SingHealth Centre for Health Services Research
Annual Report 2010/11

Enduring Insights,
Empowering Solutions
## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreword</td>
<td>2</td>
</tr>
<tr>
<td>CHSR Milestones</td>
<td>3</td>
</tr>
<tr>
<td>2010/11 Summary</td>
<td>4</td>
</tr>
<tr>
<td>Research</td>
<td>5</td>
</tr>
<tr>
<td>Publications</td>
<td>6</td>
</tr>
<tr>
<td>Conference Presentations</td>
<td>11</td>
</tr>
<tr>
<td>Grant Funded Research</td>
<td>15</td>
</tr>
<tr>
<td>Value-Adding Research</td>
<td>20</td>
</tr>
<tr>
<td>Health Service Development Programme</td>
<td>25</td>
</tr>
<tr>
<td>Education</td>
<td>27</td>
</tr>
<tr>
<td>Community Outreach</td>
<td>31</td>
</tr>
<tr>
<td>The Team</td>
<td>35</td>
</tr>
<tr>
<td>Acknowledgements</td>
<td>39</td>
</tr>
</tbody>
</table>
Dear Friends and Colleagues,

2011 is a special year for the Centre for Health Services Research. It marks the 5th year since the Centre was founded in 2006. From a small team which was founded with a generous grant from the SingHealth Foundation, the Centre has since grown in size and experience over the years.

Under the astute directorship of our founding Director, Dr Jeremy Lim, the Centre gained experience and provided support to our clinician partners in the field of health services research. We also built strong partnerships with our research partners in conducting research with the aim to deliver better and safer care to our patients at SingHealth.

The team successfully stepped up to the challenge of evolving from being a mainly internal consultancy outfit into a more research orientated team with goals of being successful in competitive grants and publishing over the last 2 years. In 2010 alone, the Centre brought in grants worth S$814,907 as principal-investigators or co-investigators. This was a record sum of grants for the Centre.

Our strength in conducting surveys led to the successful completion of a National Kidney Foundation grant funded survey of 2000 chronic kidney disease patients and general public in 2008. This has led to 5 international and local conference abstracts and presentations thus far.

The team developed expertise in health economics as well as operations research over the last 2 years. Our health economics expertise in particular proved important in aiding our partners in successfully winning their respective applications in the recent Health Service Development Programme grant call by the Ministry of Health.

In 2008, the Centre, led by Dr Jeremy Lim, won a grant from the Temasek Foundation to carry out training of trainers on evidence based health care management over 3 years in Northern India together with our very capable and respected partners from India, Prof Lazar Mathews and Dr Joseph Mathews. This has led to the forging of regional partnerships as well as spreading the importance of research led evidence based health care management in guiding the use of scarce and limited health care resources.

These 5 years have been bountiful and enriching as the team matured with the kind support of our partners and SingHealth leadership. We look forward to your continual support as the Centre strives to achieve greater heights in the years to come to realise the SingHealth mission of “Defining Tomorrow’s Medicine”.

Dr Chow Wai Leng
Assistant Director
Centre for Health Services Research

“The team successfully stepped up to the challenge of evolving from being a mainly internal consultancy outfit into a more research orientated team with goals of being successful in competitive grants and actively producing peer reviewed publications over the last 2 years. In 2010 alone, the Centre brought in grants worth S$814,907 as principal-investigators or co-investigators. This was a record sum of grants for the Centre.”
# CHSR Milestones

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<thead>
<tr>
<th>Year</th>
<th>Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>Received a grant of S$505,480 from SingHealth Foundation on 1 Aug 2006 for the establishment of SingHealth Health Services Research Network which was subsequently renamed as SingHealth Centre for Health Services Research</td>
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<td>2007</td>
<td>Supported a task force chaired by then Minister of State (Health) Mr Heng Chee How on evaluating the affordability of healthcare in Singapore</td>
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<td>2008</td>
<td>Centre’s findings from a survey of 300 chronically-ill Medifund recipients shaped the employment sourcing practices for chronically-ill patients at the Community Development Council (CDC)</td>
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<td>2009</td>
<td>Centre moved towards a more academic stance placing a greater emphasis on winning research grants and academic publications which resulted in publications of 5 papers in peer-reviewed journals and securing $596,214 worth of research and commissioned grants</td>
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<td>2010</td>
<td>Three out of three Health Service Development Programme (HSDP) applications which the Centre was involved in the crafting of the grant applications and health technology assessments succeeded in securing funding from the Ministry of Health</td>
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<td>2011</td>
<td>Co-authored a presentation that won the Best Abstract Award (Oral Presentation in Acute Myocardial Infarction Category) at the Angioplasty Summit Transcatheter Therapeutics Asia Pacific 2011 meeting in Korea</td>
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## 2010/11 SUMMARY

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<thead>
<tr>
<th>Research</th>
<th>Education</th>
<th>Community Outreach</th>
</tr>
</thead>
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<td>- 11 published articles in peer-reviewed journals and newspapers, and 32 presentations at international and regional conferences</td>
<td>- Organized 9 workshops which were attended by 178 participants</td>
<td>- 5 interns completed their internship program with CHSR</td>
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<td>- Won 6 research grants which amounted to S$850,805 from July 2010 to June 2011</td>
<td>- 8 of these workshops had CHSR staff as speakers on topics which included health economics, survey design, biostatistics, systematic review and operations research.</td>
<td>- Supported training of 22 North India hospital administrators in the Temasek Foundation-funded training of trainer program</td>
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20010/11 was another fruitful work year for Centre for Health Services Research (CHSR). The Centre won a total of $850,805 in research sponsorship grants from funding agencies like NKF, MOH, Singapore Cancer Society and SingHealth Foundation. Together with partners from KKH, SGH, and SNEC, analysts from CHSR won 6 new grant-funded projects as principal investigators and co-investigators. These projects covered a wide spectrum of healthcare topics which include quality of life of patients, healthcare process improvement and cost effectiveness studies. These projects required multi-disciplinary research techniques like health economics, statistics, clinical and computer programming know-how.

On the publication front, CHSR published 11 articles in peer-reviewed journals and newspapers from July 2010 to June 2011. 32 oral and poster presentations were also made in local and international conferences. In addition, the Centre also played a crucial role in the completion of research projects that had the potential of resulting in process changes on the ground. Last but not least, three out of three Health Service Development Programme (HSDP) applications which the Centre was involved in the grant applications and health technology assessments successfully won funding from the Ministry of Health. Details of all the aforementioned accomplishments and completed projects are summarized in the following three sections.
Over the past year, CHSR published 11 articles in peer-reviewed journals and newspapers. These publications can be broadly classified into three categories namely health process improvement, quality of life, and public health policy. The titles and descriptions of these publications are listed below.
**Health Process Improvement Article**

**Realization of Process Improvement at a Diagnostic Radiology Department with Aid of Simulation Modeling**

Oh HC, Toh HG, Cheong ESG

*Journal for Healthcare Quality* Forthcoming 2011.

Using the classical process improvement framework of Plan-Do-Study-Act (PDSA), the Department of Diagnostic Radiology at Singapore General Hospital identified several patient cycle time reduction strategies. Experimentation of these strategies (which included procurement of new machines, hiring of new staff, redesign of queue system, etc.) through pilot scale implementation was impractical since it might incur substantial expenditure and/or operationally disruptive. With this in mind, simulation modeling was employed to test these strategies via performance of “what if” analyses. Using the output generated by simulation model, the team was able to identify a cost-free cycle time reduction strategy, which subsequently led to reduction of patient cycle time and achievement of a management-defined performance target. As health-care professionals work continually to improve health-care operational efficiency in response to rising health-care costs and patient expectation, simulation modeling offers an effective scientific framework that can complement established process improvement framework like PDSA to realize healthcare process enhancement.

