

Global Innovation Network Program to combat spinal pain in youth

Relevance and Feasibility

This global network aims to unite researchers, clinicians, and digital technologists to advance knowledge on spinal pain in adolescents. The goal is to identify targets for prevention and develop new models of care for adolescent spinal pain, using digital technology.

Spinal pain becomes societies' leading cause of years lived with disability at the end of adolescence, and adolescent spinal pain is likely to continue into adulthood. Thus, adolescence is an opportune time to intervene in the prevention and treatment of spinal pain across the lifespan. Despite the importance of pediatric musculoskeletal health, given a long-term impact on health trajectories, there is currently a paucity of research in this area. To move the field forward, it is of paramount importance that the effort is coordinated, and resources are spent wisely to avoid research waste. University of Southern Denmark, Aalborg University, University of Sydney, and Macquarie University are world leading research centers for spinal pain in children and adolescents. We have a strong basis of epidemiological research that has helped to uncover this problem and have identified some potential treatment targets. Between us, we cover infancy, childhood and adolescence from general populations, primary care, and secondary care. Furthermore, we have conducted studies in both clinical- and community settings such as kindergartens and schools. We have a track record of collaboration, but expansion of the network to also include digital health technologists (Trade Expansion), as well as further interactions physically and online will increase the productivity. In the network, we will combine and expand the existing knowledge base with regard to risk populations and intervention targets and move forward by translating these into digital solutions for treatment and prevention that can be delivered on relevant platforms for young people.

By anchoring this network at the University of Southern Denmark, we will strengthen Denmark's leadership position in the field and create opportunities for Danish Health Technology developers.

Planned activities and how they are contributing to the network building/network strengthening, how they lay the foundation for continued cooperation and are relevant for others outside the network in Denmark and internationally (public and private sector).

The Danish-Australian Adolescent Spinal Pain Network will commence cooperation with a seminar for partners at the University of Southern Denmark (Lead partner). At this event, partners will share knowledge on contemporary research and health practices for spinal pain in adolescence. Partners from research, clinical, and digital technology sectors will present on key topics including consequential health impacts of adolescent spinal pain, research/expert evidence on targeting risk and prognostic factors, and digital health adaptation of intervention components for adolescents. Input and participation will be sought from

external Danish and European stakeholders, including patients. The seminar program will include time for partners to develop a strategic adolescent research agenda, including specific project outlines, with digital health applications, and social networking.

Following the network's commencement seminar, a series of reciprocal visits will occur at approximately six-month intervals to foster connections and ensure project progress and that agenda milestones are met. The first delegation visit will require a senior delegation of Danish partners to visit partners at Australian Universities. The reciprocal visit will require a post-doctoral level delegation of Australian partners visiting partners in Denmark. Delegation visits will include progress presentations, work meetings, wider networking, and social opportunities. These meetings will lead to formation of research and innovation projects that will aim to develop health applications that target adolescents' pain, health, and lifestyle factors.

The final aspect of the activity plan will be a seminar involving all partners to evaluate progress and decide future directions. Furthermore, future connections will be secured by exchange of doctoral students and a joint PhD program with a partner institution in Australia. Macquarie University has a large established scholarship program for the dual PhD. The building of close ties between the 4 universities will provide an opportunity to build a world-class cohort-based research training program in a doctoral network. Focusing these development activities on post-doctoral and PhD student members will ensure that deep and lasting connections will be sustained.

Partner commitment

Macquarie University is a comparable high ranking (QS 2024 World Rank = 130) public research university that has multidiscipline spinal pain research groups consisting of academics with backgrounds in medicine, chiropractic, physiotherapy, exercise physiology and psychology. On-campus is The Australian Institute of Health Innovation, high-technology companies, clinic health services and a hospital.

The University of Sydney is a public health university (QS 2024 World Rank =19) with a large comprehensive Faculty of Medicine and Health Sciences. According to Expertscape, it is ranked as the leading spinal pain research institution in the world. Our collaborators at the University of Sydney hold conjoint appointments within New South Wales Local Health Districts, set at the public interface of the Australian Health System. Our present collaboration includes a large trial aimed at schoolchildren with back pain funded by the Australian Medical Research Futures Fund.

At the Center for General Practice at Aalborg University, they have a strong track record of research into adolescent musculoskeletal health, including both epidemiological and clinical research. Furthermore, they

have a well-established network with general practice which can facilitate research by providing access to primary care patients.

