MEDIA RELEASE

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SINGAPOREAN BIRTH COHORT STUDY FINDS BENEFITS FOR BABIES EXPOSED TO TWO LANGUAGES

Six-month old infants spoken to in two languages show better learning and memory than infants exposed to one language

Singapore— A team of investigators and clinician-scientists in Singapore and internationally have found that there are advantages associated with exposure to two languages in infancy. As part of a long-term birth cohort study of Singaporean mothers and their offspring called GUSTO – seminally a tripartite project between A*STAR's Singapore Institute for Clinical Sciences (SICS), KK Women's and Children's Hospital (KKH) and the National University Hospital (NUH) – (see Annex A), six-month old bilingual infants recognised familiar images faster than those brought up in monolingual homes. They also paid more attention to novel images compared to monolingual infants. The findings reveal a generalised cognitive advantage that emerges early in bilingual infants, and is not specific to a particular language. The findings were published online on 30 July 2014 in the highly-regarded scientific journal, Child Development.

Infants were shown a coloured image of either a bear or a wolf. For half the group, the bear was made to become the "familiar" image while the wolf was the "novel" one, and vice versa for the rest of the group. The study showed that bilingual babies got bored of familiar images faster than monolingual babies.

Several previous studies in the field have shown that the rate at which an infant becomes bored of a familiar image and subsequent preference for novelty is a common predictor of better pre-school developmental outcomes, such as advanced performance in concept formation, non-verbal cognition, expressive and receptive language, and IQ tests. The past studies showed that babies who looked at the image and then rapidly get bored, demonstrated higher performance in various domains of cognition and language later on as children.

Bilingual babies also stared for longer periods of time at the novel image than their monolingual counterparts, demonstrating "novelty preference". Other studies in the field have shown this is linked with improved performance in later IQ and vocabulary tests during pre-school and school-going years.

Associate Professor Leher Singh, who is from the Department of Psychology at the National University of Singapore's Faculty of Arts and Social Sciences and lead author of this study said, "One of the biggest challenges of infant research is data collection. Visual habituation works wonderfully because it only takes a few minutes and capitalises on what babies do so naturally, which is to rapidly become interested in something new and then rapidly move on to something else. Even though it is quite a simple task, visual habituation is one of the few tasks in infancy that has been shown to predict later cognitive development."

A bilingual infant encounters more novel linguistic information than its monolingual peers. A six-month old infant in a bilingual home is not just learning another language; it is learning two languages while learning to discern between the two languages it is hearing. It is possible that since learning two languages at once requires more information-processing efficiency, the infants have a chance to rise to this challenge by developing skills to cope with it.

Said Assoc Prof Leher Singh, "As adults, learning a second language can be painstaking and laborious. We sometimes project that difficulty onto our young babies, imagining a state of enormous confusion as two languages jostle for space in their little heads. However, a large number of studies have shown us that babies are uniquely well positioned to take on the challenges of bilingual acquisition and in fact, may benefit from this journey."

In comparison to many other countries, a large proportion of Singaporean children are born into bilingual environments. This finding that bilingual input to babies is associated with cognitive enhancement, suggests a potentially strong neurocognitive advantage for Singaporean children outside the domain of language, in processing new information and recognising familiar objects with greater accuracy.

Said Assoc Prof Chong Yap Seng, Lead Principal Investigator for GUSTO, "This is good news for Singaporeans who are making the effort to be bilingual. These findings were possible because of the unique Singaporean setting of the study and the detailed neurodevelopmental testing that the GUSTO researchers perform." Assoc Prof Chong is Senior Consultant, Department of Obstetrics & Gynaecology, National University Hospital (NUH), as well as Acting Executive Director, Singapore Institute for Clinical Sciences (SICS), Agency for Science, Technology and Research (A*STAR).

IMAGES

Figure 1: Image of a child going through the visual habituation test

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Notes to Editor:

The sample for this study comprised 114 Chinese, Malay and Indian infants, of whom 60 were bilingual. There were no differences in the mothers' education and income, or household income, between the monolingual and bilingual groups.

Bilingual infants in this study are defined as infants having at least 25 per cent exposure to a second language.

Monolingual infants in this study are defined as infants having at least 90 per cent exposure to a first language (English).

Enclosed:

Annex A - The GUSTO Study: Growing Up in Singapore Towards healthy Outcomes

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About the Agency for Science, Technology and Research (A*STAR)

The Agency for Science, Technology and Research (A*STAR) is Singapore's lead public sector agency that fosters world-class scientific research and talent to drive economic growth and transform Singapore into a vibrant knowledge-based and innovation driven economy.

