



An exercise in post-operative care

Drs Sunita Mathur and **Tania Janaudis-Ferreira** have dedicated their research to improving the lives of transplant recipients. Here, they describe the context of their careers, their collaboration with patients and some of the techniques they use to establish exercise capacity in this vulnerable group

What initially inspired you to investigate exercise in patients that had undergone solid organ transplant?

TJF: When I first started working as a rehabilitation scientist, I was surprised to hear that there was only one inpatient rehabilitation programme for solid organ transplant recipients in Canada. I wondered why there was such a lack of support for this subpopulation. From my clinical experience as a physiotherapist, I knew that exercise was important for transplant recipients in order to maximise their physical function and quality of life. When I became more familiar with the literature, I realised that there was a vast gap when it came to research in this area. Only by addressing this gap and creating a strong evidence base for exercise training in solid organ transplant would we be able to improve the delivery and availability of rehabilitation programmes for transplant recipients.

SM: I was first introduced to the concept of exercise following transplants during a clinical placement as a physical therapy student, where I was asked to develop an exercise booklet for people recovering from

kidney transplantation. I was surprised to learn that physiotherapists were not involved with transplant rehabilitation even though it seemed clear from the patients' deficits that there was a great potential role for exercise. Later, during my PhD, I conducted a research study examining muscle atrophy in lung transplant recipients. They were very interested in learning more about exercise and ways to improve their function post-transplant, but no formal rehabilitation programmes were available for them in our city. I realised that without leadership from healthcare professionals and clinical scientists, rehabilitation programmes would not be made available for these patients. I would like all transplant candidates and recipients to have the opportunity to engage in formal rehabilitation programmes, regardless of the transplant they receive or where they live.

Can you expand on your backgrounds and what led you to collaborate on this project?

TJF: As well as my physiotherapist training, I have a Master's and PhD in the area of pulmonary rehabilitation for individuals with chronic lung diseases. When I started my

research programme concerning rehabilitation in solid organ transplant, Dr Mathur and I were already collaborating on projects related to pulmonary rehabilitation; and since Dr Mathur had conducted some research involving lung transplant recipients, it was natural that we would continue working together.

SM: I have studied muscle atrophy in various clinical populations including chronic lung disease and lung transplant. After coming to the University of Toronto, I found myself in an excellent environment to work with transplant patients, since the largest multi-organ transplant programme in Canada is just across the street, at the University Health Network. When Dr Janaudis-Ferreira began her research with the in-patient rehabilitation programme for solid organ transplant recipients, we discovered a natural collaboration and shared vision towards rehabilitation for transplant.

What methods do you use to assess exercise capacity?

TJF&SM: There are many ways to measure exercise capacity. Among transplant patients we tend to use a walking test called the Six



Minute Walk Test, where we measure how far a person can walk in six minutes. This test can be done in a hallway with minimal equipment. A more sophisticated test of fitness is called a cardiopulmonary exercise test or VO_2 max test. This involves the person walking on a treadmill or pedalling a stationary bike and the intensity of the exercise is gradually increased until the person can no longer keep up. Heart rate, breathing rate and oxygen and carbon dioxide are carefully measured. This test is more technically challenging and also harder for the patient.

We also measure muscle strength using various tools. A common measurement is hand grip strength since it is quite simple to do, but we find that strength of the leg muscles is generally more affected in transplant patients. We can measure leg strength using lab-based equipment, but we can also estimate it from simple functional tests such as the 30-second chair stand test, where we count how many times a person can stand up from a seated position in 30 seconds.

How would you like to see this research affecting treatment options following organ transplant?

TJF&SM: There are still many questions to be answered but the ultimate goal of our research programme is to ensure that physical assessment of patients and the benefits of evidence-based exercise programmes are considered integral components of pre- and post-transplant care. We would like to see more rehabilitation programmes available for solid organ candidates and recipients for all types of organs.

The project's focus is post-transplant patient fitness, specifically the patient's capacity for exercise after receiving a new organ, as physical fitness is a significant factor for transplant recipients who wish to return to their normal lifestyle

Treatment after transplant

The benefits of exercise for transplant patients are only beginning to be appreciated, and now a collaborative Canadian effort has led to the initiation of **CAN-RESTORE**, a network that seeks to further knowledge of the area and provide transplant patients access to a better quality of life

SINCE THE EARLIEST solid organ transplants of the 1950s and 60s, the field of organ transplantation has been in a constant state of refinement – an endeavour that has relied to a great extent upon advances in surgical methods and the development of immunosuppressant medications to reduce the likelihood of organ rejection.