The Spine Centre of Southern Denmark, University Hospital of Southern Denmark, located in Middelfart, is the largest specialized hospital facility for patients with back and neck pain in Denmark and has recently extended their service to include children and adolescents. They are actively monitoring this population and among other things has a joint PhD project with Macquarie University investigating pediatric low back pain in secondary care.

Trade Expansion (TRX) is a Danish app development studio that has specialized in Digital Health mobile application development. TRX has since 2013 been working with researchers (both in Denmark and abroad) to bring health research out of the universities and into the hands of patients as digital interventions. TRX is part of several national- and international networks already and has extensive practical experience in the field of Digital Health, AI, mobile application development.

How this project is anchored at the applicant organization and describe the commitment and involvement of the network partners in the planned activities and their ability to engage other stakeholders outside the network in Denmark and internationally (public and private sector).

Participating researchers at The Department of Sports Science and Clinical Biomechanics at the University of Southern Denmark (SDU) include two Professors of which one is the Research Leader. They will dedicate 10% and 5% time to this collaboration over the duration of the grant. In addition, post docs and PhD students involved are fully funded by Danish grants and stipends. Activities will draw on additional academic resources (experts in other musculoskeletal pain conditions, behavior change experts, experts in digital interventions) both within the department and the wider faculty. SDU has excellent meeting and laboratory facilities as well as early career researcher office space that will be made available at no charge to participants in this collaboration. SDU International Staff Office will assist with accommodation advice and booking as well as general advice for researchers who are on extended stay. The participating SME (Trade expansion) will dedicate staff as in-kind contribution for meetings both in Denmark and Australia. Researchers within Australian partner organisations will similarly have dedicated time to undertake research, engage within the network, and collaborate with digital technology partners. University partners will support Danish research students within joint PhD programs via scholarship (tuition and living expenses while at the partner institution). Australian partner institutions will make available to Danish collaborators visiting scholar grants, office space, electronic systems, and administration services to support visa applications and travel insurances.

Potential effects, added value and sustainability.

The network will build on existing fruitful collaboration and expand into new research projects and digital innovation that will advance knowledge on spinal pain in adolescents aiming to design better prevention and treatment. Specifically, this will extend understanding on 1) health (service) resources used by adolescents with spinal pain in Denmark and Australia, 2) prognostic factors for adolescent spinal pain that may be targets for prevention and treatment, and 3) digital interventions for adolescent spinal pain, which may be implemented in public- and clinical health in the future. We will disseminate new knowledge via academic platforms (e.g., journal publication, conference presentation) and via educational modules for clinicians (continuing professional development) and public health services (promotion).

We will work with Danish partners to seek funding to develop beta versions of digital child health interventions for future testing and use in Denmark and Australia.

We expect the planned network activities and outputs will be mutually beneficial for partners in Denmark and Australia. In the short term this will likely result in high quality research productivity for partners, while in the long-term this will result in ongoing shared resources and enriched experiences for international higher degree research training programs as well as development and testing of digital interventions for spinal health in adolescents.

How the planned activities will help realize the global potential for Danish research and innovation, how we will ensure the continuous cooperation with the network after ended grant period and how this project will help your network apply for funding from programmes of a larger scale.

We have included Danish early-mid career people in the network activities; we will send our more junior members to Australia for extended stays so that they can gain deep insights into the Sydney spinal pain network to learn the culture and methodologies. We expect a rich and fully emersed work experience, gaining Australian perspectives. Our researchers will learn how the Sydney community functions to generate productive and impactful research outputs, and will bring these new insights back and incorporate them into Danish institutions.

During the grant period we will aim to develop applications for large scale funding for further development of interventions that are tailored to adolescents combined with research that studies effectiveness and factors around implementation and uptake as well as socioeconomic effects. These projects will be carried forward by the early-mid career researchers involved in the network.

Specifically, we will identify *European Union Horizon* calls that aim to support research in the adolescent area. From 2024, Australia will participate in Horizon through NHMRC-EU Collaborative Research Grant

Scheme, that will include randomized trials and implementation evaluations. In Australia, we will target the National health And Medical research Council that has both individual grants and grants that support clinical trials in collaboration with non-Australian partners.

Furthermore, we aim to communicate the activities and findings from this collaboration to showcase the importance of research and evidence-based approaches to public health challenges and raise awareness about adolescent spinal pain and what can be done to prevent and treat it.