

Impact Objectives

- Improve the lives of children living with type 1 diabetes
- Reduce the burden of care that type 1 diabetes has on children and their families
- Develop more effective methods of controlling blood glucose levels, day and night
- Prevent long-term complications through maintaining controlled blood glucose levels

A voice for the diabetes community

Drs Timothy Jones and Elizabeth Davis are directors at the Children's Diabetes Centre. Here, Dr Jones discusses what makes the Centre so special and its impact on clinical paediatric diabetes research



What initiatives will you now be able to deliver thanks to the opening of the Children's Diabetes Centre in Western Australia?

The new Centre has enabled us to broaden our approach and widen our perspective in all aspects of diabetes research. It has also enabled more collaborations; locally, nationally and internationally.

It was important to grow the research programme areas that are becoming increasingly significant, such as working with consumers, educationalists, psychosocial teams and health economists.

An important focus of our Centre is the 'translation' of research into clinical care. We are fortunate enough to have researchers who are patient facing, which makes the translation of research into clinical care easier – we see this as a unique aspect of our Centre. Research may discover better ways to treat patients, but this is of no use unless what is found is put into practice in the clinic. The Centre involves a range of people and collaborators that are needed to translate new knowledge into practice.

Another unique feature is the high level of consumer involvement that is seeded into all aspects of our research, from

highlighting problems patients confront at home, to translation of research into clinical outcomes. We encourage our diabetes community to have a 'voice'.

Can you tell us a little about your research into type 1 diabetes?

Our studies have one central focus, to prevent long-term complications through maintaining controlled blood glucose levels. Long-term complications, such as kidney failure, blindness and cardiovascular disease can be debilitating and devastating to patients and their families. We also focus on reducing low blood glucose or hypoglycaemia, and the fear of hypoglycaemia that is so common and distressing for the young person with diabetes and their family. Finally, a core aim is to reduce the burden of care for patients and loved ones, and thus reduce the psychological distress that many experience.

What is the Free-Living Closed-Loop Insulin Delivery System?

Also known as an artificial pancreas, the Free-Living Closed-Loop Insulin Delivery System comprises a sensor that sits under the skin and continuously monitors glucose. It also involves an insulin pump coded with a special algorithm, which calculates the amount of insulin needed to keep blood glucose levels within a normal range. By automatically monitoring these levels and adjusting insulin doses, the system alleviates the need for people with type 1 diabetes to continually prick their fingers

to test glucose levels. It also stops insulin delivery during a hypoglycemic episode, when levels can fall dangerously low. The communication between the system components is wireless.

Will you be using any novel approaches to complete the randomised controlled trials?

The actual system itself is novel and the measures we are using to assess its impact are broad and include a whole toolbox of measures such as quality of life and economic outcomes. We can glean a lot of information that will improve future systems and help put the technology into practice. The trial is also multi-centred and is being run through five different centres across Australia.

We are conducting patient groups and holding interviews to learn more about patient experiences. From this information we can establish how the system can be improved for future use.

How do you see the research outcomes translating into clinical practice?

A major focus of our Centre is the integration of research into clinical care. Our researchers not only work closely with our clinicians to achieve this, but also a wider multidisciplinary team of health economists, dieticians, social workers, educationalists, and our consumers, the people living with diabetes and their families.

A new era in the treatment of type 1 diabetes

The Children's Diabetes Centre based at Perth Children's Hospital and the Telethon Kids Institute in Western Australia is at the forefront of children's type 1 diabetes research. With multiple trials underway, it is paving the way to improve the lives of children with diabetes and the international effort to develop closed-loop technology

Type 1 diabetes can develop at any time, and those diagnosed must live accompanied by a chronic, and at times debilitating illness, for the rest of their lives. A person living with type 1 diabetes suffers repeatedly with high blood glucose (or sugar) levels because their pancreas is unable to produce insulin, the hormone that enables the body to use the glucose ingested via carbohydrates for energy. Without insulin, the blood glucose continues to rise, leading to hyperglycemia. In order to prevent this, a person with type 1 diabetes must administer insulin into their bloodstream by injecting it under their skin. It's a fine balance, however, as if the blood glucose drops too low (hypoglycemia), this can cause unpleasant symptoms such as confusion, difficulty talking, seizures, and even death.

In order to maintain 'healthy' blood glucose levels, individuals with type 1 diabetes must consistently measure their glucose levels throughout the day. They may have daily injections, in addition to needing to inject insulin after eating. A healthy diet and exercise are also recommended, although physical activity brings with it the risk of hypoglycemia. Hypoglycemia can also occur during sleep, if blood glucose levels run low at night. The constant monitoring, along with the symptoms experienced in hypo- and hyperglycemia, can be stressful and unpleasant for the individual affected, and burdensome to them and their families. How easy is this for children or those caring for children? Surely, there must be a simpler and more effective way to manage type 1 diabetes?

TECHNOLOGY PAVES THE WAY

A team of researchers, including Directors of the Children's Diabetes Centre in Western Australia, Drs Timothy Jones and Elizabeth Davis, are part of an international effort to develop and test a number of technologies,

all based on glucose control, that share the same ultimate goal; improving the lives of those with type 1 diabetes.

The Centre is at the forefront of research of this kind and provides a uniquely holistic research programme that incorporates state-of-the-art technologies, therapies and education. 'Through the Centre's broader spectrum of research, it now has the ability to offer a more holistic and multifaceted approach to its programmes,' explains Jones. 'From addressing problems such as mental health issues suffered by young adolescents, to monitoring glucose levels whilst undertaking different forms of exercise.'

