

Health Research Symposium 2019: Genomics and Big Data in Health and Disease

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The Health Research Symposium 2019, organised by the Food and Health Bureau, was held on 12 June 2019 at the Hong Kong Academy of Medicine Jockey Club Building. The event provided a platform to facilitate dialogues among local researchers on their latest achievements in health-related research and to learn from international experiences. The event aimed to set a benchmark for excellent research in health and medicine and to foster collaboration in research to improve the health of the population. The Symposium was attended by some 500 delegates, including 119 poster presenters.

Prof Sophia Chan Siu-chee, the Secretary for Food and Health, opened the Symposium by welcoming the keynote speakers, distinguished guests, and other participants. Reflecting on the Symposium's theme, Prof Chan noted that genomics and use of health big data were inter-related and covered nearly every aspect of medical and health research including communicable and non-communicable diseases. Research on genomics and big data fully supports the Government's stated priorities in advancing health and medical research in the coming years. Following the Chief Executive's 2017 Policy Address, the Steering Committee on Genomic Medicine was set up to consider strategies for developing genomic medicine for better public health policies and clinical outcomes. The Government has allocated about \$1.2 billion to implement the Hong Kong Genome Project, under which 40 000 to 50 000 whole genome sequences will be obtained in the coming 6 years to establish a genome database of the local population, as well as a talent pool and relevant infrastructure. In addition, the Hospital Authority has established a Big Data Analytics Platform to facilitate healthcare-related research and innovation. The pilot stage of the Platform was launched in December 2018; six research projects from different local universities are ongoing. Prof Chan said that the Hospital Authority expected to formally launch the Platform by the end of 2019. All these showcase the Government's strong commitment to promoting clinical application and innovative research on genomic medicine for the benefit of patients and their families.

Keynote Session 1 (Moderator: Prof Yip Shea-ping)

Towards precision medicine
Prof Euan Ashley

*Professor of Medicine, Genetics & Data Science,
Stanford University, USA*

Prof Ashley introduced the concept of precision medicine and highlighted some contributions made by clinical genomics to its origin and evolution. He recapped the rapid advancements in genomic technology and illustrated the utility of genomics for clinical medicine using specific patient examples. Some of the essential algorithmic approaches to the interpretation of human genomes were discussed. Areas where current short read sequencing technologies perform well were identified, as well as areas where new approaches were required. In the context of precision and accuracy in genomics, newer technologies such as long read sequencing and new algorithms for improving test performance in complex areas of the genome were introduced. He also presented the use of gold standards in genomics and the limitations of the human reference genome. Finally, Prof Ashley highlighted the near-term future of clinical genomics. Throughout the talk, illustrative patient examples were used including those from the Undiagnosed Diseases Network.

Genomic study on molecular pathways of cancer development and its relevance to cancer precision medicine

Prof Leung Suet-yi

Associate Dean (Research), YW Kan Professor in Natural Sciences, Chair of Gastrointestinal Cancer Genetics and Genomics, Hereditary Gastrointestinal Cancer Genetic Diagnosis Laboratory, Department of Pathology, Li Ka Shing Faculty of Medicine, The University of Hong Kong

Genomic studies have revealed the molecular diversity and organ-specific differences in pathways of cancer development with therapeutic implications. Using gastrointestinal cancers as a model, gastric and colorectal cancers have been found to share some common oncogenic pathways, yet with marked divergent differential incidence of oncogenic pathway alterations. Some of these molecular alterations are emerging as biomarkers for prognostication, guiding patient treatment and prediction of genetic predisposition for focused preventive screening. Prof Leung explained that emerging technologies including next-generation sequencing could facilitate the discovery of novel

genes or pathways that contribute to development of inherited or sporadic gastrointestinal cancers. Coupled with development of new-generation organoid cancer models, next-generation sequencing enables direct culture of patient cancer cells for drug sensitivity testing, and correlation with genomic changes to identify genomic determinants of drug response. Prof Leung said that overall, coupling genomics and organoid-based drug screening, linking back to patient pathology and therapeutic response can empower the development of precision cancer therapy.

Keynote Session 2 (Moderator: Prof Leung Suet-yi)

Observational data for biomedical discovery

Dr Nicholas Tatonetti

Herbert Irving Assistant Professor of Biomedical Informatics, Departments of Biomedical Informatics, Systems Biology, and Medicine, Columbia University, USA

Dr Tatonetti stated that observation was the starting point of discovery. Based on observations, scientists form hypotheses that are tested and evaluated. In the information age, trillions of observations are made and recorded every day: from online social interactions to emergency room visits. In this new age, Dr Tatonetti observed that researchers must turn to computational algorithms to ‘mine’ for new hypotheses and relationships. Data mining is an emerging field dedicated to training algorithms to recognise patterns in enormous sets of data to automatically identify new hypotheses. Dr Tatonetti discussed how data-mining algorithms could be used to identify unexpected effects of drugs used alone or in combination with other drugs. Drug-drug interactions are an important and understudied public health concern. Drug-drug interactions are difficult and expensive to study because of the complex combinatorial nature of their investigation. Dr Tatonetti described how he developed new methods for mining clinical data and then discovered and validated two previously unknown novel drug-drug interactions, namely paroxetine (selective serotonin reuptake inhibitor) and pravastatin (HMG-CoA reductase inhibitor), which together cause hyperglycaemia, and ceftriaxone (cephalosporin antibiotic) and lansoprazole (proton-pump inhibitor), which together are associated with prolonged QT syndrome. The putative associations have been validated prospectively using animal models.

