (Sec. 5, Source E). More specifically, the research findings were included in the LDTSG's vision statement in 2019, which is now being used by members, such as Liverpool city council and the Lawn Tennis Association (LTA), to increase the numbers of courts and access in the area, in turn driving greater participation levels. As a precursor to this documentation and to establish a stronger relationship between the research and its beneficiaries, a symposium was held at the university in 2018. In attendance were representatives of the local council, LTA, clinical commissioning group and public health bodies (Sec. 5, Source F). Consequently, this vision is now being realised and more of the general public have access to tennis courts in Liverpool (Sec. 5, Source G).

On a larger scale, to complement the work in Liverpool, the research submitted here is now being utilised by the LTA as part of a drive to increase the numbers of recreational tennis players across the country. The research has been disseminated through their national network and consequently is now directly impacting a number of local authorities to improve their current tennis facilities (Sec. 5, Source H). In the Northern

Region, a new tennis centre is being built at Doncaster and an existing centre in Ulverston is being expanded, following direct evidence cited in section 2. Furthermore, the data provided by our group is now attached to existing strategies provided by the LTA in various locations promoting the sport for its enhanced overall health benefits, such as increased gated access to free courts and other tennis for free initiatives (Sec. 5, Source H).

Lastly, the research in this case study was highlighted in a UK government report, conducted by Guild HE and the Physiological Society in 2019, analysing the impact of sport and exercise science to the UK economy (Sec. 5, Source I). A parliamentary reception hosted by the Shadow Minister for Education, Gordon Marsden MP, was also held to launch the report, and the work submitted here was further communicated by Prof Khaiyat. Amongst many findings, the report details a particular importance of sport science research in solving many health issues of generations to come.

To conclude, the details provided here demonstrate impact both regionally and nationally, from improved facilities and access, to increased awareness and understanding. More pertinently, the health benefits of tennis are now receiving more attention in many local authorities and this is being translated into higher numbers taking up the sport and improving their health outcomes.

5. Sources to corroborate the impact

- A. Liverpool International Tennis Tournament readership:
<https://liverpooltennis.co.uk/press-area/>
- B. Liverpool International Tennis Tournament media event - BBC Radio Merseyside exert
- C. Liverpool International Tennis Tournament media event - Liverpool Echo news article: <https://www.liverpoolecho.co.uk/sport/liverpool-hope-university-asks-can-11509781>
- D. BBC Breakfast TV coverage: <https://www.youtube.com/watch?v=75XcbW38vYE>
- E. Liverpool and District Tennis Steering Group vision statement
- F. Programme for Health Benefits Tennis Symposium at Liverpool Hope University
- G. Chair of the Liverpool and District Tennis Steering Group
- H. Head of North Region at the Lawn Tennis Association
- I. Sport and Exercise Science Education: Impact on the UK Economy Report