Maximising and evaluating the uptake, use and impact of golf and health studies

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ABSTRACT

Introduction The dissemination of research, and evaluation of its impact is an increasing priority for the scientific community and funders. We take the topic of golf and health and aim to outline processes that may contribute to improved research uptake, use and impact proposing a research impact (RI) tool. We then evaluate our published research using the Research Contributions Framework (RCF).

Methods Building on existing research and frameworks we i) assessed the need for, ii) carried out and iii) published research, before iv) creating digital resources, v) sharing these resources widely and vi) evaluating our research.

To evaluate uptake, use and impact of our three principal golf and health research outputs, we performed a contributions analysis, using the RCF first proposed by Morton.

Results/Discussion We developed a specific six-step Research Impact tool. Having implemented this, research uptake and use included over 300 press articles, a dedicated website and social media channels. Golf's global industry leadership dispersed information across >150 countries, embedded golf and health into curricula for industry professionals and used leading tournaments to promote health. National policy makers hosted dedicated meetings regarding golf and health and began to implement policy change.

Conclusion To date, strong uptake and use can be demonstrated for these studies, while a final contribution to impact requires further time to determine. Frameworks we used aiming to maximise impact (Research Impact tool) and evaluate its contribution to uptake, use and impact (Research Contribution Framework) could potentially add value to public health/sports medicine researchers.

INTRODUCTION

The effective communication of research, demonstration of impact beyond academia and the building of relationships between researchers and key stakeholders are increasingly recognised as key in building dynamic and responsive research communities.[1–5] Impact was first formally assessed in the higher education sector in the UK in the 2014 Research Evaluation Framework,[1] and in 2021 demonstrating impact will account for a higher percentage of the overall grade for the presenting institution/university. Public health/sports medicine can benefit from increasing efforts to maximise the uptake, use and impact of research, aiming to have research shared widely and facilitate action by participants, policy makers, industry bodies and other research teams. Evaluation can assess what has worked, and what lessons can be learnt.

Research groups and journal publishers have suggested frameworks to maximise research visibility, its uptake and use.[6 7] These highlight opportunities to break down barriers to research use, for example, article access, perceived lack of user time and lack of user engagement.[6] Actions researchers can take to make research accessible to the end user are described[6–10] including the creation of 'bite-sized' communication resources and planned use of social media. Also described is the opportunity to go beyond citation numbers, Altmetric and download numbers to evaluate research. The Research Contribution Framework (RCF)[11] originally published by Morton provides a practical approach used by academics/universities for *evaluating* the uptake, use and impact of research, helping to analyse how research can impact the real world. Morton[11] defined these terms as follows:

- *Research uptake:* research users have engaged with research: they know the research exists.
- *Research use:* research users act on research, discuss it, pass it on to others, adapt it to context, present findings, use it to inform policy, or practice developments.
- *Research impact (RI):* changes in awareness, knowledge and understanding, ideas, attitudes and perceptions and policy and practice as a result of research.

It is seldom possible to attribute broad health messaging and policy change to specific research papers, but the framework provides a tool to evaluate the potential *contribution* of research to uptake, use and impact.

Global Action on Physical Activity's 'best investments' guide[12] recognises the need for sports systems and programmes that promote participation across the life span. Golf is a sport played by over 60 million persons across the life span on six continents worldwide.[13 14] The World Golf Foundation (WGF) recognised the opportunity to explore the relationships between golf and health aiming to increase interest and participation in the sport, and recognising economic, social and other barriers to participation. Our Golf and Health research team aimed to conduct strong scientific research that identified relationships between golf and health and share this information widely.

In this current paper, we take the topic of golf and health and aim to outline processes (Research Impact tool) that may contribute to improved research uptake, use and impact. We then evaluate the uptake, use and impact of our published

research using the Research Contributions FrameworkRCF. We also discuss how these approaches may be relevant to other public health/sports and exercise research.

METHODS

Overview

We aimed to generate research with high uptake, use and impact by building on existing evidence/frameworks[5–7] to refine a six-step process, creating and using a Research Impact (RI) tool.

Following this, we used the RCF to evaluate the impact of our golf and health research.

Maximising uptake, use and impact, and developing the Research Impact tool

We engaged directly with stakeholders including golfers, the golf industry, policy makers and fellow scientists. This building of relationships, involvement of stakeholders and recognition of cultural and contextual considerations underpin efforts to achieve impact[2–4 11] and we consulted these groups at each step of the process outlined below.

