

MEDIA RELEASE

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SINGAPORE-UK TEAM TO DEVELOP A NOVEL DEVICE TO REDUCE CHEMOTHERAPY SIDE-EFFECTS

Highly-efficient and miniaturised cooling-compression technology aims to prevent/reduce pain and sensitivity in hands and feet due to chemotherapy

Singapore — A team of clinicians and scientists from the National University Cancer Institute, Singapore (NCIS) at the National University Hospital (NUH) and the N.1 Institute for Health at the National University of Singapore (NUS) has partnered Paxman Coolers Ltd (UK) (Paxman) to develop a device that may prevent or reduce numbness and pain caused by certain types of anti-cancer therapy¹. Chemotherapy-induced peripheral neuropathy (CIPN) is a severe side-effect of chemotherapy drugs called taxanes, which are used to treat common cancers such as breast, lung, ovarian and stomach cancer. CIPN affects about 1.4 million cancer patients globally every year².

CIPN causes progressive and often irreversible pain or sensitivity in the hands and feet of patients undergoing chemotherapy leading to delays and discontinuation of treatment. It contributes to long-term poor patient well-being and significantly increases economic burden in terms of healthcare costs. The condition also leads to loss in work productivity, as affected patients are unable to return to work quickly.

Unmet clinical need

Few to no prevention and treatment strategies exist for CIPN. Recently, cryotherapy (or cooling) of the limbs during chemotherapy has demonstrated a protective effect by preventing/reducing CIPN severity. However, the currently used frozen gloves or ice packs are not user-friendly, deliver unstable cooling and can cause severe frostbite. There is a need for a medical device developed for patients' use in a chemo suite and which can deliver stable cooling, tolerable over the entire duration of the chemotherapy.

A novel solution for CIPN

In collaboration with Paxman, the Singapore research team from NUHS comprising clinicians and researchers from the Department of Haematology-Oncology at NCIS and NUH, and the N.1 Institute for Health at NUS are developing a portable limb cryocompression device specifically targeting prevention of CIPN in cancer patients. The team has studied various

¹ J Binder, E Unver, J Clayton, P Burke, R Paxman, R Sundar, A Bandla. A Limb Hypothermia Wearable for Chemotherapy-Induced Peripheral Neuropathy: A Mixed-Methods Approach in Medical Product Development. *Frontiers in Digital Health*. Published: 15 Dec 2020.

² Charles L Loprinzi, Christina Lacchetti, Jonathan Bleeker, et al. Prevention and Management of Chemotherapy-Induced Peripheral Neuropathy in Survivors of Adult Cancers: ASCO Guideline Update *Journal of Clinical Oncology*. Published: 1 Oct 2020, E-published: 14 Jul 2020.

proof of concept aspects of the cryocompression technology, over the past eight years³, previously supported by the National Health Innovation Centre Singapore (NHIC) through its Innovation to Develop grant. Working together as a team since 2019, Paxman, global leaders in scalp cooling for prevention of chemo-induced hair loss, was identified as the ideal commercialisation partner for the project.

The research team has been awarded a translational grant from the National Research Foundation (NRF) Central Gap Fund in May 2021, which will be administered by NHIC. Pilot studies will commence in Q2 2022 to investigate the device in healthy volunteers, and cancer patients undergoing CIPN-causing chemotherapy. The efficacy of prevention will be monitored using various clinical and patient-reported outcomes.

Principal Investigator Assistant Professor Raghav Sundar, Consultant at the Department of Haematology-Oncology at the National University Cancer Institute, Singapore (NCIS) and Investigator at The N.1 Institute for Health at NUS, said, "This collaboration will have a significant and broad impact. By preventing or reducing CIPN, the overall health and quality of life of cancer patients will be significantly enhanced, during and after chemotherapy. The treatment of CIPN is an unmet and increasingly urgent clinical need, and a preventative solution will hopefully improve patient quality-of-life."

Co-Principal Investigator Dr Aishwarya Bandla, Head of Translational Tx Core at The NUS N.1 Institute for Health, added, "This international multidisciplinary collaboration brings together complementary cross-sector expertise from the hospital, academia, and industry. The overall product-development process will utilise a patient-centered approach, placing the patients' safety and efficacy at the heart of the design process."