**Quality of Life Articles**

**The Health Related Quality of Life of Junior Doctors**

Tong SC, Tin AS, Tan DMH, Lim JFY

*Annals Academy of Medicine* Forthcoming 2011.

It has been reported in the literature that junior doctors experience a large amount of work-related stress and fatigue. This paper sought to determine the health-related quality of life (HR-QoL) of junior doctors (JD) using the Short Form 36 (SF-36) and compare their HR-QoL with that of population norms and senior doctors (SD). The SF-36v2 (Singapore version) was self-administered to a convenience sample of 372 doctors of both medical and surgical disciplines from a large tertiary teaching hospital. JD were defined as those less than 30 years of age (48%). Adjusted normative values were derived from the SF-36 Norms for the Singapore General Population Calculator for all eight scales. The mean score differences between the JD and their adjusted normative values as well as that for the SD were computed and contrasted. 213 of the doctors responded, giving a response rate of 57%. Of the 213 doctor respondents, 185 responded fully. The mean age of respondents was 33.6 years of age (Std Deviation 8.1). 45% were female and 88% were Chinese. JD had lower scores than SD in all scales except Physical Functioning. After adjustment for gender and race, the JD had statistically significant lower Mental Health scores than SD (p=0.01). Compared to the normative population, JD scored lower in all domains except for Physical Functioning. In particular, the difference between JD and normative values for Vitality was –14.9. JD have poorer mental health scores compared to their senior colleagues. Lower vitality scores also suggest that JD are more fatigued than their normative population.

**Validation of the Kidney Disease Quality of Life-Short Form: A cross-sectional study of a dialysis-targeted health measure in Singapore**

Joshi VD, Lim JFY, Mooppil N

*BMC Nephrology* 2010; 10(36)

In Singapore, the prevalence of end-stage renal disease (ESRD) and the number of people on dialysis is increasing. The impact of ESRD on patient quality of life has been recognized as an important outcome measure. The Kidney Disease Quality Of Life-Short Form (KDQOL-SF TM) has been validated and is widely used as a measure of quality of life in dialysis patients in many countries, but not in Singapore. This study aimed to determine the reliability and validity of the KDQOL-SF TM for haemodialysis patients in Singapore. Based on data gathered
from a cross-sectional study of 1180 patients who were 21 years old and older and were undergoing haemodialysis at National Kidney Foundation in Singapore, it was concluded that the psychometric properties of the KDQOL-SF™ supported the validity and reliability of the KDQOL-SFTM as a measure of quality of life of haemodialysis patients in Singapore. It was, however, necessary to determine the test-retest reliability of the KDQOL-SFTM among the haemodialysis population of Singapore.

The Influence of Ethnicity on Health-Related Quality of Life of Hemodialysis patients in Singapore

Wang VW, Seow YY, Chow WL, Low YS, Lee A, Lim JFY

The association between health-related quality of life (HRQoL) and ethnicity has been studied among hemodialysis (HD) patients in several countries with varying results. However, the effect of ethnicity on the HRQoL of HD patients in the Asian context has yet to be evaluated. This study sought to examine the HRQoL of HD patients in Singapore and to understand the influence of ethnicity on their HRQoL. A census-style survey inclusive of KDQOL-SFTM was conducted among 1249 HD patients from 22 dialysis centres across Singapore. Multiple linear regression models were used to analyze the influence of ethnicity on each SF-36 scale while adjusting for the influence of socioeconomic status (SES) factors and other determinants of HRQoL. Compared with other ethnicities, Chinese were most likely to report lower HRQoL. After adjusting for gender, age, and other possible determinants of HRQoL, the influence of ethnicity on HRQoL persisted, with significant mean differences in role-physical, general health, role-emotional and physical component summary scales. After adjusting for demographic, SES and other influential factors, ethnicity remained an important factor influencing HRQoL of Singaporean HD patients. Further studies are needed to identify modifiable factors that might explain the interethnic differences in HRQoL among HD patients.

Public Health Policy Articles

Factors Influencing Costs of Inpatient Ischaemic Stroke Care in Singapore

Chow WL, Tin AS, Meyyappan A
Proceedings of Singapore Healthcare 2010; 19(4)

Stroke is a major public issue in Singapore, accounting for almost 10,000 admissions annually and the burden of disease is set to increase with an ageing population. This study sought to examine the factors influencing the cost of acute stroke care in Singapore.

From the retrospective analysis of 2,087 discharges with a primary discharge diagnosis of stroke from a tertiary hospital in Singapore from 1 January 2007 to 31 December 2008, it was found that ward costs accounted for 48% of total cost. Length of stay strongly correlated to total cost. Being discharged to step-down facilities, death, receiving inpatient rehabilitation and length of stay significantly incurred higher total cost in multivariate analysis. However, there was an inverse relationship between age and total cost, possibly as a result of higher costs incurred for radiological, laboratory investigations and expert care. Further research is needed to examine factors influencing the cost of treatment particularly for those being discharged to step-down facilities and receiving inpatient rehabilitation as they have been found to incur higher total cost. This would impact on the planning of the continuum of healthcare facilities for stroke management.

3 Myths that Plague Healthcare Spending in Asia

Lim JFY, Kallidaikurichi S
TODAY 2011, April 04

To ameliorate the health of Asia, it is vital to debunk three myths that have been plaguing
Asian healthcare system. These three myths include the beliefs that more spending on healthcare would improve health, health is a private responsibility and good health comes from good healthcare. Firstly, more spending does not necessarily improve health, as seen in Singapore where the country’s low spending on healthcare yields impressive health statistics. Secondly, health should be managed in a similar manner as education where health should not be a private responsibility. Instead, it should be financed and regulated by government agencies to lay out the foundations of good health. Thirdly, good health does not necessarily come from good healthcare. Since 1900, the average lifespan of persons in the US has lengthened by greater than 30 years with 25 years of this gain being attributable to advances in public health. Prominent in the list of 10 achievements stood motor vehicle safety, safer and healthier foods and fluoridation of drinking water. As such, it is important to note that good health results from the people and the state working in unison, disregarding bureaucratic silos which artificially divvy up health into healthcare, social services, environment, sanitation and other divisions. To improve health, we need to cast aside our misconceptions and debunk these three most damaging myths that mislead policy-makers.

**Bringing Back Humanity to Medicine**
Lim JFY, Rohini OP
*TODAY* 2011, May 09

There are two faces of medicine namely, a ‘hard’, scientific base and a ‘soft’, humanistic form of comfort. It is critical to strike a balance between these two polarities and this requires two essential ingredients: communication to understand what the patients’ wants, and the empathy to use this understanding of the patient’s needs in healing. In this knowledge era, communication has become even more important. Information about any particular disease is easily available, and the key task of the doctor is to help patients explore this information, place it in the context of the patient’s life-goals and guide them to make genuine choices towards fulfilling these goals.

The typical paternal doctor-patient relationship in Asian healthcare is unwelcome, as patients expect doctors to be advisors rather than decision-makers. It is important to incorporate humanities into the medical curriculum in order to cultivate empathy, that is, the ability to understand and share the feelings of another. Infusing humanities into medicine will create a balance between the ‘hard’ and ‘soft’ polarities, and make doctors become better professionals.