Data analytics & applications in Hong Kong Hospital Authority: past, present & future

¹ Ms Eva Tsui, ² Dr Anderson Tsang Chun-on

¹ *Chief Manager, Statistics & Workforce Planning Department, Hospital Authority, Hong Kong SAR*

² *Clinical Assistant Professor, Division of Neurosurgery, The University of Hong Kong*

The Hong Kong Hospital Authority has implemented public healthcare IT systems to collect patient-based administrative and clinical data across many areas of healthcare services. Ms Tsui and Dr Tsang illustrated how data analytics and statistical modelling skills have been applied to transform this huge volume of real-world data into useful information and then into actionable insights, to inform clinical service planning and developments, and to improve the healthcare system and population’s health. In one example, Ms Tsui described how a risk-prediction tool was developed to estimate the likelihood of unplanned readmission among individual elderly patients through a logistics regression model over one million episodes. This model relies on 14 predictor variables that have standardised definitions across all public hospitals and sustainable data quality over time. In another example, Dr Tsang described a research study that aimed to develop a rapid automated tool to predict the likelihood of large vessel occlusion based on retrospective data of computed tomographic images and clinical information. After a collaborative input towards the study design, an algorithm using the deep learning convolutional neural network model was developed by researchers at The University of Hong Kong, with predictive performance comparable to other validated instruments.

Sharing session on Research Fellowship Scheme

Two researchers supported by the Research Fellowship Scheme shared what they learned from their training programmes and how they applied the skills acquired in their research projects. Dr Ryan Au Yeung Shiu-lun (School of Public Health, Li Ka Shing Faculty of Medicine, The University of Hong Kong) presented his work on *The causal role of adiponectin and triglycerides in ischemic heart disease using a separate sample Mendelian randomisation analysis from publicly available data*, and Dr Wen Chunyi (Department of Biomedical Engineering, The Hong Kong Polytechnic University) discussed *Photoacoustic molecular imaging of osteoarthritic pain: a proof-of-concept study*.

Award ceremony

The Symposium ended with an award ceremony to acknowledge outstanding researches that have influenced health policy and practice in Hong Kong. The award recipients were as follows:

Excellent Research Awards

Principal applicant	Title
Prof CHIEN Wai-tong The Nethersole School of Nursing, The Chinese University of Hong Kong (Administering institution: The Hong Kong Polytechnic University)	An evaluation of the effectiveness of adherence therapy for patients with schizophrenia: a randomized controlled trial
Dr Richard CHOY Kwong-wai Department of Obstetrics and Gynaecology, The Chinese University of Hong Kong	Clinical application of an established target-enrichment massively parallel sequencing method for genetic screening and diagnosis of hereditary hearing loss patients with normal arrayCGH result
Prof JIN Dong-yan Department of Biochemistry, The University of Hong Kong	Roles of Epstein-Barr virus-encoded miR-BART microRNAs in viral persistence and transformation of epithelial cells
Prof Stephen TSUI Kwok-wing School of Biomedical Sciences, The Chinese University of Hong Kong	Whole exome sequencing to dissect the genetic factors behind developmental delay and learning difficulties
Prof Eliza WONG Lai-yi Jockey Club School of Public Health and Primary Care, The Chinese University of Hong Kong	Validation and valuation of the preference-based health index using EQ-5D-5L in the Hong Kong population
Prof Vincent WONG Wai-sun Department of Medicine and Therapeutics, The Chinese University of Hong Kong	Dietary determinants of endotoxemia and nonalcoholic fatty liver disease: a population study

Excellent Health Promotion Project Award

Principal applicant	Title
Dr Derek CHEUNG Yee-tak School of Public Health, The University of Hong Kong	Promotion and brief intervention of smoking cessation at the smoking hotspots
Dr TANG Hoi-yin Psychogeriatric Team, Division I, Kwai Chung Hospital	A training workshop for foreign domestic workers caring for elderly with dementia at home

The Most Promising Young Researcher Award

Principal applicant	Title
Dr Jasper CHAN Fuk-woo Department of Microbiology, The University of Hong Kong	Epidemiology, seroprevalence, and clinical manifestations of immunodeficiency due to autoantibody against interferon gamma in Hong Kong
Dr Alexander LAU Yuk-lun Department of Medicine and Therapeutics, The Chinese University of Hong Kong	Neutralizing antibodies to interferon-beta therapy in Chinese patients with relapsing and remitting multiple sclerosis: a pilot study

Best Poster Awards

Principal applicant	Title
Dr Larry CHOW Applied Biology and Chemical Technology, The Hong Kong Polytechnic University	The use of a novel synthetic flavonoid to improve bioavailability of paclitaxel: a pharmacokinetic, mechanistic and in vivo efficacy study
Prof Benjamin John COWLING School of Public Health, The University of Hong Kong	Intra-season waning of influenza vaccination effectiveness in children
Dr Esther LAU Yuet-ying Department of Psychology, The Education University of Hong Kong	Effects of sleep disturbances on disrupted affective cognition in individuals with depression
Dr Peggy OR Pui-lai Department of Health and Physical Education, The Education University of Hong Kong	School children: An active role in disease prevention

Dr Chui Tak-yi, JP, Under Secretary for Food and Health, thanked the keynote speakers, moderators, judges, speakers in the parallel sessions, and all those with poster presentations. He also congratulated all the awardees who had conducted

world-class studies and proved themselves as leading experts in their research area. Finally, Dr Chui thanked the organising committee and all delegates for attending and looked forward to meeting them again at the next Health Research Symposium.