"This funding is a testimony to the high impact the new product will have on the quality of life for cancer patients receiving taxane-based therapies, not only in Singapore, but throughout the world. It will allow our collaborative team, not only to crucially accelerate the research and development process but will also significantly de-risk the project from a commercial perspective," commented Mr Richard Paxman, CEO of Paxman.

"Paxman is determined, not only to provide patient access to scalp cooling technology to prevent chemotherapy-induced hair loss globally, but now also to give patients the chance to reduce or prevent the debilitating side effect of peripheral neuropathy. We bring to this collaboration extensive expertise in design, development, manufacture, regulatory approval, along with experience of commercialising medical cooling devices. The company is perfectly placed to roll out this technology to its existing and growing customer base throughout the world."

³ (i) Bandla A, Tan S, Kumarakulasinghe NB, Huang Y, Ang S, Magarajah G, Hairom Z, Lim JSJ, Wong A, Chan G, Ngoi N, Ang E, Lee YM, Chan A, Lee SC, Thakor N, Wilder-Smith E, Sundar R. Safety and tolerability of cryocompression as a method of enhanced limb hypothermia to reduce taxane-induced peripheral neuropathy. *Support Care Cancer*. Published: August 2020. E-published: 6 December 2019

(ii) Sundar R, Bandla A, Tan SS, Liao LD, Kumarakulasinghe NB, Jeyasekharan AD, Ow SG, Ho J, Tan DS, Lim JS, Vijayan J, Therimadasamy AK, Hairom Z, Ang E, Ang S, Thakor NV, Lee SC, Wilder-Smith EP. Limb Hypothermia for Preventing Paclitaxel-Induced Peripheral Neuropathy in Breast Cancer Patients: A Pilot Study. *Frontiers in Oncology*. Published: 10 January 2017.

(iii) Bandla A, Sundar R, Liao LD, Sze Hui Tan S, Lee SC, Thakor NV, Wilder-Smith EP. Hypothermia for preventing chemotherapy-induced neuropathy - a pilot study on safety and tolerability in healthy controls. *Acta Oncologica*. E-published: 11 September 2015.

Chinese Glossary

National University Cancer Institute, Singapore (NCIS)	新加坡国立大学癌症中心 (国大癌症中心)
National University Hospital (NUH)	新加坡国立大学医院 (国大医院)
National University Health System (NUHS)	国立大学医学组织 (国大医学组织)
National University Singapore	新加坡国立大学
The N.1 Institute for Health, NUS	国大 N. 1 个性化医疗研究所
Dr Raghav Sundar Consultant, Department of Haematology-Oncology, National University Cancer Institute, Singapore (NCIS) Investigator, The N.1 Institute for Health, NUS	Raghav Sundar 医生 顾问, 肿瘤血液科, 新加坡国立大学癌症中心 (国大癌症中心) 国大 N. 1 个性化医疗研究所主要研究员
Dr Aishwarya Bandla Head, Translational Tx Core, The N.1 Institute for Health, NUS	Aishwarya Bandla 博士 国大 N. 1 个性化医疗研究所主要研究员

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About the National University Health System (NUHS)

The National University Health System (NUHS) aims to transform how illness is prevented and managed by discovering causes of disease, development of more effective treatments through collaborative multidisciplinary research and clinical trials, and creation of better technologies and care delivery systems in partnership with others who share the same values and vision.

Institutions in the NUHS Group include the National University Hospital, Ng Teng Fong General Hospital, Jurong Community Hospital and Alexandra Hospital; three National

Specialty Centres - National University Cancer Institute, Singapore (NCIS), National University Heart Centre, Singapore (NUHCS) and National University Centre for Oral Health, Singapore (NUCOHS); the National University Polyclinics (NUP); Jurong Medical Centre; and three NUS health sciences schools – NUS Yong Loo Lin School of Medicine (including the Alice Lee Centre for Nursing Studies), NUS Faculty of Dentistry and NUS Saw Swee Hock School of Public Health.