**Time to Take a Holistic View of Health in Asia**
Lim JFY, Kallidaikurichi S
*TODAY* 2010, November 23

Beside the veneer of economic prosperity, Asia is facing significant challenges in healthcare. In addition to the common struggles with balancing the triangle of healthcare - high quality, low cost and universal access, Asia with its potpourri of developing and developed countries is further confronted with dual burden of communicable diseases and chronic conditions. In view of SARS and other similar incidents, there is enlightened self-interest within Asia that will bring Asia tighter on healthcare. Specific studies on Asia have suggested that Asians are physiologically different in drug metabolism and disease risk. Thoughtlessly imitated Western healthcare models will no longer suffice. Individual Asian countries should adopt ideas specifically tailored for healthcare solutions needed in the region. The nascent academic convergence of various science disciplines has strengthened policy-making at all levels of healthcare delivery. What Asia needs is a concerted and coherent approach to tackling the second convergence of Asia policymakers, industry, civic society and researchers. Despite the vastly different socio-economic conditions between Asian countries, they strive for a common goal—affordable and quality healthcare available to all citizens. There is much Asian countries can learn from each other and learn together.
Doctors as Accident Leaders? No More.
Lim JFY, Chia AC
TODAY 2011, April 18

Healthcare organizations are inherently difficult to manage given the complexity of modern medicine. There are at least three challenges that doctors face in making the transition from clinical care to healthcare leadership. First, doctors need to look beyond the primacy of the doctor-patient relationship and focus equally on the health system as a whole. Second, doctors are taught that they are leaders of a healthcare team with ultimate accountability. It is not uncommon to have doctors returning to the wards late in the night to check on their patients. Third, most health systems are in dire need of reform. Clinician leaders need to work both “in” and “on” the system. The agenda for leadership development in healthcare must go beyond a conventional leadership programme. Strategy formulation, financial and operations management are vital tools in the manager’s armamentarium – but, the clinician leader’s toolkit should include leading-edge ideas in engaging networks and the understanding of human behaviour. A new approach to clinician leadership development is needed. The most effective clinician leaders straddle successfully the often-divergent worlds of management, politics and medicine. The era of the “accidental” clinician leader is a bygone one, and rightly so.

Re-Designing Hospitals for the Future
Lim JFY, Phua KH
TODAY 2011, March 21

As Asian nations stand at the crossroads of health system reforms, four key factors have to be taken into consideration as the policy makers in these countries re-design hospitals for the future. First, they must not rule out the possibility of developing new tertiary care models to provide “better, faster, cheaper and safer” care. Second, they must adopt an integrated approach in the hospital design where they critically examine the role of hospitals vis-a-vis the rest of the health system; balance between growth of the private, public and people sectors; and integrate different levels of care, from prevention through cure and rehabilitation to palliation with a strong community orientation. Third, the policy makers must also explore the application of new technologies which could potentially enable Asian countries to navigate the demographic and epidemiologic transitions. Last but not least, policy makers must also adopt the healthcare financing models that support cost-sustainable retention of the most complex and sophisticated services within hospitals, while actively creating and enabling complementary structures in the community to offer care that does not need to occur on hospital premises.

Where Innovation’s a Matter of Life and Death
Lim JFY, Teo CP
TODAY 2011, February 28

In reverse innovation, the inventions of developed world inventions are adapted and simplified to satisfy the local healthcare needs in developing countries. By doing this, the costs of the original products might be reduced to become affordable to citizens of developing countries. Such reverse innovations in healthcare products are a matter of life and death to people who can ill-afford to pay the market prices of products in developed countries. Compared to the traditional notions of product development, innovations must extend to include new applications of old technologies, creation of new processes and structures to adapt to local conditions. In addition, the business model has to be calibrated to ensure financial viability of these innovations. It is also crucial that governments and industry players play an active role in developing the eco-system that supports and promotes reverse innovation.
Over the past year, CHSR has made **32** oral and poster presentations both locally and overseas, including those in prestigious international conferences such as Health Technology Assessment International (HTAi) and International Society for Pharmacoeconomics and Outcomes Research (ISPOR).
6th International Conference on Social Work in Health and Mental Health. Ireland, July 2010

Determinants influencing attitudes and behaviour in kidney donation in Singapore by Ow Yong LM, Lim CAY, Chow WL, van der Erf S, Joshi VD, Lim JFY, Swah TS, Teo SSH, Goh P, Tan GCS, Kee T

5th Singapore Public Health and Occupational Medicine Conference Singapore, August 2010

Evaluation of Time-Intervals from Screening/Onset of Symptoms to Initiation of Treatment for Breast Cancer in a Tertiary Hospital in Singapore by Ang SY, Tin AS, Wong YTE

Factors Influencing the Perceptions of Singaporeans on Affordable Healthcare in Singapore by Tin AS, Joshi VD, Chow WL

Scientific Evaluation of Patient Appointment Strategies with Aid of Discrete Event Simulation by Oh HC, Chow WL, Swah TS, Neo NN

Do Patients Understand Their Healthcare Workers? – A Pilot Study in a Tertiary Hospital by Tong SC, Tin AS, Ng KS, Narayanaswamy S, Chow WL

The Impact of Mammographic Screening in Disease Presentation among Asia Women by Wang VW, Tan SM, Chow WL

The Influence of Print Media on Youths’ Perceptions of Lasik Surgery by Chow WL, Wang VW, Chan CML, Ng WY

The XXIII International Congress of the Transplantation Society Canada, August 2010


14th International Conference on Intracranial Pressure and Brain Monitoring Germany, September 2010

Personality, Psychological and Neurocognitive Factors Across Time in Mild Traumatic Brain Injury Patients with Post-Concussive Symptoms by Ang CBT, Meyyappan A, Collinson S

7th National Healthcare Quality Improvement Conference Singapore, October 2010

A Comparative Study of Using an Innovative Drain Pouch and a Safety Pin for Breast Surgery Patients with a Unoplast or Blake Drain by Tan ML, Nagalingam S, Tan G, Baloo, Chan MM, Tin AS

SingHealth Duke-NUS Scientific Congress Singapore, October 2010

Systematic Review on Role of Patient Activation Level in Chronic Disease Management by Tin AS, Tong SC (Best Oral Paper Award: Evidence-Based Medicine-Medical)

Is Titanium Dioxide Coating an Effective Adjunct to Conventional Terminal Cleaning in Preventing MRSA Environmental Recontamination? by Chow WL, Lim WW, Lim JFY, Tin AS, Kurup A, Ling ML, Tan AL, Ong BC

The Impact of Pap Smear Screening in Disease Prevention among Asia Women by Wang VW, Chow WL, Quek SC, Toh HC

Realization of Health Care Improvement with Aid of Discrete Event Simulation by Oh HC, Chow WL
Economic Evaluation of Singapore Integrated Diabetic Retinopathy Programme by Ang SY, Wang VW, Chow WL


Knowledge of Chronic Kidney Disease among Primary Care Patients in Singapore by Chow WL, Van Der Erf S, Joshi VD, Swah TS, Teo SSH, Tan GCS, Goh PSC, Lim CAY, Kee TYS

Living With Inflammatory Bowel Disease (IBD): Understanding Patient Needs and Fears by Gill PK, Chow WL, Grinyer A, Thomas C, Thia TJK, Ling KL

Effects Of Patient Isolation On Well-Being of Patients: The Healthcare Worker’s Perspective by Tong SC, Hwang CC, Phuah GK

Differences in Personality and Psychological Profiles of Mild Traumatic Brain Injury Patients with Post Concussive Syndrome by Meyyappan A, Ang BT, Collinson SL