Step 1. Assessing the need for research and consider intended use and impact

Working out what research is needed and can practically and feasibly be conducted offering a good return for time, monetary and other resource deployment is a key first step in creating impactful research. We directly discussed research opportunities, and the intended use and impact of research with key groups including researchers, policy makers and the golf industry.

Step 2. Carrying out the research

A research team was selected which included academic researchers and those with a practice and policy background, providing understanding of the context for the research. Researchers with specialist methodological knowledge were consulted as appropriate and bimonthly meetings appraised progress and determined future steps and research priorities.

Step 3. Publishing the research in academic journals and making it accessible

Publishing in peer-reviewed journals is important to gain feedback during review, and for credibility. Our method was to identify factors that facilitate access to end-users. Once we had identified these factors, we aimed to publish in reputable, peer-reviewed, high impact and engaging journals that could support access for end-users and maximise potential uptake.

Step 4. Creating communication resources

Research impact can be positively influenced through multifaceted opportunities to engage with findings.[15 16] We reviewed the literature regarding communication resources, and spoke with authors of key papers, and with journal editors and professional journalists to establish a strategy.

Step 5. Sharing the research and associated resources

Social media platforms including Twitter, Facebook, Instagram, YouTube, websites and others can take content and share beyond traditional research users.[6–8 10] We met with professional golfers, golf industry leaders, policy makers and scientific colleagues in advance of each publication to establish systems and processes to share our research and associated resources widely.

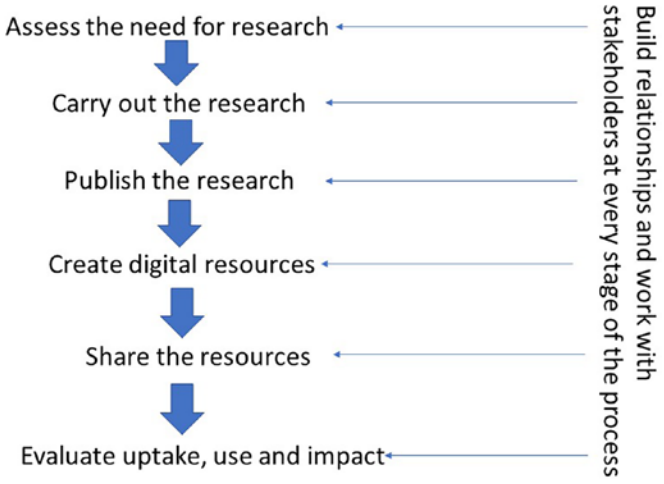

Figure 1 Research impact tool. Processes to support high uptake, use and impact of research.

Step 6. Evaluating the uptake, use and impact of the research and the Research Contribution Framework

At the start of the research programme, we committed to evaluate the contribution to knowledge and impact of our work on golf and health. Members of the research team teach public health evaluation courses, and evaluation was discussed with faculty, with experts from organisations such as Institute for Health Improvement, World Health Organisation (WHO) and with independent consultants. We determined that a 'contributions approach' was appropriate in linking research to activity and outcomes, being practical and balancing feasibility and rigour.[11]

Thus, we used the Research Contribution Framework and existing literature[4 5 11 16 17] to capture uptake, use and impact for each key research study, involving the author of the RCF with our work. Data regarding the uptake, use and impact of each research paper was collected by the first author (AM). Citations, downloads, Altmetric and number of press articles were checked and then updated 30 June 2019. Coauthors were asked to share examples of uptake, use and impact with the first author. Following analysis of the data, we produced models demonstrating the pathway to impact for each research study and a narrative synthesis providing additional detail.

RESULTS AND DISCUSSION

The Research Impact tool detailing processes to support high uptake, use and impact of research is shown in figure 1.

We provide results and discussion from using the tool with our golf and health research below.

Step 1. Assessing the need for research and considering intended use and impact

WHO and public health leaders have called for individual sports to help identify what is known about the associations between their sport and health, and to show leadership in promoting physical activity for health and collaborative action.[12 18] We alerted the WGF to this opportunity. The WGF unites and represents the key players in the global golf industry, and determined action was required, agreeing to i) establish an advisory board on golf and health, ii) fund research to evaluate the health benefits and disbenefits of golf.