The Centre is the only paediatric clinical diabetes CRE (Centre for Research Excellence) in Australia funded jointly by the JDRF and the National Health Medical Research Council (NHMRC). 'Our researchers are always working on new technologies and therapies to reduce the burden on children and families with type 1 diabetes,' says Davis.

The Centre is currently involved in an international, multi-centre closed-loop trial involving four other academic institutions – Westmead Hospital in New South Wales, Women's and Children's Hospital in South Australia, The Royal Melbourne Hospital in Victoria and The John Hunter Hospital in New South Wales – and multidisciplinary teams that lend a diverse skillset to the work. 'It is important to involve a number of centres across different parts of the country to collect data from a broader range of demographics and not just one community living in isolation,' highlights Jones. 'This multi-centred approach will help increase exposure of the trial to more patients across the country, which in turn will translate research into clinical practice.'

NEW INNOVATIONS

The closed loop technology, also known as the Free-Living Closed-Loop Insulin Delivery System, can monitor and adjust blood glucose levels in type 1 diabetics during the day and at night. It essentially functions as an artificial pancreas. The idea is that it will give peace of mind to those with type 1 diabetes and their families, and improve glucose levels.

The system constantly monitors glucose via a sensor that sits under the skin. In order for blood glucose levels to be kept in a normal range, the amount of insulin required is calculated by an insulin pump coded with a special algorithm. 'The system has the potential to give peace of mind, not only to the person with diabetes, but other family members, especially since low episodes often occur at night when the person is asleep,' adds Jones. 'There is a human cost with anxiety, but also an economic cost of parents waking at night worrying about their child.' This all needs to be taken into account when assessing the benefits of such a system. The technology represents a new paradigm in therapy for diabetes.

THE MORE, THE MERRIER

In addition to the closed loop trial, a number of other trials are running in tandem at the Centre. 'Other studies we are currently running revolve around exercise and food intake – two critical areas in the management of diabetes,' Davis explains. 'We predict that outcomes will help patients on a day-to-day basis reduce the impact of blood glucose variability.'

Based on previous studies, which have shown sprints raise blood glucose levels, one of the Centre's trials focuses on the success of integrating short sprints into physical activities as a therapeutic measure to avoid hypoglycemia.



‘The system gives peace of mind not only to the young person with diabetes, but other family members, especially since low episodes often occur at night when the person is asleep’

In another trial, the team is exploring the effects of different food contents and how this impacts blood glucose levels. ‘The effects of exercise and food dovetailed nicely into the closed-loop studies,’ says Davis. ‘If we understand what’s needed with insulin adjustments, and the way we give insulin around each of the things that challenge you every day, that is really important information to feed into the development of technology.’

The team is also looking into a smartphone app to support school children with type 1 diabetes. The app will send a child’s readings to their parent’s smartphone. Researchers are also testing an app that tracks the correlation between emotional state and blood glucose level. ‘We want to see how emotional stress impacts on blood glucose levels,’ Davis adds. ‘We are told that it does by our patients, but there is little data available.’

NURTURING TALENT

The Centre places great importance on

training the next generation of researchers in the field and as such, it is recognised as a leader in this area: ‘Our Centre is internationally renowned for the high value we place on the training and development of young scientists through our research,’ says Jones. ‘Over the past 10 years, we have trained multiple clinical research fellows, postdoctoral research scientists and postgraduate students.’

DISSEMINATING PROGRESS

The Centre is set apart owing to its holistic and multifaceted approach to diabetes research and patient care. The Centre boasts a number of researchers working within the hospital and clinic, allowing the Centre to easily translate their research findings into clinical care, and see the real world benefits of their work. It is making great headway in ameliorating the burden of care for young people with diabetes and their families, and a large research seminar is being held by the Centre in early 2017, where the team will present its latest projects and their outcomes.

Project Insights

FUNDING

National Health and Medical Research Council (NHMRC) • Juvenile Diabetes Research Foundation International (JDRFI) • Australian JDRF Clinical Research Network • Australian Research Council (ARC) • Princess Margaret Hospital Foundation • Australasian Paediatric Endocrine Group (APEG) • Diabetes Australia Research Trust • Telethon Kids Institute • University of Western Australia (UWA) • Diabetes Research Foundation Western Australia

TRIAL PARTICIPANTS

Children’s Diabetes Centre, Western Australia • Royal Children’s Hospital, Victoria • Women’s and Children’s Hospital, South Australia • John Hunter Children’s Hospital, New South Wales • Westmead Children’s Hospital, New South Wales • Sir Charles Gairdner, Western Australia • Fiona Stanley Hospital, Western Australia • Royal Perth Hospital, Western Australia

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CENTRE DIRECTORS’ BIOS

Clinical Professor Timothy Jones is head of department of Diabetes and Endocrinology, Perth Children’s Hospital, co-director of research at the Children’s Diabetes Centre at Telethon Kids Institute, and Clinical Professor at Telethon Kids Institute.

Clinical Professor Elizabeth Davis is the clinical lead of the diabetes service at Perth Children’s Hospital, and co-director of research at the Children’s Diabetes Centre. Professor Davis is a member of the institute’s leadership team at Telethon Kids Institute and head of the Chronic and Severe Disease Research Focus Area. She is president of the Australasian Paediatric Endocrine Group (APEG) and a clinical professor at the University of Western Australia.