The Asia PCR / SingLIVE 2011 Singapore, January 2011

Cost Analysis and In Hospital Safety on using Transradial Approach versus Transfemoral Approach in Primary Percutaneous Coronary Intervention for Acute ST Segment Elevation Myocardial Infarction Patients in Killip Class 1 or 2: A Single Centre Study by Tan VH, Wang VW, Chow WL, Ang SY, Chow J, Ong SH, Goh YS, Gan HW, Tan KS, Lim V, Jayaram L, Goh PP, Tan CH

SGH 19th Annual Scientific Meeting Singapore, April 2011

Rapid Health Technology Assessment: Intrathecal Baclofen Pump Therapy for Intractable Spasticity by Oh HC, Ng WH


Evaluating Manpower Scheduling Strategies with Discrete Event Simulation in SGH Outpatient Pharmacy by Oh HC, Chow WL, Wong AJ, Tan MC, Lee SB, Lim MM

Attitudes towards Participating in Clinical Trials – A survey of 1,070 patients by Tin AS, Tong SC, Ang SY, Chow WL, Lim JFY

Is Patient Activation Related to Self-reported Health Process and Outcome Measures? by Tin AS, Tong SC, Tan DMH, Goh SY, Chow WL

Predictive Gene Testing in High-Risk Families is a Cost-Effective Strategy in Hereditary Non-Polyposis Colorectal Cancer by Wang VW, Koh PK, Ong SC, Chow WL, Lim JFY

Will Health-Related Quality of Life be Better after Kidney Transplantation among Patients in Singapore? by Ong SC, Van Der Erf S, Chow WL, Joshi VD, Lim JFY, Lim C, Tee PS, Lu YM, Kee TYS

Angioplasty Summit Transcatheter Therapeutics Asia Pacific 2011 Korea, April 2011


(Best Abstract Award: Oral Presentation in Acute Myocardial Infarction Category)
Health-Related Quality of Life for Patients on Kidney Transplant Waiting List – What Factors Really Matter?
by Ong SC, Chow WL, Van Der Erf S, Joshi VD, Tee PS, Lu YM, Kee YS

Can Intra-Operative Radiotherapy Using Intrabeam be used in the Management of Early Stage Breast Cancer? A Rapid HTA
by Wang VW, Chua ET

Is Simultaneous Pancreas Kidney Transplant the Most Cost-Effective Treatment for Type 1 Diabetes Patients with Renal Failure? A Cost-Utility Analysis
by Ong SC, Lee VTW, Lim JFY, Chow WL, Tong SC, Kee TYS, Madhavan K
In the last work year, CHSR won 6 new grant-funded projects in partnership with collaborators from KKH, SGH, and SNEC. These projects covered a wide spectrum of healthcare topics and their details are presented below.
An Automated Computer Imaging Program for Diabetic Retinopathy Detection and Screening

**Investigators:** Wong TY, Lamoureux E, Hsu W, Lee ML, Chow WL, Ee A, Yeo I, Wong E, Sabanayagam C  
**Grant Awarded:** $592,605  
**Funding Agency:** Tanoto Initiative

Diabetes mellitus is expected to affect 690,000 persons in Singapore and 300 million people worldwide by 2025. Diabetic retinopathy (DR), the most common and specific microvascular complication of diabetes is a leading cause of visual impairment and blindness in the working populations. The prevalence of DR was 21.8% in a clinic-based study in Singapore. As early detection and treatment of DR is the key to preventing blindness, annual diabetic retinal photography (DRP) screening is offered in Singapore to patients attending primary care services (polyclinics) as early as 1995 with the DRPs being assessed or “graded” by family physicians (FP). However, manual grading of DRP by FP is costly, time consuming, tedious and subject to intra- and inter-grader variations. Availability of digital retinal images coupled with advances in image processing techniques offer the potential for automating the detection of DR (microaneurysms, retinal hemorrhages, etc). This project aims to develop and validate an automated computer imaging program for DR detection and screening that will identify diabetic patients into those that need further assessment and those who do not. Thus, our proposed system will lead to a considerable reduction in workload in grading by FP, increased efficiency and potentially, substantial savings to the Singapore health system and patients.

The Clinical and Psychosocial Impact of Living Kidney Donation

**Investigators:** Kee TYS, Ong SC, Chow WL, Lim JFY, Goh A, Lim C, Ow Yang LM, Erh J, Tee PS  
**Grant Awarded:** $160,000  
**Funding Agency:** National Kidney Foundation

To date, kidney transplantation is the best treatment for kidney failure patients. Specifically, living kidney transplantation is favourable for shortening the waiting time for kidney availability, permitting timing of surgery to optimize the recipient’s health, enabling identification of donors with the greatest histocompatibility and improving function for the transplanted kidney postoperatively. However, living donor rates in Singapore are low relative to other developed countries. Understanding the psychosocial impact and clinical outcomes of living kidney donors (LKDs) is essential to developing strategies to garner greater public support for the national living organ transplant programme. The aims of the study are to evaluate psychosocial outcomes of past LKDs cross-sectional versus general public controls, to examine the factors that influence psychosocial outcomes of LKDs, to assess LKDs’ clinical outcomes pre- and post-donation and to evaluate psychosocial and clinical outcomes of LKDs. The study consists of two main arms. One arm entails cross-sectional and retrospective studies which are to be performed in four phases. The first phase would be the survey instruments preparation and development for LKDs and general population controls. Pre-survey focus group discussions and structured interviews would be conducted to sharpen the survey instruments. The second phase would be conducting the survey itself. The third phase would involve providing health assessments for past LKDs to obtain their latest clinical outcomes. The fourth phase would involve chart reviews to obtain LKDs’ and the recipients’ past clinical outcomes. The other arm of the study would involve prospective psychosocial evaluation and clinical outcomes extraction for 12 months post-donation for new LKDs and their recipients.
“It has been extremely fruitful to have collaborated with SingHealth Centre for Health Services Research in my area of interest which is transplantation. In 2008, we worked together on a large scale survey of the public, transplant and dialysis patients which examine knowledge, attitudes and behaviour towards kidney disease and kidney transplantation. 7 papers have been presented over the last 2 years and submitted for publication as a result of this survey, funded by the NKF research funds. The findings of these papers have significantly contributed to our knowledge on kidney donation and are shaping the way in which we increase our efforts to raise awareness, knowledge and acceptance of kidney donation and transplantation at the Singapore General Hospital. We are again working together on another NKF research funded study examining the clinical and psychosocial impact of living kidney donation. There is a paucity of data on living kidney donation in Asia and no data available locally on living kidney donors. We therefore hope to fill the knowledge gaps in these areas which will also help improve our services in living kidney donor transplantation. I am really looking forward to this collaboration with SingHealth Centre for Health Services Research.

The leadership and team at the centre are extremely professional, knowledgeable and supportive. As an extremely busy clinician, educator and administrator, they make my research efforts a lot easier and most importantly more sophisticated and world-class. I look forward to many more collaborations with the centre.”

