Drs Cy Frank, Linda Woodhouse, Walter Herzog and David Hart give an overview of the pioneering approaches and changes in attitude their seven-year project has instilled in the osteoarthritis community of Alberta, Canada and beyond.

Why is osteoarthritis (OA) currently such an important target for medical research?

Despite decades of intense research, there has been little progress in terms of how OA is managed clinically. As baby boomers hit their ‘osteoarthritic years’, the burden of disease is escalating. In addition, more youths are engaged in active lifestyles and sports that lead to joint injury, which in turn increases the risk of developing post-traumatic OA at a younger age, impacting work, family management and the maintenance of a healthy lifestyle. While joint replacement is considered the procedure of choice for severe OA, recent reports suggest that 20–50 per cent of individuals do not benefit from this surgery and joint replacements at a young age likely mean that revisions are needed 15–20 years later. Outcomes following revisions tend not to be as good as the original joint replacement.

Our efforts in research and clinical care must move upstream in order to develop and implement effective non-surgical strategies to prevent the onset, or halt the progression, of OA.

What are the downsides of the current treatments available for this condition?

The fact is that there is no effective treatment to slow down, stop or reverse early OA. Current treatments are focused mainly on managing symptoms (pain and reduced physical function) until the disease progresses to the point where a total joint replacement is required. With the evidence revealing younger and younger people are developing OA, these replacements are not suitable as an individual should only receive one or possibly two in a lifetime, and young patients often wear out the implants or cause them to loosen.

How is your team working to improve upon these techniques?

Potential therapies currently include stem cells and the use of nanotechnology to induce repair of cartilage and other joint tissues, as well as better ways of controlling joint inflammation and pain. Currently, there are good strategies to manage pain at rest, but those do not work as well when individuals are moving under load.

Aside from these potential therapies, the Alberta OA Team is also investigating the use of conservative and lifestyle interventions to slow the rate of OA. For example, muscle weakness and obesity have been linked to the onset and progression of OA in preclinical models and might provide the opportunity for unexplored exercise and nutrition interventions as a simple and cost-effective treatments.

Can you give an overview of the work you have been undertaking and how it touches upon every aspect of this disease?

The OA Team researchers run the gamut from those focused on prevention to early detection to non-invasive interventions and tissue repair. We are also involved with streamlining the healthcare system so that patients who need interventions see the most suitable healthcare provider at the appropriate time. What is unique is that our OA Team is multidisciplinary and multisectorial – it allows researchers, patients, health system administrators and health policy makers to all meet in
New solutions for old problems

Spearheaded by a group of internationally renowned experts in degenerative joint disease and musculoskeletal care, the Alberta Osteoarthritis Team demonstrates the astonishing impact that can be generated by a long-term, integrated approach to a complex disease.

ONE IN EIGHT Canadians suffers from osteoarthritis (OA), and it is anticipated that this figure could rise to around one in four by 2040. Currently, between 80-90 per cent of hip and knee replacements are a direct result of OA, and by 2016 the need for such operations is expected to reach almost 12,000 a year in Alberta. Alarmingly, in the absence of effective treatment, the recipients of total joint replacement surgery are getting younger at great personal, societal and economic expense.

The Alberta Osteoarthritis Team formed amid this climate of escalating and sometimes unwarranted surgical conclusions to OA. Regarding it as a potentially preventable disease, the OA Team is focused on tracing OA’s causes in the hope of identifying risk factors and options for prevention, and improving the outcomes of joint replacements and the overall quality of life for OA patients.

DIFFERENTIATING DISEASE

Led by Drs Cy Frank, Walter Herzog and Linda Woodhouse, the multidisciplinary OA Team received a seven-year funding grant from the Alberta Innovates Health Solutions Interdisciplinary Team Grants programme in 2008. Initially a group of individuals sharing a common goal, the OA Team now comprises a large body of staff, trainees, patients, engaged stakeholders and policy makers all collaborating to increase the power behind the push and pull of knowledge uptake.