Step 2. Carrying out the research

An important stage was to comprehensively review what was known about the relationships between golf and health. The Scoping Review[19] mapped the available evidence finding associated improved physical health and mental well-being, and a potential contribution to increased life expectancy. It highlighted the existing knowledge gaps including golf's contribution to muscular strengthening and balance, and the associations/effects between golf and mental health.

Second, to evaluate a knowledge gap we conducted the first study of golf spectators step counts, and their reason for attendance.[20] Step count was used, as physical activity while spectating is primarily walking. Over 10 million spectators[21] attend professional golf events worldwide each year. In our study, spectators took a mean of 11 589 steps providing an initial step in evaluating whether health enhancing physical activity can be achieved while spectating, and what may facilitate this.[20]

Third, clarity was required on the suggested actions that i) golfers/potential participants, ii) the golf industry/facilities and iii) policy/decision makers external to golf can take to positively influence health through golf and avoid any negative health consequences associated with the sport. We used modified Delphi methodology engaging 25 expert panellists including experts in public health, policy and golf to produce an international consensus on golf and health[22] highlighting concrete actions to promote better health through golf and increase inclusivity and diversity.

Step 3. Publishing the research in academic journals and making it accessible

Publishing research open-access can positively influence the uptake of research. Evidence suggests that downloads, altmetrics and citation rates are higher for open-access publications compared with articles subject to a pay-wall.[15] Our end-users extend beyond academia. Publishing articles on golf and health without open access would decrease the opportunity for members of the public, golfers, the golf industry and policy makers to review the full scientific article and judge the science for themselves.

Higher impact journals produce on average more downloads and citations. Many leading journals encourage the creation of digital/communication resources to support publication, while some have websites, platforms and social medias that can support dissemination.

The scoping review,[19] spectator health study,[20] international consensus on golf and health[22] and associated studies[23–29] were all published open access following peer-review, with six publications in the *British Journal of Sports Medicine*, which has the strongest 2019 impact factor (11.6) in the field, whose website achieves >8 million hits per year, and has >200 000 followers of their social medias.

Step 4. Creating communication resources

Our literature review supported that creating bite-sized communication resources from the content of published studies can deliver more engagement.[6–9 30] The UK Chief Medical Officers have used infographics to distill key messages on physical inactivity.[31] Communication/digital resources are not a substitute for reading the full research article or guideline, but can provide an accessible summary, and encourage the user to access the full article.[30] Communication resources can include infographics/visual abstracts, video, podcast, blogs and press release.[6–10 30 31]

For each principal publication, we engaged with potential end-users before producing as a minimum, infographics, which were published postpeer review,[23–25] podcast and video material.

Step 5. Sharing the research, associated resources and relevant information

We encouraged leading figures in golf to take an interest and leverage their networks. This included golf and health player ambassadors with >25 major championship titles between them, female and male, representing five continents and an age range of 20–82 years. The ambassadors agreed to promote the findings from each of the three research products and other key public health/physical activity messaging via their social media, the conventional media and through their networks.

In addition, we produced summaries for policy makers and industry leaders, and sought meetings with them. We targeted major, relevant scientific conferences to present our work.

Step 6. Evaluating the uptake, use and impact of the research using the Research ContributionFramework

Figures 2–4 show the pathway to uptake, use and impact of:

(i) The golf and health scoping review[19];

(ii) The golf spectator study[20];

(iii) The international consensus on golf and health[22] using the RCF,[11] with further description in the accompanying text.

Golf and health scoping review

The scoping review[19] achieved strong uptake and use with >120 popular press outputs, and direct use by golf industry leaders and parliamentary groups. This research has become embedded in curriculums for teaching professionals. Academically, it has become a primary reference point in the field, having >33 000 full text or PDF accesses, 19 citations and being in the top 1% of all papers by Altmetric. It has helped shape the research agenda, identifying research gaps and in some instances directly helping to secure funding to address these.

Cross-sectional spectator health study

A concrete use of this research[20] has been to develop public health initiatives at events which include the Ryder Cup, the Open Championship, the Women's British Open, the Solheim Cup, the Andalucia Masters and events in China and Indonesia. These have been attended by >1 million spectators, and have engaged leading professionals to advocate for increasing physical activity, and involved collaborations with local authorities and in many cases government departments. To date, >70 popular press articles have appeared, with 7 academic citations. The primary paper has had >2000 full text/PDF downloads, and is in the top 5% of all papers by Altmetric. Our further work[26] showed that 40% of spectators self-reported increasing physical activity postintervention at a Scottish event, although further study to optimise interventions, and assess generalisability is needed.