Dr Terence Kee
Consultant Renal Physician (SGH)

A Multicenter Study of Children and Young Adults with Cancer in Singapore: The Measure of Health Related Quality of Life and Neuropsychological/Neurobehavioral Outcomes and to Test the Reliability and Validity of Survey Tools

Investigators: Aung L, Tay L, Saw MS, Chan MY, Chin F, Chong CT, Tin AS, Tawng KD
Grant Awarded: $88,000
Funding Agency: Singapore Cancer Society Cancer Research Grant

Primarily, this project aims to measure the Health Related Quality of Life (HRQOL) and neuropsychological / neurobehavioral outcomes in children, adolescents and young adults with cancer and to assess the burden of cancer on their families. The proposed study also aims to test the reliability and validity of survey tools in a multicenter setting in our ethnically diverse Singapore. In the assessment of HRQOL, patients will complete a self-administered questionnaire in the clinic or a mailed questionnaire. Additionally, a battery of standardized neuropsychological tests will be administered at standardized time points. For patients who survive the malignancy, the study also addresses questions on what the consequences of cure are, whether they differ by treatment regimens and how to improve their health related outcomes. On the whole, the findings of this project will support stakeholders in the decision-making processes on matters pertinent to policy formulation and resource allocation in treatment of children and young adults with cancer in Singapore.
**Enhancement of Patient Care at SGH Department of Emergency Medicine via Resource Reallocation and Discrete Event Simulation**

**Investigators:** Oh HC, Phua TB, Choa G, Chow PY  
**Grant Awarded:** $85,000  
**Funding Agency:** MOH HQI2F

The proposed research offers a scientific evaluation study which determines the resource allocation strategies, infrastructure and process flow design that can effectively cope with future workload of Department of Emergency Medicine (DEM) at Singapore General Hospital (SGH). It entails the development of a discrete-event simulation (DES) model to represent the patient flow at SGH DEM. The aforementioned model is to be subsequently employed within the Plan-Do-Study-Act (PDSA) framework that is used in Quality Improvement with the aim to determine effective resource allocation strategies, infrastructure and process flow design that can (1) enhance patient care through reduction of waiting time to consultation and (2) cope effectively with future workload of SGH DEM. The effectiveness of resource allocation strategies, infrastructure layout and process flow designs will be assessed in terms of their impact on patient times to first consults and patient satisfaction levels.

**The Burnout Syndrome Among Nurses in Singapore – Prevalence, Influencing factors and Its’ Association with Turnover and Absenteeism**

**Investigators:** Ayre TC, Ng BY, Beck KR, Ratnam P, Fong KY, Nur H, Ang SY, Wang WV, Xie J, Wong LT, Tien CE, Tan CT  
**Grant Awarded:** $36,200  
**Funding Agency:** SingHealth Foundation

Turnover and absenteeism are known to be associated with the burnout syndrome. Nursing is known to be a physically and mentally demanding profession, and nurses are known to be at increased risk of burnout. More significantly, nurses are now at the forefront of rapid changes in the healthcare system in Singapore. The aims of this study are to evaluate the prevalence of burnout and quantify its effects on turnover and absenteeism among nurses; as well as to investigate the influence of various mediating factors on burnout among nurses in Singapore. We will adopt a cross sectional survey design and involve registered nurses working in a large tertiary hospital in Singapore. The questionnaire used is based on the Maslach Burnout Inventory, NEO Five-Factor Inventory and the General Nordic Questionnaire for Psychological and Social Factors at Work. Other variables such as demographics and work-related information will also be collected. To the best of the authors’ knowledge, this will be the first and largest study on the burnout syndrome among nurses in Singapore. Findings from this study will help inform human resource practice and enable nursing managers to better devise strategies for improving retention of nurses in our local setting.

**Effectiveness and Cost-Effectiveness of Liaison Nurse and Care Algorithm in the Management of Pressure Ulcers in the Acute Care Setting**

**Investigators:** Tay AC, Ang SY, Kim SJ, Ayre TC, Ong HK, Liew SM, Wang WV, Ong SC, Ko JP, Chan KL, Lim NY, Lee CN  
**Grant Awarded:** $40,000  
**Funding Agency:** SingHealth Foundation

It is well-recognized that pressure ulcers are a significant cause of morbidity and lead to lower quality of life for both the patients and their carers. Pressure sores also incurred substantial health care resources and costs. Various guidelines and protocols have been published, as pressure ulcers are common adverse events that are largely preventable. However, despite the availability of guidelines, it was reported that the management of pressure ulcers is still not optimal. This study aims to evaluate the effectiveness and cost-effectiveness of a liaison nurse scheme coupled with the use of an evidence-based pressure ulcer
management algorithm. The liaison nurse initiative (link nurse schemes) has been shown to be effective in other fields of nursing, while algorithms have been demonstrated to result in faster learning, higher retention and greater compliance with established standards than prose text. A comparative pre-post study design will be adopted with 6 inpatient wards in Singapore General Hospital and 2 inpatient wards in National Heart Centre. Clinical Effectiveness will be evaluated by assessing the differences in prevalence and incidence of pressure ulcers, as well as healing rates, before and after implementation of the liaison nurse scheme and care algorithm. For economic evaluation, an activity-based costing will be used and the hospital-provider perspective will be adopted. Results of this study will help to inform how evidence-based guidelines can be successfully implemented in practice and lead to better quality of care.

**Enhancement of SGH Outpatient Pharmacy Patient Experience with Aid of Discrete Event Simulation**

*Investigators: Oh HC, Chow WL, Wong AJ, Tan MC*

*Grant Awarded: $10,000*

*Funding Agency: SingHealth Foundation*

Singapore General Hospital (SGH) Outpatient Pharmacy is merging two existing facilities to form a new facility in 2011. The new pharmacy includes addition of new medication pre-packing machines and a conveyor belt system that require introduction of new workflow. In addition to the need to accommodate the growing patient expectation, anticipated changes in patient volume and profile, the design of the new pharmacy has to be done in an effective and timely manner to prevent or minimize overcrowding.

The proposed project aims to derive scientifically the workflow of new pharmacy, as well as the resource requirements and their allocation strategies that can effectively cope with future pharmacy workload. It entails the development of a simulation model to represent the patient flow at the new pharmacy built with new infrastructures. The aforementioned model is to be subsequently employed to determine optimal workflow and resource allocation strategies that can (1) enhance patient experience through reduction of waiting time and (2) cope effectively with future workload of the new pharmacy. This project involves computational programming of a discrete-event simulation (DES) model to represent the process flow in the new SGH Outpatient Pharmacy. The latter model allows decision-makers to evaluate scientifically the impact of different workflow designs and resource allocation strategies on patient waiting times and cycle times at the new pharmacy. Such an approach is especially relevant when it is expensive and disruptive to introduce changes to a complex and critical system like the outpatient pharmacy in order to evaluate the effectiveness of a new workflow design or resource allocation strategy.
Listed in the following pages were completed projects which the Centre was instrumental in contributing to the knowledge base of the healthcare community and informing policy makers.
Cost-effectiveness Analysis of Human Papillomavirus Vaccination in Singapore

Investigators: Wang VW, Chow WL, Quek SC, Ang SY, Van Der Erf S

We sought to assess the cost-effectiveness of vaccination with two different human papillomavirus (HPV) vaccines in addition to a cervical cancer screening program as compared to screening alone in Singapore, and to evaluate the cost-effectiveness of one HPV vaccine versus the other. A Markov model representing the natural history of HPV infection was adapted to the Singapore context. The model followed a cohort of 12-year-old girls over a lifetime. Three strategies were compared: the bivalent vaccine versus the quadrivalent vaccine in addition to conventional cervical cancer screening versus screening alone. We took the healthcare service provider’s perspective. Vaccination with screening compared with screening alone showed a discounted incremental cost-effectiveness ratio (ICER) of SGD21,992 per quality adjusted life-year (QALY) gained for the bivalent vaccine and SGD28,384 for the other. The ICER for either vaccine on shorter sustained protection remained below the cost-effectiveness threshold for Singapore. When comparing the two vaccines, total costs are lower for the bivalent vaccine, as savings in preventing additional precancerous lesions and cervical cancer is greater than savings in preventing genital warts offered by the quadrivalent vaccine. The ICER (bivalent versus quadrivalent) was most sensitive to vaccine price and cross-protection efficacy. But the bivalent vaccine remained a more cost-effective strategy in most scenarios. Vaccination of non-sexually active adolescent girls with either vaccine in addition to the screening program can be regarded as a cost-effective strategy in Singapore. Despite the uncertainties in their comparative efficacy, the bivalent vaccine would be a more favourable option.