For example, it is important to get the message across that while an effective intervention, joint replacement surgery, should not be considered with the flippancy that is currently widespread in medicine: “We typically manage all types of OA the same way — we tell the patient to ‘take anti-inflammatories and call me in a few years when you need a joint replacement’,” Woodhouse reports. Focusing upstream, the OA Team aims to develop and implement non-surgical strategies in an effort to prevent the onset or halt the progression of knee OA. As well as improving patient outcomes, these measures should reduce healthcare costs and allow for better access to the most appropriate type of care.

Looking at conditions and lifestyle choices that can affect the progression of OA such as obesity, smoking and sports, the Team’s research has resulted in vital outreach programmes to educate the public. Their findings show that through the implementation of neuromuscular training and other similar strategies, incidences of knee injuries can be significantly reduced by as much as 40 per cent. Therefore, the Team is particularly interested in engaging adolescents in schools and community organisations,

Is Alberta a particularly well-suited region for this kind of project?

Yes, we have a province-wide integrated healthcare system that delivers care to more than 4 million people and is large enough to do significant studies without being too large. The province of Alberta, in particular Alberta Health Services, has invested significant resources to create Strategic Clinical Networks that bring clinicians, researchers, patients, administrators and policy makers from across the province together in teams that meet every month to implement evidence into practice.

This initiative is drawing to a close next year; what have been the major advantages of working over such a long timescale?

The seven-year framework has resulted in a change in the culture of OA research. Team members are now committed to the ‘greater good’ even in times of funding instabilities. There were growing pains in the Team and it took a few years to sort them all out. Developing in this manner to be the Team we are now is a process and a learning experience in itself, and making it work without offending people but ending up with a solid group of engaged individuals is no easy feat. This environment has been of particular benefit to our trainees, who have had the opportunity to develop their professional careers in a very collaborative community, a set of skills they will take to their independent research positions and use to achieve more successes.
Although the grant is nearing the end of its seven-year duration, the OA Team has made too much progress to stop now especially those involved in sports, to share the findings and reduce the risks of knee injuries as a means of primary prevention for OA.

When it comes to adults for whom OA is already a reality, there is a strong need for personalised care to slow or put a stop to OA progression. Through early detection and sub-typing of the disease, the Team hopes to change the way in which care is delivered for each patient. For instance, if the pathogenesis of one’s OA is idiopathic, then the type of care received should reflect this and differ from the treatments for biomechanical, post-traumatic or metabolic OA. The Team’s research has led to pioneering advances with well-defined models of mechanical, inflammation and metabolic subtypes of OA, as well as models of reversible muscle weakness. Now the OA Team is able to take these models and begin to identify the interventions that are best suited to each subtype.

KNOWLEDGE FLOWS BOTH WAYS

Besides conducting pioneering research in the field of OA, one of the Team’s major innovations is to use an integrated knowledge translation approach that involves patients and other end users right from the start. Providing training to patients allows them to become ‘patient engagement researchers’ (PERs) who are able to collaborate on qualitative research with the OA Team and help with the identification of knowledge gaps in musculoskeletal (MSK) care. Working to address these gaps, the integrative structure allows a smooth uptake and translation of research findings into the healthcare system, patient populations and to those at risk of becoming OA patients. “We are a unique group with the potential to achieve research results and implementation not possible anywhere else at this time,” states Herzog.

Facilitating the translation of research knowledge into clinical practice is pivotal to the group’s success and, as the glue between three key MSK care players in Alberta, it is perfectly placed to do so. Addressing the basic science research and the evaluation of MSK care delivery are the McCaig Institute of Bone and Joint Health and the Alberta Bone and Joint Health Institute. As Scientific Director of the Bone and Joint Strategic Clinical Network (BJHSCN), Woodhouse is at the helm of an organisation dedicated to the implementation of evidence-based practice for the development of a sustainable healthcare system in Alberta. In order to do this the BJHSCN evaluates new models of care using the Triple Aim Framework, which takes into account accessibility, accountability, acceptability, efficacy, effectiveness and safety.

With the levels of expertise behind it and a strong focus on knowledge transfer, it is hardly surprising that the project’s outcomes have exceeded all of the Team’s expectations. The ability to generate exciting collaborations...
The advances made by the Alberta Osteoarthritis Team have gone far beyond the initial expectations of its members; here is a breakdown of their key achievements.