International Consensus on Golf and Health

The International Consensus on Golf and Health[23] has generated four citations to date and provided concrete guidance for golfers, the golf industry and facilities and for decision makers to improve health through golf. It demonstrated strong uptake and use in the months since publication, with >9000 full text/PDF downloads, an Altmetric in the top 1% of all papers and

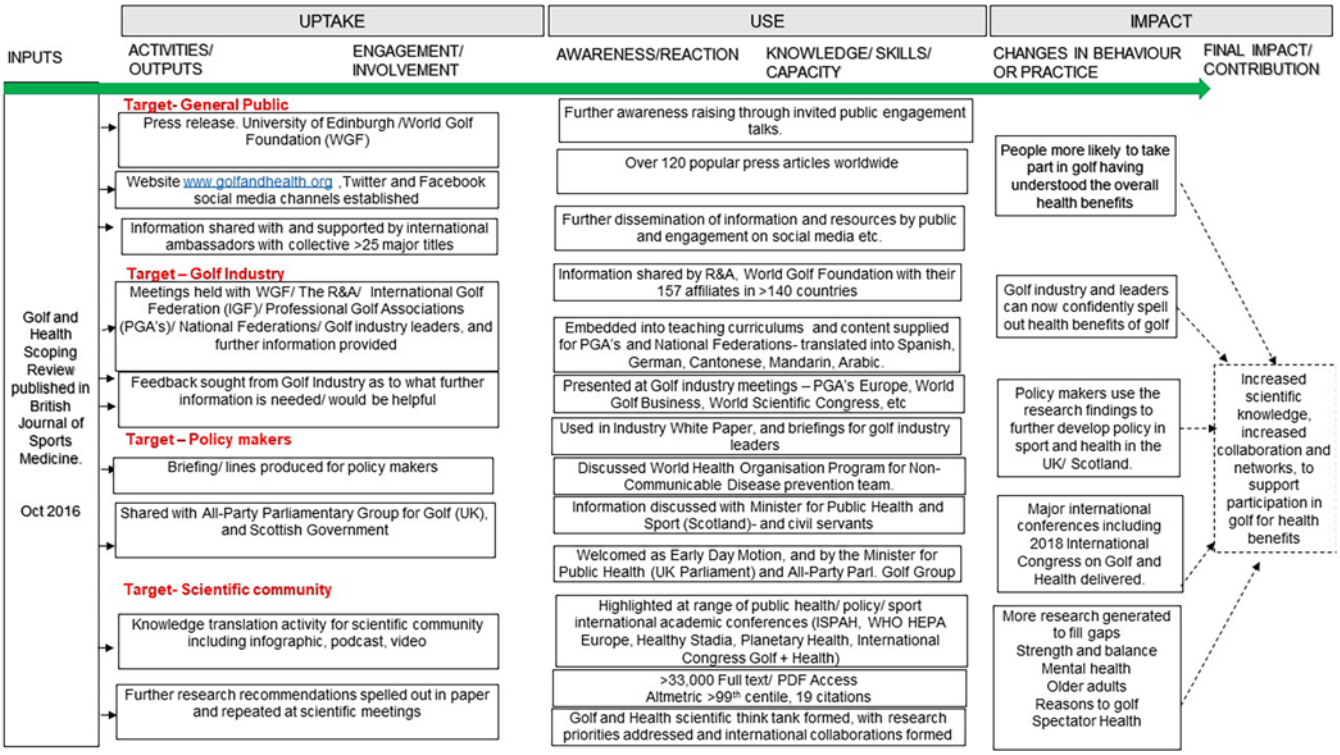

Figure 2 Pathway to impact of 'golf and health—a scoping review'.