Is Simultaneous Pancreas Kidney Transplant the Most Cost-Effective Treatment for Type 1 Diabetes Patients with Renal Failure? A Cost-Utility Analysis

Investigators: Ong SC, Lee VTW, Lim JFY, Chow WL, Tong SC, Kee TYS, Madhavan K

Cadaveric simultaneous pancreas kidney (SPK) transplant has been shown to improve quality of life, reduce long-term diabetic complications and prolong survival in Type 1 diabetes patients with renal failure (IDDM-RF). The objective of the current study is to assess its cost-effectiveness compared with other treatment strategies for IDDM-RF prior to establishment of a pancreas transplant programme in Singapore. A decision analysis model was developed from a health service perspective based on a 5-year model for IDDM-RF treatment strategies, consisting of cadaveric kidney transplant (Ktx-CD), living donor kidney transplant (Ktx-LD), SPK and dialysis. Singapore cost and survival data were used whenever possible. Sensitivity analyses were performed to evaluate the impact of uncertainties around key variables. In the baseline analysis, Ktx-LD was the most cost-effective strategy with the lowest cost per quality-adjusted life-year (QALY) gained. Cost per QALY for Ktx-LD was SGD69,381; SPK, SGD72,905; Ktx-CD, SGD81,674 and dialysis, SGD177,341. The Ktx-CD was dominated strategy. ICERs with dialysis as a reference for Ktx-LD and SPK strategies were SGD 33,715 and SGD45,379, respectively. Both strategies are considered highly cost-effective under WHO guidelines (less than GDP per capita for Singapore in year 2009, that is, SGD53,900). In the sensitivity analysis, an 8% increase in kidney graft survival or 8% increase in patient survival would make SPK the most cost-effective strategy. In conclusion, both Ktx-LD and SPK are highly cost-effective strategies in the treatment of IDDM-RF. SPK is potentially the most cost-effective strategy if an increase of 8% in graft or patient survival is achieved.
**Reduction of Long-stayers in Cardiovascular Medicine Ward**

**Investigators:** Foong JY, Xue L, Tong SC, Wong A, Tan BC, Liew SM, Loo YJ

This project primarily aimed to reduce the number of Cardiovascular Medicine (CVM) patients at National Heart Centre who were admitted more than 7 days despite being fit for discharge earlier. In the cause and effect analysis, several factors which potentially contributed to this situation were identified. Further in-depth evaluation of these factors led the team to the conclusion that two key contributing factors were patients’ caregiver not being aware of discharge dates and inadequate advance discharge planning. To address these factors, the team introduced three interventions which included daily discharge review by care coordinators; introduction of early discharge plan on third day of admission for team doctors to plan for early discharge; introduction of an extra column in the nursing care record to remind nursing staff to notify caregivers concerned of any discharge plan. Upon implementation of these interventions, it was found that the median number of CVM patients who were admitted more than 7 days had reduced from 15 to 14. In addition, the average length of stay (ALOS) and unscheduled readmission rate within 15 days of discharge among the CVM patients were also reduced by 0.2 day and 0.22% respectively to illustrate the effectiveness of interventions.

**Evaluating Manpower Scheduling Strategies with Discrete Event Simulation in SGH Outpatient Pharmacy**

**Investigators:** Oh HC, Chow WL, Wong AJ, Tan MC, Lee SB, Lim MM

SGH Outpatient Pharmacy had uncertainty over the impact of different manpower scheduling strategies on the length of time (i.e. cycle time) that their patients needed to spend during their visits. This project aimed to address this uncertainty via application of discrete event simulation (DES). Recent service rates of pharmacy staff and manpower allocation schedules were used to represent the process characteristics of the pharmacy in a DES model. Based on different manpower availability schedules that emulated different manpower allocation strategies, the DES model projected quantitatively their respective impact on patient cycle times and manpower resource requirements. Manpower allocation strategies evaluated in this study were evolved via study of pharmacy retrospective patient arrival patterns, existing manpower allocation plan and identification of key pharmacy sub-processes (i.e. registration, typing, packing, checking and dispensing) which would result in the most reduction in patient cycle times via reallocation of manpower. Based on DES model projections, two key inferences were made. First, increasing the manpower of checking and dispensing sub-processes to their respective maximum operationally possible levels could realize the two highest reductions (22.9%-28.8%) in median and 95th percentile cycle times among the five sub-processes. Second, matching manpower availability with patient arrival pattern could reduce both median and 95th percentile cycle times (39.7%-45.7%) with less than 7.5% increase (or two new hires) in overall manpower requirement.

“The simulation models which are validated using actual data are very useful as we are able to test out ideas and make necessary adjustments to workflow including resource allocation. This model has helped us tremendously in our planning process for the Outpatient Pharmacy renovation project.”

Ms Lee Soo Boon
Pharmacy Practice Manager (SGH)
Predictive Gene Testing in High-Risk Families is a Cost-Effective Strategy in Hereditary Non-Polyposis Colorectal Cancer

Investigators: Wang VW, Koh PK, Ong SC, Chow WL, Lim J

Colorectal cancer is the most common cancer in Singapore. We sought to evaluate the long-term cost-effectiveness of targeted genetic testing and surveillance programs in individuals at high risk of Hereditary Non-Polyposis Colorectal Cancer (HNPCC), as compared to an unselective clinical surveillance program alone in Singapore. A Markov model analysis from the healthcare service provider’s perspective was developed to follow over a lifetime a cohort of cancer-free 21-year-old individuals, who are first-degree relatives of HNPCC patients with a known mutation. We found that genetic testing strategy provided a lifetime saving of SGD 14,194 per person and the same life years gained, as compared to clinical surveillance alone. This was achieved by sparing non-mutation carriers unnecessary and invasive intensive clinical surveillance (assuming 100% compliance with recommended surveillance programs in both strategies). Sensitivity analyses showed that as long as the compliance rate in mutation carriers is not lower than that for individuals without genetic testing, pursuing a genetic testing strategy would either be a more favourable option with discounted incremental cost-effectiveness ratios (ICERs) ranging from SGD 916 to 98,591 per life year gained or a dominant status achieved (more life year gained and less costly). Genetic testing for individuals at high risk of HNPCC allows targeted clinical surveillance to be directed at mutation carriers, ensuring efficient use of healthcare resources and reduces CRC-related mortality. It can be regarded as a cost-effective strategy in Singapore, if an improved compliance with recommended surveillance protocol is achieved in proven mutation carriers.

Cost Analysis and In-hospital Safety Study on Using IKARI-Shaped Guiding Catheter for Transradial Approach Versus Other Guiding Catheters for Transfemoral Approach in Primary Percutaneous Coronary Intervention for Acute ST Segment Elevation Myocardial Infarction Patients in Killip Class 1 or 2 at Presentation: A Single Centre Study


The transradial approach (TRA) is fast becoming a preferred route for primary percutaneous coronary intervention (PPCI). This study aimed to perform a cost analysis on TRA using an IKARI-shaped guiding catheter versus other guiding catheters used in transfemoral approach (TFA) in PPCI setting for acute ST segment elevation myocardial infarction (STEMI) patients in Killip Class 1 or 2 at presentation. This is a retrospective study comprising data from STEMI registry. We included STEMI patients who were admitted from A&E in 2008 with Killip Class 1 or 2. Patients who failed TRA were excluded. The composite MACE including all-cause death, myocardial infarction, emergency CABG, target lesion revascularisation or stent thrombosis were assessed. Cost analysis was conducted using total hospitalization costs (before government subsidy) obtained from the hospital financial system. A decision tree was constructed to compare average costs between TRA and TFA. There were 215
patients (111 for TRA, 104 for TFA) included in the analysis, with similar demographic profiles. Average hospitalization costs were lower in TRA (USD 7999.46) vs. TFA (USD 8526.99). Sensitivity analyses suggested that using TRA for PPCI in Killip 1 or 2 STEMI patients consistently achieved lower total hospitalization cost in worst and best case scenario. No significant differences were found in incidence of access site complications and MACE during hospitalization between the two groups. In conclusion, TRA using iKARI-shape guiding catheter in PPCI setting consistently achieved lower hospitalization costs compared to TFA without increases in access site complications or in-hospital MACE.