Most importantly, transplant survival rates are higher than ever before. Better awareness of organ donation together with innovations in the preservation of organs before transplant has meant that there is a much greater availability of organs for donation. The clear successes of the field have made post-operative concerns more of an issue, including the assurance of a good quality of life and the ability of patients to return to their normal lifestyles following surgery.

POST-OPERATIVE CONCERNS

Drs Sunita Mathur and Tania Janaudis-Ferreira from the University of Toronto are collaborating to tackle some of these concerns. Working closely with the Toronto Lung Transplant Program at the University Health Network, their focus is pre- and post-transplant patient fitness, specifically the patient's capacity for exercise after receiving a new organ, as physical fitness is a significant factor for those who wish to return to their normal lifestyle, job and societal role. Mathur's work builds on early investigations that show post-surgery transplant recipients have a reduced capacity for physical exercise, even up to two years after the transplant. This long-term impairment has been attributed to a variety of causes, including low physical activity after transplant, changes in muscle tissue and side effects of the immunosuppressant medications that transplant recipients must take to prevent organ rejection.

Mathur and colleagues have published data showing a reduction in muscle strength and endurance in patients who receive lung transplants. Sarcopenia, the loss of muscle mass and function usually associated with ageing, commonly affects transplant patients, who tend to be inactive both prior to surgery and shortly afterwards. This has far-reaching health consequences including loss of independent mobility, and potential effects on the immune and metabolic systems, where muscle tissue also plays a role. This is an aspect of transplantation which had not been thoroughly considered in the literature before.

The Toronto team has also assessed the worth of exercise rehabilitation before and after lung transplantation, finding both to be of fundamental importance to the recovery of transplant recipients. Very few studies have considered the potential benefits of exercise for transplant recipients, and there is a lack of large randomised controlled trials or cohort studies on the subject: "A recent systematic review identified only 15 randomised controlled trials on exercise after transplant ever conducted across all types of solid organ transplant recipients, with the majority conducted in heart transplant," Mathur reveals. Studies in the field are also limited by small sample sizes and would benefit from larger scale, multicentre trials.

EXERCISE IN SOLID ORGAN TRANSPLANT

The programme of research currently being undertaken by Mathur and Janaudis-Ferreira seeks to bridge this knowledge gap and establish evidence-based rehabilitation programmes after transplant surgery for better recovery, the ability to live a physically active life and to help patients return to their normal lifestyles. As well as the lack of evidence-based studies, there is an inconsistency when it comes to availability



Co-investigators of the exercise and solid organ transplant meeting grant. From left to right: Dr John Patcai, Dr Tania Janaudis-Ferreira, Dr Sunita Mathur, Lisa Wickerson and Dr Lianne Singer.

INTELLIGENCE

ESTABLISHING RESEARCH PRIORITIES FOR EXERCISE IN SOLID ORGAN TRANSPLANT

OBJECTIVES

- To identify common areas of research inquiry in exercise and rehabilitation across solid organ transplant
- To develop a research agenda consisting of the top research priorities and high leverage research questions in the field of exercise and rehabilitation for solid organ transplant
- To develop a network of researchers, clinicians and patient partners focused on improving knowledge and practice for exercise and rehabilitation in transplantation

KEY COLLABORATORS

Dr Lianne Singer, MD; Lisa Wickerson, BScPT, MSc, Toronto Lung Transplant Program, University Health Network, Canada • **Dr John Patcai, MD**, Department of Medicine, University of Toronto, Canada

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CONTACTS

Dr Sunita Mathur
Assistant Professor

Dr Tania Janaudis-Ferreira
Assistant Professor

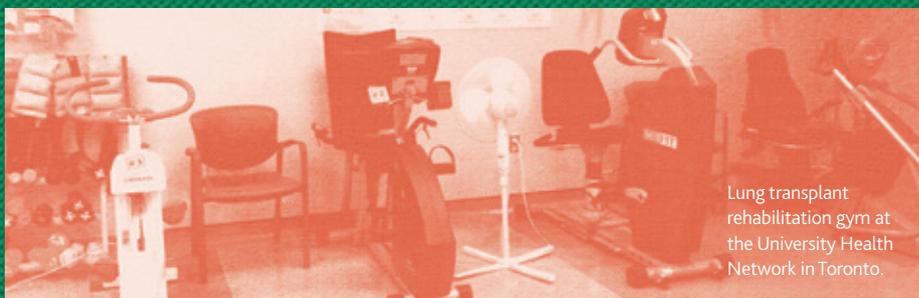
Department of Physical Therapy
University of Toronto
160-500 University Avenue
Toronto, Ontario M5G 1V7
Canada