>120 media articles. It has been discussed with nine government ministers or heads of state, and senior leaders from all seven organisations represented on the board of the WGF. Its contribution to impact will be better determined in the years to come, although some early examples are evident. Tony Bennett, Head of Inclusion and Disability at the International Golf Federation describes that:

> The International Consensus on Golf and Health, and other research led by the University of Edinburgh and the World

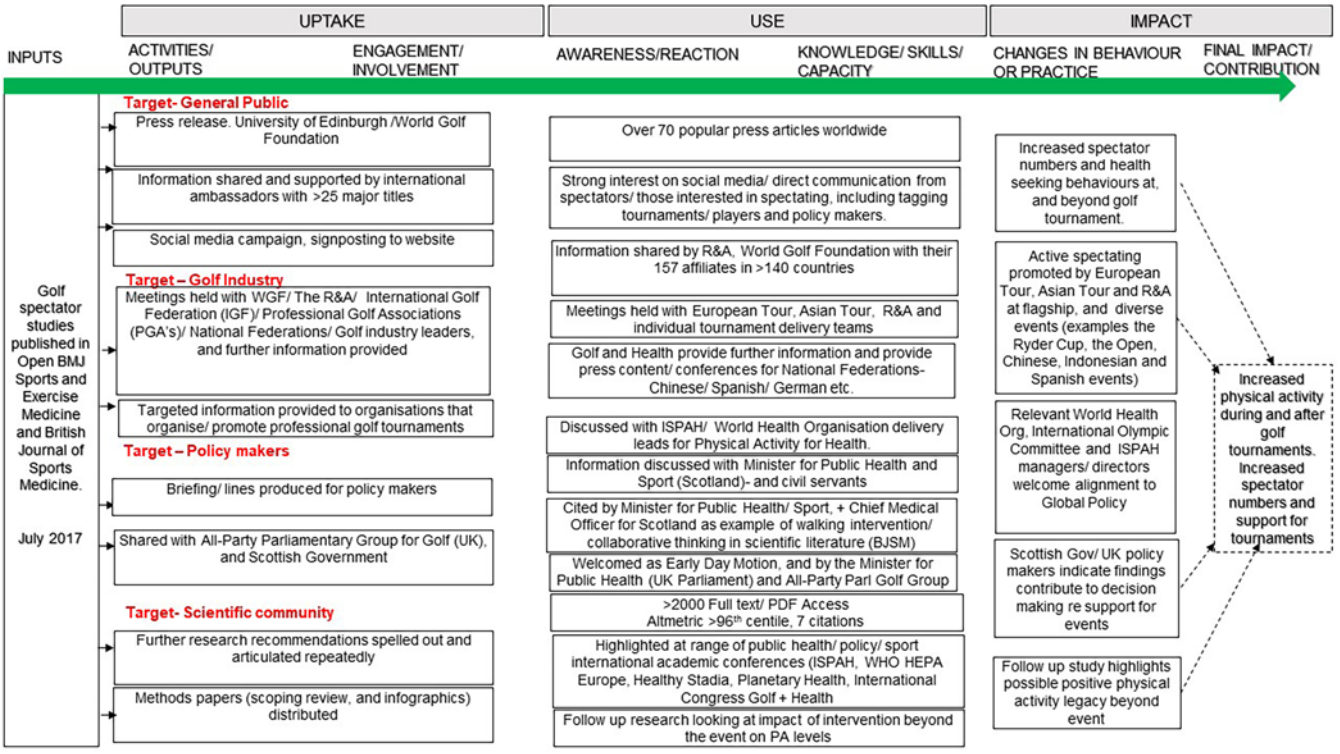

Figure 3 Pathway to impact of 'Golf Spectator Physical Activity' study.