In line with its mission-oriented mandate, A*STAR spearheads research and development in fields that are essential to growing Singapore's manufacturing sector and catalysing new growth industries. A*STAR supports these economic clusters by providing intellectual, human and industrial capital to its partners in industry.

A*STAR oversees 18 biomedical sciences and physical sciences and engineering research entities, located in Biopolis and Fusionopolis, as well as their vicinity. These two R&D hubs

house a bustling and diverse community of local and international research scientists and engineers from A*STAR's research entities as well as a growing number of corporate laboratories.

For more information on A*STAR, please visit: www.a-star.edu.sg.

About the Singapore Institute for Clinical Sciences (SICS)

Established in 2007, the Singapore Institute for Clinical Sciences (SICS) is a research institute within the Agency for Science, Technology and Research (A*STAR), and its mission is to develop disease-oriented clinical and translational research programmes in key disease areas.

SICS is distinguished by its focus on clinical sciences and the use of innovative approaches and technologies that enable the efficient and effective study of human health and diseases. The clinical scientists in SICS conduct the full spectrum of "bench to bedside" research activities in metabolic diseases (including diabetes, obesity and insulin resistance), pathways to normal growth and development (including cognitive and behavioural development), nutritional sciences as well as in certain viral infectious diseases such as chronic viral diseases.

The institute aims to attract, train and nurture clinician-scientists and to develop joint programs with universities, academic medical centres, government hospitals and research institutes.

For more information on SICS, please visit: www.sics.a-star.edu.sg.

About the KK Women's and Children's Hospital (KKH)

KK Women's and Children's Hospital (KKH) is a leading healthcare centre for Obstetrics, Gynaecology, Paediatrics and Neonatology. Founded in 1858, the 830-bed JCI accredited hospital is a referral centre providing tertiary services to manage complex conditions in women and children. More than 400 specialists adopt a multi-disciplinary and holistic approach to treatment, and harness the latest innovations and technology for the best medical care possible.

As an academic and research institution, KKH is a major teaching hospital for Duke-NUS Graduate Medical School, Yong Loo Lin School of Medicine and Lee Kong Chian School of Medicine. The hospital also runs the largest residency programmes for Obstetrics and Gynaecology and Paediatrics in Singapore, accredited by the Accreditation Council for Graduate Medical Education International (ACGME-I).

For more information on KKH, please visit: www.kkh.com.sg.

About the National University Hospital (NUH)

The NUH is a tertiary hospital cum academic medical centre and major referral centre for a comprehensive range of medical, surgical and dental specialties including Cardiology, Gastroenterology and Hepatology, Obstetrics and Gynaecology, Oncology, Ophthalmology, Paediatrics, Orthopaedic Surgery and Hand and Reconstructive Microsurgery. The Hospital also provides organ transplant programmes for adults (in kidney, liver and pancreas) and is the only public hospital in Singapore to offer a paediatric kidney and liver transplant

programme. Staffed by a team of healthcare professionals who rank among the best in the field, the NUH offers quality patient care by embracing innovations and advances in medical treatment. In 2004, the NUH became the first Singapore hospital to receive the Joint Commission International (JCI) accreditation, an international stamp for excellent clinical practices in patient care and safety. Today, patient safety and good clinical outcomes remain the focus of the hospital as it continues to play a key role in the training of doctors, nurses and allied health professionals, and in translational research which paves the way for new cures and treatment, offering patients hope and a new lease of life. 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.

For more information about the NUH, please visit: www.nuh.com.sg.

About the National University Health System (NUHS)

The National University Health System (NUHS) groups the National University Hospital (NUH), the NUS Yong Loo Lin School of Medicine, the NUS Faculty of Dentistry and the Saw Swee Hock School of Public Health under a common governance structure to create synergies to advance health by integrating clinical care, research and education. The enhanced capabilities and capacity will enable the NUHS to deliver better patient care, train future generations of doctors more effectively and bring innovative treatments to patients through groundbreaking research.

For more information about the NUHS: www.nuhs.edu.sg.

About the National University of Singapore (NUS)

A leading global university centred in Asia, the National University of Singapore (NUS) is Singapore's flagship university, which offers a global approach to education and research, with a focus on Asian perspectives and expertise.

NUS has 16 faculties and schools across three campuses. Its transformative education includes a broad-based curriculum underscored by multi-disciplinary courses and cross-faculty enrichment. Over 37,000 students from 100 countries enrich the community with their diverse social and cultural perspectives.