**Economic Evaluation of Cardiac Rehabilitation for Patients with Chronic Heart Failure**

**Investigators:** Wong WP, Ong SC, Chow WL, Ang SY, Tan SY, Lim J

Chronic heart failure (CHF) is a growing problem affecting mostly older adults. Often associated with long-term medical therapy and functional limitation, cardiac rehabilitation, comprising lifestyle risk factor modification, education and exercise training, is now recognized as an important component of care for CHF patients. Although studies supporting efficacy of cardiac rehabilitation in improving functional abilities, quality of life and survival exist, there are limited number of reports on economic evaluation. The aim of this study was to determine the cost implications of cardiac rehabilitation for CHF patients. Patients’ medical records were reviewed to identify their healthcare resources utilisation including hospitalisation, outpatient visits, medication used, laboratory tests and procedures done. Only direct costs were included in this study. Monetary values was reported in 2010 Singapore dollars. CHF patients who have been referred for cardiac rehabilitation program and attended the full 24 sessions were categorised as cardiac rehabilitation (CR) group. While not all patients attended all 24 sessions of cardiac rehabilitation, those who did not attend at least 12 sessions consecutively served as the non cardiac rehabilitation (NCR) group. A total of 106 patients with complete data were analysed. Of whom 66 completed the full 24 sessions of cardiac rehabilitation program, whilst 40 patients were categorised as the NCR. Percentage of re-admission to hospital for the CR was 15% as compared to the NCR’s 35% (P=0.016). Median length of stay (LOS) for the CR group was also significantly shorter than that of NCR group, 5 versus 7 days (P=0.014). Even though the mortality rate of CR group was slightly higher than that of NCR group, that was 9.1% versus the 7.5%, the difference was not statistically significant (P=0.78). Total mean cost for the CR was SGD6285 per annum as compared to the NCR SGD9244. CHF patients who completed full cardiac rehabilitation programme were associated with lower re-admission rates, shorter LOS and costs spent on healthcare resources.

“I'm really thankful to the team at CHSR, especially Zoe, for the professional advice and expertise on health services research design and data analysis. Without the guidance, I'll be completely lost, especially when it comes to cost data and their interpretations. Zoe is especially patient in explaining difficult terms and economic concepts. The help so freely rendered also encourages me to look further in this area. Their professionalism is impressive, and their passion in their work contagious. I've also learnt about perseverance and patience in that process. Thank you everyone at CHSRI”

Dr Wong Wai Pong, Senior Principal Physiotherapist Department of Physiotherapy (SGH)
Our Centre was also involved in health technology assessments or cost effectiveness analysis of the following 3 Health Service Development Programme (HSDP) applications which eventually succeeded in winning funding from the Ministry of Health in February 2011.
**Ultrafiltration Combined with Telephonic Intervention for Patients Hospitalized for Acute Volume Overload (SingHealth)**

Volume overload is a common diagnosis for heart and renal patients admitted to hospital. Based on review of data in 2009, it accounted for approximately 1000 admissions in the National Heart Centre (Singapore) and approximately 400 admissions in Department of Renal Medicine, Singapore General Hospital (SGH). The proposed project aims to provide early extracorporeal ultrafiltration via a peripheral venous access in patients with acute volume overload secondary to decompensated heart failure and/or renal impairment, especially in those patients who fail to respond or show slow response to diuretic therapy. The use of UF is expected to reduce the hospital length of stay (LOS) and also to reduce readmissions to hospital. This will eventually contribute to health economic benefits from the patient, hospital and payer viewpoints.

**The Singapore Integrated Diabetic Retinopathy Programme (SiDRP): Centralised Tele-ophthalmic Service for Diabetic Retinopathy Screening (SingHealth, National Healthcare Group)**

The Singapore Integrated Diabetic Retinopathy Programme (SiDRP) is a national comprehensive diabetic retinopathy (DR) screening programme based on the concept of centralized assessment of DR from retinal photographs read by trained technicians, and supported by a tele-ophthalmology infrastructure. SiDRP offers a more effective and prompt service delivery of DR screening by streamlining and automating the entire process. It entails image capture at the polyclinic, electronic transfer of the images to Singapore Eye Research Institute (SERI)’s Ocular Imaging Centre (OIC), and reporting of image readings to the polyclinic within 1-hour timeframe. OIC will function as a national-level centralized grading centre for DR, supporting all government polyclinics in the early phase, and thereafter with the future to provide comprehensive coverage of all patients, including private GPs, opticians and other relevant entities. By providing faster, more cost-effective and accurate disease diagnoses, SiDRP will reduce over-referrals of mild DR cases, cases attributable to false negative results, and simultaneously, allow for polyclinic doctors/family physicians to have more time for clinical management of polyclinic patients. In conclusion, SiDRP will translate to greater productivity, improved economics of eye disease management and cost savings for patients, public healthcare providers and the government, and improve the general eye health of all Singaporeans with diabetes.

**Pancreas Transplantation for Insulin-Dependent Diabetes Mellitus in Singapore (National University Health System)**

Pancreas transplantation is accepted treatment for patients with Type 1 diabetes and end-stage renal failure. There is definite patient survival advantage for pancreas transplant, compared to no transplant. In Singapore, patients with Type 1 diabetes and renal failure have a 5-year survival of 38%, compared to 5-year survival of 90% with successful transplant. Pancreas transplantation has been integrated into the health care system with acceptable clinical benefits in many developed countries, notably in the US, Canada, Australia, UK and some major European countries. Evidence exists for improved graft and patient survival, and reduction of complications through the years with data mainly from transplant registries.
The Centre has an extensive educational outreach programme where workshops are organized to impart knowledge with the goal of building health services research capabilities in SingHealth. The topics covered in these workshops included health economics, survey design, biostatistics, systematic review and operations research. In the last work year, we conducted 9 workshops, 6 of which were funded by SingHealth Talent Development Fund and trained over 178 participants.
**Introduction to Simulation Modeling and Arena**

**Dates:** 21 July, 24 August 2010  
**Speaker:** Dr Oh Hong Choon

Simulation modeling entails mathematical representation of a real world system of interest so that the system performance can be projected once the system characteristics are defined. It allows decision-makers to evaluate the effectiveness of a process improvement strategy without committing excessive resources and/or disrupting the workflow within a system of interest. Over the years, simulation modeling has evolved to become one of the commonly used decision-support tools in industries which involve manufacturing/assembling processes, transportation and provision of services. Major manufacturers like Toyota and Volvo have reported employing simulation modeling to support production plant design, evaluation of production policies, lot sizes, work in progress inventory levels, production plans, etc. In the healthcare industry, simulation modeling has also been employed to support health service quality improvement projects with decisions pertinent to facility layout design and capacity planning, manpower planning, patient appointment scheduling and organ allocation, etc. As healthcare professionals work continually to improve health service in response to rising patient expectation, simulation modeling offers an effective scientific framework that supports their decision-making processes. This 2-part workshop introduced fundamentals of simulation modeling and explained how they could be applied to address several operational problems faced by healthcare professionals. In addition, it also covered key features of a simulation software (Arena) with hands-on session which allowed users to gain practical experience of developing models using Arena.