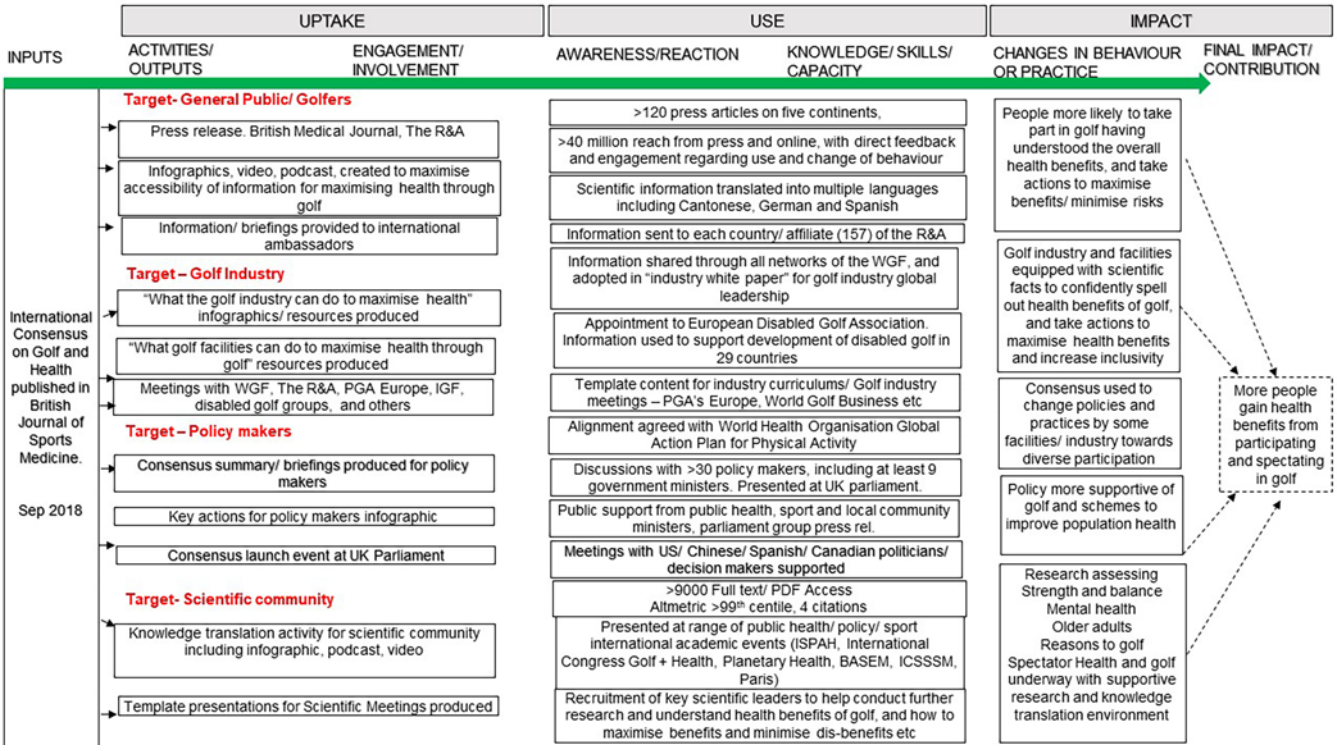

Figure 4 Pathway to impact. 'An International Consensus on Golf and Health'. HEPA, Health Enhancing Physical Activity; ISPAH, International Society for Physical Activity for Health.

Golf Foundation has helped considerably in bringing policy makers, and the golf industry together towards increasing inclusivity around golf. Examples include collaborations relating to development initiatives and tournaments for golfers with a disability through EDGA (formally the European Disabled Golf Association), communications regarding health benefits of golf for all of society, and detailed discussions with government ministers.

Summary by stakeholder group

Uptake, use and impact for general public/golfers

Activities including building relationships with key stakeholders, developing press releases and websites, social media engagement and the involvement of golf and health ambassadors supported the uptake and use of the research inputs. Overall, over 300 broadcast television, radio, print/online articles have highlighted research findings including major networks like CNN, NBC, BBC, Sky Broadcasting and the front pages of several newspapers. The research has been translated into several languages including Spanish, German, French, Mandarin and Arabic.

Some feedback has been received regarding changes of behaviour, for example, 65.1% of 129 respondents reported considering increasing physical activity, and 40.4% self-reported increased physical activity levels 3 months postreceiving information at the Paul Lawrie Matchplay where they were spectating.[26] Receiving messaging from persons or organisations favoured by the end-user can positively influence behaviour.[32] Engaging athlete ambassadors representing five continents, and a wide range of ages may facilitate changes of behaviour. Examples of public facing information are shown at www.golfandhealth.org.

An intended impact of a contribution to increased overall global participation and interest in the game cannot be shown at this stage, but many promising regional examples such as China highlights golf and health messaging in increasing participation evidenced in the quote below from the 2018 International Congress on Golf and Health:

> Golf and health is the most important area for China Golf currently. We are seeing growth and aim for more than 500% increase in junior participation between 2018–2022.
>
> Mr Wei, Director of Golf Development. China Golf Association.

Uptake, use and impact for the golf industry and facilities

Key messages and actions from our research were included in the 2016, 2017 and 2018 Industry White Papers, which shares key information and actions for Golf's global leadership. WGF Chief Executive Steve Mona reports 'the golf industry is now equipped with stronger science on golf and health and can take concrete actions to improve health for people'.