NUS has three Research Centres of Excellence (RCE) and 24 university-level research institutes and centres. It is also a partner in Singapore's fifth RCE. NUS shares a close affiliation with 16 national-level research institutes and centres. Research activities are strategic and robust, and NUS is well-known for its research strengths in engineering, life sciences and biomedicine, social sciences and natural sciences. It also strives to create a supportive and innovative environment to promote creative enterprise within its community.

For more information, please visit: www.nus.edu.sg.

Annex A

The GUSTO Study: Growing Up in Singapore Towards healthy Outcomes

GUSTO is a major long-term study of pregnant Singaporean mothers and their offspring from birth till nine years of age. The study aims to find ways of preventing the onset of diseases in later years. Backed by mounting evidence that the environment in which a baby is conceived, born and grows up, determines the child's growth and development, KK Women's and Children's Hospital (KKH), and the National University Hospital (NUH) partnered A*STAR's Singapore Institute for Clinical Sciences to study and better understand just how profoundly environmental factors affect the development of diseases like diabetes.

The GUSTO birth cohort programme was launched in June 2009. The team recruited 1,247 expectant mothers in their 11th to 14th week of pregnancy over a period of 15 months for GUSTO. Altogether 1,176 GUSTO babies were safely delivered, with the youngest and last GUSTO baby born on Labour Day, 1 May 2011.

This seminal effort was led by Associate Professor Chong Yap Seng, Associate Professor of Medicine, Department of Obstetrics & Gynaecology, Yong Loo Lin School of Medicine, National University of Singapore; Senior Consultant, Department of Obstetrics & Gynaecology, National University Hospital, and Acting Executive Director, Singapore Institute for Clinical Sciences (SICS), A*STAR.

Successes & Outcomes:

Over the past four years, GUSTO has established a state-of-the-art cohort study with detailed protocol and high compliance. It is one of the most intensively studied cohorts in Asia of mothers and children, growing in strength in epigenetic analysis, and involves over 100 investigators in Singapore, Canada, New Zealand, and the United Kingdom.

GUSTO research has established techniques for performing MRI scans on infants without any need for sedation. With techniques for MRI assessments developed in GUSTO, NUH and KKH now use the same techniques in their routine clinical management. As a result, even very ill babies may be safely sent for MRI scans without any need for sedation. This has achieved a broader objective of changing clinical practice.

GUSTO data shows a much higher incidence of gestational diabetes mellitus (GDM) than previously expected and informs clinical studies aimed at reducing rates of gestational diabetes, late preterm births, childhood obesity, allergies in children, neurodevelopment, and improved capacity for early school performance. The team found that higher glucose levels in expectant mothers can still affect fat levels in infants, even in the absence of GDM.

GUSTO data also showed that changes in gene expression relating to mild prematurity are more important than those related to birth size, and this has major implications for future disease risk.

By creating unifying research and an integrated basic and clinical disciplines platform, GUSTO has attracted considerable partnership with industry without compromising its academic objectives, and energised Singapore's thrust in nutritional sciences. The extent of industry funding, local and inter-department collaborations has made it possible to create

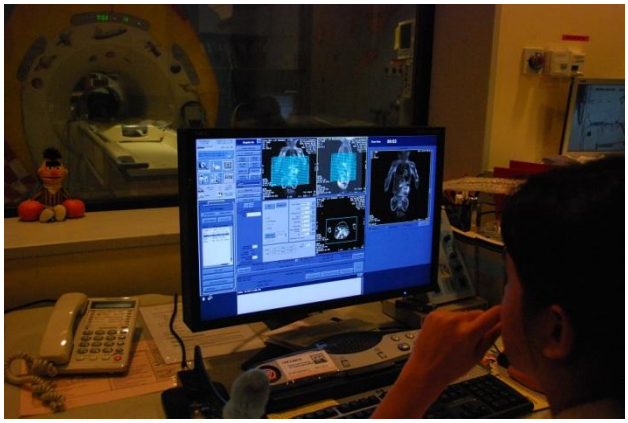
jobs and develop human capital to build capabilities to conduct competitive translational and clinical research, and has attracted companies to Singapore as a hub for research and development.

GUSTO researchers are proud to have contributed to the understanding that led to the United Nations Political Declaration of the High-level Meeting of the General Assembly on the Prevention and Control of Non-communicable Diseases (NCDs) in 2011 to focus on the developmental dimension (Clause 26).

IMAGES

Facial imitation test on the day of birth, recorded on video for neurocognitive analysis

A 6-month old GUSTO baby fitted with EEG net cap for tests in SICS Neurodevelopment Research Center.



MRI scan of a GUSTO baby at the KK Women's and Children's Hospital - snugly sleeping through the procedure – without any need for sedation.