T + 1 416 978 7761
E sunita.mathur@utoronto.ca

T + 1 416 243 3600 ext 2518
E taniajanaudis.ferreira@westpark.org

SUNITA MATHUR focuses on examining muscle atrophy and muscle weakness in people with chronic disease, including solid organ transplant recipients. She is interested in developing new methods to examine muscle structure and function as well as exercise training programmes to optimise musculoskeletal health, physical activity and mobility.

TANIA JANAUDIS-FERREIRA studies the field of rehabilitation for two patient populations: solid organ transplant recipients and individuals with chronic lung disease. Her work is aimed at improving functional abilities of these individuals to maximise their quality of life and participation in daily activities.



Lung transplant rehabilitation gym at the University Health Network in Toronto.

of transplant rehabilitation programmes. For example, there are virtually no kidney transplant exercise rehabilitation programmes, whereas most of the patients receiving heart and lung transplants receive both pre- and post-transplant rehabilitation. Since physical fitness affects patients of all transplant types, the team hopes that developing a solid evidence base will provide the driving force for the provision of rehabilitation programmes regardless of transplant type.

To this end Mathur and Janaudis-Ferreira organised the Exercise in Solid Organ Transplant (ESOT) meeting: a two-day gathering of researchers and clinicians from various disciplines that took place in Toronto. This enabled the transfer of knowledge between those working with different transplant types, facilitating discussion of research priorities and the development of a national network, The Canadian Network for Rehabilitation and Exercise for Solid Organ Transplant Optimal Recovery (CAN-RESTORE), to facilitate future work. A thorough literature review was conducted to identify knowledge gaps and opportunities for further research prior to the meeting. Attendees reviewed the role of exercise in relation to transplantation and developed a research agenda, prioritised according to the importance of the issues raised. The meeting produced a report on these knowledge gaps and research priorities. Finally, they developed a knowledge dissemination plan: awareness is a key step between bench and bedside, especially when it comes to translating research findings into potential programmes for rehabilitation.

CAN-RESTORE

The unanswered questions from this meeting set the pivots around which future work will be orientated. One primary goal for the contributors is to standardise physical function assessment methods for transplant candidates and recipients. This includes defining the

optimal physical function tests for judging exercise capacity, and for predicting transplant outcomes. Future work will also seek to establish exercise outcomes – such as aerobic fitness and muscle strength – that most relate to quality of life and survival. Mathur, Janaudis-Ferreira and their colleagues intend to spread the word of their findings and encourage the importance of exercise rehabilitation, both for the sake of patients everywhere and also to stimulate further research into the subject.

The ESOT meeting also addressed some important barriers to this field of research, chiefly the rarity of transplantation procedures. In a given city or region, the number of transplants being conducted is too low to perform large studies; this is also a problem for exercise professionals, who often feel isolated since there may only be one or two people in a whole region with specialised knowledge about rehabilitation for transplant patients. To address these issues, the attendees decided to establish a collaborative network that brings together researchers and clinicians from across the country in order to pool their efforts, share knowledge and propel the field forward. CAN-RESTORE is led by a nine-member committee of patient representatives and a multidisciplinary team of clinicians and researchers, and promises to fulfil all of these ambitions. The goal, as Mathur and Janaudis-Ferreira describe it, is to: “Promote healthy active living after transplantation”.

The wider impact of the work is clear – building a knowledge base around the role of exercise in transplantation could provide the driving force for rehabilitation programmes across the globe, building a cost-effective strategy for improving the quality of life for thousands of transplant recipients. The newly founded network could also provide many unanticipated consequences, by facilitating the transfer of knowledge and encouraging interdisciplinary collaboration.

EXERCISE IN SOLID ORGAN TRANSPLANT MEETING 2013

Key points:

- The study of rehabilitation practices and their effect on survival and wellbeing
- Development of novel exercise training regimes and the examination of the effects of daily physical activity on long-term health
- The delivery of such rehabilitation, along with the possibility of integrating technology, such as web-based approaches and telehealth
- The economic benefits of rehabilitation: what are the long-term healthcare savings that such a programme can provide?



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