Examples of use include the R&A sending information to each of 150 affiliated National Federations and suggesting adoption of health promoting actions. The Professional Golf Associations of Europe/Confederation of Professional Golf have facilitated the adoption of golf and health into the curriculums for all prospective coaches in their area of influence.

Changes in behaviour/practice include the promotion of physical activity for health, and active spectating at some of the biggest golf events worldwide, as previously described. Industry leaders have highlighted they view this positive health messaging as an opportunity for i) further revenue, ii) strengthening commercial and governmental partnerships as well as iii) potentially improving health. Feedback confirms adoption of messaging and recommendations by some facilities, with the Golf Club Managers Association of the UK, being signatory to the action plans suggested for facilities in the consensus document. The Home of Golf (St Andrew's Links Trust) are taking

action to diversify facilities and encourage industry partners to support the golf and health initiative.

The golf and health research has likely contributed to the further prioritisation of increasing inclusivity and diversity within the sport. Examples of leadership include the R&A's Women and Girl's Charter, a worldwide initiative. A member of the research team (RH) has been appointed to the EDGA to further support development of inclusive policies and actions. At the Australian Open and Scottish Open, players with a disability were integrated into the professional event showcasing leading players and working with local government to promote inclusivity in golf and sport more widely.

Uptake, use and impact for policy makers

Activities to support uptake and use by policy makers included providing summary briefings, and infographics spelling out the relationships of golf with health, and actions to support improved health through golf, physical activity more generally and opportunities to align work to local, national and international policy.

This supported awareness and capacity for use. Speaking at the launch of our international consensus on golf and health, WHO Director of Non-Communicable disease Professor Fiona Bull describes golfs efforts to contribution to health improvements:

> Golf is a popular sport for men and women and it is great to see golf's global leadership recognising health priorities and identifying ways golf can be more accessible to more people.

Better awareness of golf's health benefits, and opportunities to support golf and physical activity through policy has been observed. Direct communications indicate this has informed and help shape policy regarding major events, health and social prescribing, and walking/physical activity policy. In the editorial 'Physical activity investments that work—A National Walking Strategy for Scotland' co-written between our research group, the Minister for Public Health and Sport and the Chief Medical Officer for Scotland, actions taken are outlined as follows: "we work with the World Golf Foundation, the R&A and the European Tour to encourage spectators to walk the course. Our golfers are encouraged to walk the course rather than riding carts".[33] Multiple motions in the UK Parliament have welcomed the research and opportunities related to golf and health, while the All-Party Parliamentary Group on Golf are signatory to the International Consensus on Golf and Health and the suggested actions for policy makers.[34] Figure 5 highlights the interlinking activities of our research, policy makers and the golf industry.

Uptake, use and impact for the scientific community

The golf and health research team included professors in global public health and physical activity for health.

Studies were presented at many local, national and international meetings including the World Scientific Congress on Golf, the World Golf Business Forum, the International Congress on Golf and Health, Planetary Health, the International Sports Science and Sports Medicine Conference and WHO-sponsored events including International Society for Physical Activity for Health and Health Enhancing Physical Activity Europe meetings.

Recommendations for further research were articulated in the 2016 Scoping Review,[19] and repeatedly spelled out during scientific meetings and forums. An update of the status of these research priorities is shown in online supplementary appendix 1. In summary, these have substantially moved forward, with funding decisions and prioritisation for golf and strength and balance and spectator health directly influenced by the scoping review and other research agendas being taken forward collaboratively.[35–42]

Interdisciplinary and international collaborations have been facilitated by events including the International Congress on Golf

Figure 5 Examples of uptake and use. (A) UK Parliament motion on golf and health. (B) Ambassador Gary Player (South Africa) welcomes the launch of International Consensus on Golf and Health[19] at parliament. (C) Andrew Murray (University of Edinburgh), Fiona Bull (WHO), Steve Brine (UK Government), Annika Sorenstam (player ambassador), Martin Slumbers (the R&A), Craig Tracey (Parliament Golf (APPG)) pictured in tweet by Steve Brine (Minister for Public Health). (D) Example of spectator health initiative supported by players, golf industry and Scottish Government.

Figure 6 Infographic. Processes to support high uptake, use and impact of research.

and Health. For example, groups in Australia, Japan and the UK are evaluating interventions relating to golf and dementia, while the associations between golf, strength and balance are being investigated collaboratively by the University of Southern California and University of Southampton.