With member institutions under a common governance structure, NUHS creates synergies for the advancement of health by integrating patient care, health science education and biomedical research.

As a Regional Health System, NUHS works closely with health and social care partners across Singapore to develop and implement programmes that contribute to a healthy and engaged population in the Western part of Singapore.

For more information, please visit <http://www.nuhs.edu.sg>.

About the National University Hospital

The National University Hospital is a tertiary hospital and major referral centre with over 50 medical, surgical and dental specialties, offering a comprehensive suite of specialist care for adults, women and children. It is the only public hospital in Singapore to offer a paediatric kidney and liver transplant programme, in addition to kidney, liver and pancreas transplantation for adults.

The hospital was opened on 24 June 1985 as Singapore's first restructured hospital. Each year, the Hospital attends to more than one million patients.

As an academic health institution, patient safety and good clinical outcomes are the focus of the Hospital. It plays a key role in the training of doctors, nurses, allied health and other healthcare professionals. Translational research is pivotal in the Hospital's three-pronged focus, and paves the way for new cures and treatment.

A member of the National University Health System, it is the principal teaching hospital of the NUS Yong Loo Lin School of Medicine and the NUS Faculty of Dentistry.

About National University Cancer Institute, Singapore

The National University Cancer Institute, Singapore (NCIS) offers a broad spectrum of cancer care and management covering both paediatric and adult cancers, with expertise in prevention, screening, diagnosis, treatment, rehabilitation and palliative care. The Institute's strength lies in the multi-disciplinary approach taken to develop a comprehensive and personalised plan for each cancer patient and his or her family. Our award-winning clinician-scientists and clinician-investigators conduct translational research and clinical trials, providing patients with access to evidence-based cancer diagnostics, technology and therapies. For more information about NCIS, please visit www.ncis.com.sg.

About The N.1 Institute for Health (N.1) at the National University of Singapore (NUS)

The N.1 Institute for Health (N.1) is an internationally recognised clinical stage research institute focused on N-of-1 medicine, where clinical trials are designed specifically for each patient recruited into its ongoing clinical studies. The institute currently has over 10 prospective clinical trials cleared or ongoing.

N.1 is divided into three primary thrusts of N.1-Onco, N.1-Neuro, and N.1-Thrive. All three thrusts specialise in the use of interventional Artificial Intelligence (AI) – to optimise personalised combination therapy for solid and hematologic cancer patients (N.1/Onco), digital therapeutics to optimise personalised learning and prevent cognitive decline (N.1/Neuro), and training regimens to optimise human physical performance as part of the institute's health and human potential portfolio (N.1/Thrive).

The N.1 team is comprised of pre-eminent and multidisciplinary researchers with expertise in engineering, clinical trial innovation, behavioural sciences, strategy, and policy, among other domains.

For more information about N.1, please visit <https://n1labs.org/>.

About Paxman

Paxman develops and offers the market leading Paxman Scalp Cooling System that is used to minimize hair loss in connection with chemotherapy treatment. Presently, the system is available at a large number of cancer centres in Europe, North- and South America, Asia and Australia. With more than 3,500 delivered systems to over 50 international markets, Paxman is the leading player in its field.

Scalp cooling treatment has a strong clinical support and is a fully established therapy in, for example, the UK, Scandinavia, the Netherlands, Belgium, Australia and a number of other countries.

Paxman was founded as a family business by Glenn Paxman following his wife Sue Paxman's hair loss in connection with chemotherapy treatment for cancer. Glenn realized that there were shortcomings in the existing methods for scalp cooling and developed a liquid-based system together with his brother in its first version in 1996. Today, their son Richard Paxman is the CEO of Paxman, and their daughter Claire Paxman is Director of Strategic Initiatives. The Paxman Scalp Cooling System is a self-contained, mobile, and electrically powered cooling unit to which a specially designed cooling cap is connected. Each cooling unit has an integrated touch screen with a menu-controlled, graphic user interface that makes it easy for healthcare staff to initiate, monitor and complete the scalp cooling process. The associated Paxman cold cap is made from lightweight, biocompatible silicone that is soft and flexible, providing an optimal fit for the patient.