**IMPACTING HEALTHCARE AND SOCIETY**

- The Team’s research findings have provided key insights into accessibility issues for surgical operations, appropriateness of care and its effectiveness.
- Evidence of OA prevalence and healthcare utilisation in First Nations people has facilitated the development of a model to estimate the impact of obesity at different stages of the care continuum for OA progression within Alberta.
- The socioeconomic impact of the Team’s findings includes an estimated CAD $32 million reduction in out-of-pocket expenses for patients with OA. Alberta does 73 per cent more joint arthroplasties each year using only 5 per cent more bed days, translating into a CAD $33 million productivity gain since 2010.
- With the number of people requiring joint replacement surgery expected to drop, the Team anticipates significant socioeconomic benefits for the individual, healthcare system and society.

**INFORMING DECISION MAKING**

- Engaging with various policy and programme groups to inform decision making, elements from the Team have played key roles in the development and leadership of the Bone and Joint Health Strategic Clinical Network (BJHSCN) in Alberta.
- Team research results were shared at events with clinicians, health professionals and administrators, athletic therapists and physiotherapists, as well as key decision making and advocacy groups.

**SPREADING THE KNOWLEDGE**

- To date, the OA Team has supported over 100 trainees, 74 of whom received direct funding from the project.
- The trainees have collectively published 131 articles in peer-reviewed journals as first authors. 10 of them have gone on to work in academia, six to work in industry research, two to serve as research analysts in government and 10 have become healthcare professionals.
- In total, 663 peer-reviewed journal publications have been produced over the six years of the grant as well as 31 non-peer-reviewed articles, 48 books and book chapters and 14 technical reports.
- The Team leveraged CAD $74 million to support research in OA.

**TRANSFERRING TO TECHNOLOGY**

- The OA Team completed 52 individual technology transfer activities including 10 invention disclosures, nine issued patents, four license agreements, one pre-commercial trial and one commercial product.
- The project produced three spin-off companies: Osteometabolix Pharmaceuticals Inc, Singularis Inc, and 3D Gait Analysis Systems.

**FAR-REACHING IMPACT**

The project’s successes demonstrate the potential of such an integrative approach when it comes to addressing complex diseases, and this makes it a good model for tackling other conditions such as obesity, diabetes and cardiovascular disease. Just as this approach could have more varied applications, it could also be useful for establishing better healthcare systems not just outside Alberta but across the globe. Through the Team’s International Advisory Board, it has already fostered strong international ties with Denmark, Japan, Sweden, Finland, Switzerland, Brazil and the US, while trainees and investigators have often been sent abroad for collaborative purposes and formal trainee exchange programmes have been developed. A global reach will mean an ever more integrated approach in order to translate findings into clinical trials and healthcare delivery, and the results would undoubtedly be worth this effort, as doing so could dramatically reduce the incidence of knee injuries and unnecessary joint replacement operations everywhere.

**A GLOBAL NETWORK**

Although the grant is nearing the end of its seven-year duration, the OA Team has made too much progress to stop now. An overarching aim is to provide evidence on the efficacy and effectiveness of prevention strategies and early intervention treatments, as well as the promising potential of experimental joint replacement techniques such as tissue regeneration. To do this they will need to stick around. After serving up the promised deliverables to the project’s various funding agencies, the Team is planning to carry on in a slightly modified form as an OA Network. In fact, following a two-day team meeting with all parties involved, a pragmatic strategic plan and a feasible framework for the continuation of this work has been put in place.

**INTELLIGENCE**

**ALBERTA OSTEOARTHRITIS TEAM**

**OBJECTIVES**

Located at various institutions provincially, nationally and internationally, researchers representing 18 different disciplines comprise the Alberta Osteoarthritis (OA) Team whose work is dedicated to:

- Improving health services for OA
- Developing novel therapies
- Defining the risks of OA development and progression
- Improving the quality of care for people in mid-to end-stage disease
- Increasing capacity in the field of OA research at both the human resource and fiscal levels.

**KEY COLLABORATORS**

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