Strengths and limitations

It was agreed that findings would be published for each of the studies regardless of the results. Clearly, involving and accepting funding from the golf industry presents a conflict of interest/potential limitation when stakeholders have interests (eg, financial/commercial) in supporting some, but not all of the research findings. Nevertheless, industry has largely supported efforts to counter inclusivity and diversity issues identified in the consensus, and tackle health disbenefits identified (eg, with skin cancer awareness, and efforts to set up prospective epidemiological injury studies). It is likely that conflict of interest through industry involvement will be a consideration in other sports/public health studies, which can be a limitation (risk of bias) but can be very valuable for practical implementation.

The Research Impact tool offers value in offering transferable and practical steps that may contribute to increased uptake, use and impact. While it builds on the available evidence we expect with time and as evidence emerges it can be further improved. We emphasise the importance of engaging key stakeholders and noting the considerations for particular aspects of public health/sport. Additionally, technology evolves quickly, so while infographic, animation, podcast and blog are useful communication resources currently, and Twitter, Instagram, Facebook, etc are prominent platforms to share this content, type of communication tool and platform will change and we encourage researchers to use what is most relevant to their end-user group.

The choice of a Research Contribution Framework reflects an implicit acknowledgement that causal attribution in a complex world is a limited notion, and that appraising a plausible contribution to impact is the goal. Many research articles and other factors can contribute to an eventual outcome. We acknowledge it is infrequently possible to directly attribute wide public health messaging or policy change to specific research output, and we highlight likely contributions to change rather than causative effects.

Research impact, defined by Morton as 'changes in awareness, knowledge and understanding, ideas, attitudes and perceptions, and policy and practice as a result of research'[11] can take many years before being fully evident. Our evaluation was limited in that the research was published between 6 and 27 months before the evaluation, before eventual impact can be determined. Despite this funders and other stakeholders welcomed the process of evaluation, using a contribution analysis, and we recommend it is considered for programmes of research in public health, sport and the social sciences.

Key learning and practical application

Building strong relationships and taking into account the opinions/expertise of key stakeholders (in our case with fellow researchers, the golf industry and facilities and public health stakeholders) is vital at every step in maximising uptake, use and potential impact. Our Research Impact RI tool is displayed as an infographic in figure 6, and in video form at this link (https://www.youtube.com/watch?v=aNtIK6lC8Lc). The RI tool may provide guidance to help public health/sports researchers maximise the impact of their work, potentially increasing visibility, engagement and supporting action based on the research produced.

Having a commitment to evaluation helped understand what worked, and what did not. The RCF was practical and can be applied to a range of settings. The RCF lends itself well to public health and sport research providing insights into the potential contribution of research to changes in practice/policy. It can link research to outcomes and impact, appreciating that social science impact evaluation is complex.

What is already known?

- Evaluation of the impact from research is gaining priority with the scientific community and funders but this can be challenging.

What this paper adds and how might it impact future practice.?

- We outline specific processes that may contribute to improved research uptake, use and impact (research impact tool), which may be transferable to other public health/sports medicine research.
- The Research Contribution Framework can support evaluation of the uptake, use and impact of research and may add value to public health/sports medicine researchers.
- We demonstrate uptake and use among key stakeholders regarding golf and health, including participants, industry leaders, politicians/decision makers and the scientific community.
- Our golf and health research contributed to >300 popular press articles, increased awareness/action regarding inclusivity from golf industry, action from government ministers and the commissioning of further research to target identified knowledge gaps.

CONCLUSION

We outline a Research Impact tool, highlighting specific, transferable processes that may contribute to the uptake, use and potentially impact of research. This is intended as a guide, rather than a set of infallible rules. We found it helpful in maximising the uptake, use and impact of our golf and health research, which highlighted that golf can provide health enhancing physical activity, and a range of actions that can be taken to promote better health through golf.

We then evaluated our work by contributions analysis, using the Research Contribution Framework first described by Morton. The golf and health research described has had strong uptake and use with the general public, golfers, golf industry and facilities and policy makers recognising we describe contributions as opposed to direct causal effects. Further time and evaluation is needed to determine its contribution to an intended impact of a better understanding of golf and health and increased interest and participation in physical activity and in particular golf.

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Contributors AM conceived the idea and developed the methodology with PK and those acknowledged. AM designed graphical content with DG and JD. SM provided guidance on the Research Contribution Framework. All authors worked together to produce a draft and final manuscript.

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