The use of scalp cooling is proven to be an effective way of combating CIA and can result in a high level of retention or can completely preserve the hair. For patients, this means the opportunity to regain some control, maintain their privacy, and encourage a positive attitude toward treatment.

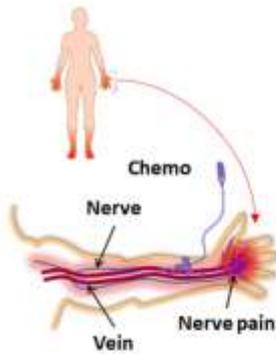
About The National Research Foundation (NRF)

The National Research Foundation (NRF) is a department within the Prime Minister's Office. The NRF sets the national direction for research and development (R&D) by developing policies, plans and strategies for research, innovation and enterprise. It also funds strategic initiatives and builds up R&D capabilities by nurturing research talent. The NRF aims to transform Singapore into a vibrant R&D hub that contributes towards a knowledge-intensive, innovative and entrepreneurial economy; and make Singapore a magnet for excellence in science and innovation.

ANNEX – Infographic & Image

WEARABLE LIMB CRYOCOMPRESSION SYSTEM

A NOVEL SOLUTION FOR CHEMOTHERAPY INDUCED NEUROPATHY



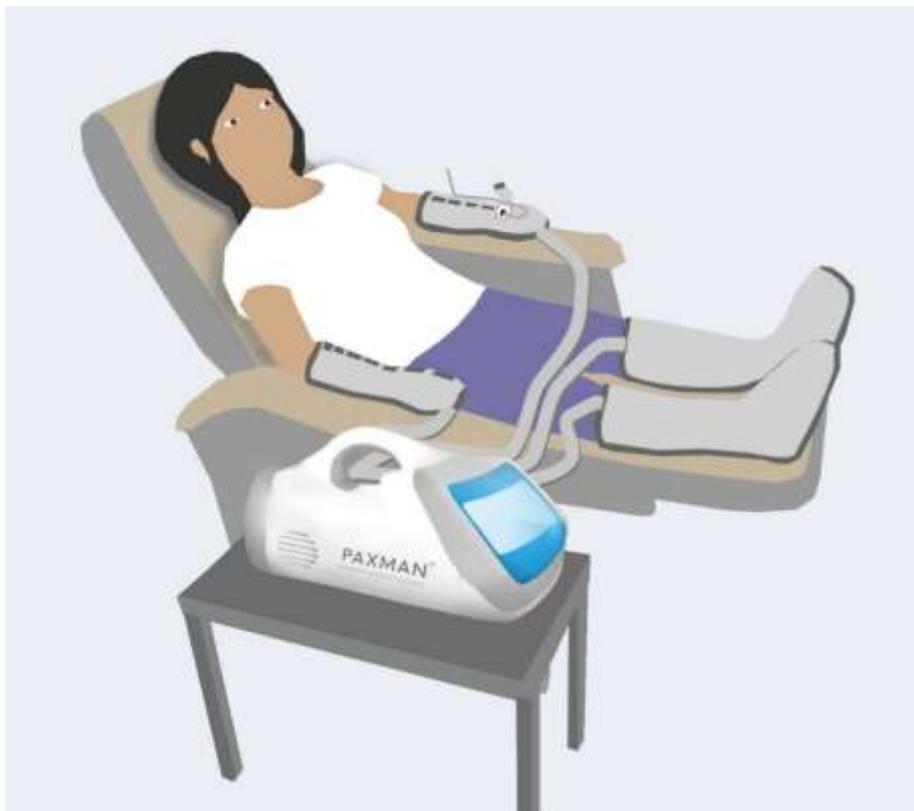
CLINICAL UNMET NEED



PROPOSED TECHNOLOGY



EXISTING APPROACHES



An illustration of the team's portable limb cryocompression device being used in a chemo suite while a patient is undergoing chemotherapy.

Credit infographic and image to: NUHS, NUS, Paxman