**Understanding of Essential Biostatistics and Using SPSS (Basic)**

**Dates:** 16 September 2010, 19 May 2011  
**Speaker:** Dr Tin Aung Soe

In order to analyze and interpret data systematically, a basic concept of data handling and data processing is required so that data can be meaningfully transformed into knowledge of science. This workshop was conducted two times during the last work year in response to the overwhelming demand from SingHealth participants. We also expanded on the workshop content and duration by introducing a data processing course using Statistical Package for Social Science (SPSS) software. The objectives of the workshop were to understand the importance of variables and data, to understand different statistical methods used in medical research and to be able to conduct simple and basic statistical procedures using SPSS software. This workshop was primarily aimed at SingHealth potential researchers or research-related personnel who were keen to embark their own research. A total of 20 participants attended the one day workshop. Overall, 90% of the participants rated the workshop “excellent” or “good”.

"Excellent workshop that provides a good background on basic statistics as well as SPSS training."

Dr Vikneswaran Namiasvayam  
Consultant  
Department of Gastroenterology and Hepatology (SGH)
Conducting Focus Group Discussions
Date: 6 September 2010
Speaker: Ms Pavita Gill

Focus group sessions are a qualitative research technique widely used in private industries to gain insights into attitudes, opinions, motivations and problems as they relate to human behaviour. The method involves a small number of respondents brought together to discuss relevant topics under the guidance of a moderator. The objectives of the 3-hour talk were to understand how to construct, conduct and moderate a focus group discussion. A total of 12 participants attended the workshop. Overall, more than 90% of participants rated the workshop "excellent" or "good".

Engineering Health Services Delivery with Operations Research
Date: 3 November 2010
Speaker: Dr Oh Hong Choon

The roots of operations research can be traced back to World War II when early attempts were made by British and American military forces to use a scientific approach in the management of their operations and activities. Subsequently, operations research received extensive interests from the industry before it evolved over the years to become a key domain that has been instrumental in advancement of various industrial, government, and military processes. Similarly, operations research plays an increasingly important role in modern medicine, life sciences and healthcare. In particular, many operational problems arising in the hospitals can be formulated into mathematical models and can be analyzed using sophisticated optimization, decision analysis, and computational techniques. As health-care professionals work continually to improve health-care operational efficiency in response to rising health-care costs and patient expectation, operations research offer effective scientific frameworks that can support their decision-making processes. This talk introduced the fundamentals of operations research and explained how they could be applied to address several operational problems faced by healthcare professionals. In addition, the speakers also shared some of his experience in which operations research methodologies had been applied successfully in the local healthcare industry.

Basic Principles of Economic Evaluation of Healthcare Programmes
Date: 20-21 January 2011
Speakers: Prof Akë Blomqvist; Dr Ong Siew Chin, Zoe

Cost-effectiveness (or “value” for money spent on treatment services) is of central concern in most health care and government systems. Economic evaluation is one of the tools available to assist policy makers in prioritising resource allocation in the health care sector, by assessing the value for money of alternative interventions and implement efficient resources. This 2-day workshop aimed to help healthcare professionals understand the fundamental concepts of economic evaluation and the role of economic evaluation in evidence-based decision-making, as well as to be able to critique and conduct economic evaluation studies. The workshop included a series of interactive lectures followed by 2 case studies for comprehensive understanding of different types of healthcare cost evaluation. A total of 25 participants attended and more than 90% of participants felt that the workshop was “good” and “excellent”.
Systematic Review and Meta-Analysis

**Dates:** 6-7 January 2011  
**Speakers:** Dr Edwin Chan, Dr Pryseley Assam, Dr Dianne Bautista, Dr Naeem Khan, Dr Wenyun Li, Dr Fahad Siddiqui

A systematic review is a review in which there is a comprehensive search for relevant studies on a specific topic, and those identified are then appraised and synthesized according to a predetermined and explicit method. In contrast, a meta-analysis is the statistical combination of at least 2 studies to produce a single estimate of the effect of the healthcare intervention under consideration. This workshop aimed to highlight the usefulness and ways of performing a systematic review and meta-analysis in the healthcare industry. Participants got to see a demonstration of how meta-analysis was being generated. Following the theoretical instruction, participants also gained hands-on practice in performing systematic review and meta-analysis. A total of 27 participants attended and more than 95% of participants rated the workshop “excellent” or “good”.

Research Project Management

**Date:** 1 March 2011  
**Speaker:** Dr Jeremy Lim

The management of a research project is full of uncertainty and complexity. Research has substantial elements of creativity and innovation hence predicting the outcomes of research in full is therefore very difficult. The researchers in a project may have many competing demands on their time and they may find themselves competing against each other for individual scientific priority or the right to patent a research result. Therefore, this seminar aimed to help the researchers and project managers/coordinators to increase awareness of multiple issues related to research project management. The key objective of the seminar was to be able to effectively manage the research projects. A total of 28 participants attended the seminar and all rated the seminar “good” or “excellent”.

Research Project Management
The Centre continues to contribute as the main organizer, curriculum planner and teaching faculty of Temasek-Foundation-funded three-year training program on evidence-based healthcare management for Northern India hospital administrators. In the last work year, 22 hospital administrators were trained. Moreover, 5 interns also completed their internship programs in CHSR. These internship programs seek to expose future leaders to healthcare, research and to foster an in-depth understanding of the nuances of healthcare policies.
Temasek Foundation-SingHealth Training-of-Trainers

The Temasek Foundation-SingHealth Training-of-Trainers initiative aims to enhance the management of health care and hospital services in North India through the creation of “islands of expertise” that build the capacity and capability of health care and hospital administrators, managers and clinicians in rational, evidence-based decision-making in health care policy and practice.

Upon training in Chandigarh (India), 22 participants went on to attend the Singapore leg of the training program from the 1st till 4th of November 2010. The workshop was held at the Health Science Authority (HSA) and Kandang Kerbau Women’s and Children’s Hospital (KKH) with faculty members comprising of staff from both SingHealth and Duke-National University of Singapore (Duke-NUS). A wide gamut of topics were covered and they included those pertinent to quality improvement techniques, infection control, financial & accounting, nursing service enhancement, healthcare management principles, effective change, procurement, pedagogy, and simulation modeling. In addition, the participants were brought to a tour of facilities at Singapore General Hospital (SGH) and St Luke’s Hospital. During the four-day workshop, participants also had the chance to brainstorm and present the group projects that they wished to undertake, and had their respective project strategies being evaluated by faculty members.

Participants were also given the chance to evaluate anonymously the usefulness of the workshop. The participants were asked to rate each session of the workshop across a continuous scale. A rating of 1 indicates that the session was most unhelpful, while a rating of 10 indicates the session was most useful to them. The participants rated the sessions an average score of 8.9. The average ratings of the individual sessions were summarized in Figure 1. In addition to rating of individual of workshop sessions, participants were also given the chance to feedback anonymously on various aspects (like value, relevance of contents, etc) of the workshop. Overall, 100% of the participants either agreed or strongly agreed that the workshop was excellent.
With the completion of three TOT workshops, the training initiative progresses to the next phase where selected participants from these workshops are to conduct 16 short courses based on what they have learnt from the TOT workshops. The first short course was conducted in Chandigarh, 11th – 13th May 2010. To date, another four short courses had been conducted. The second short course was conducted at Government Medical College and Hospital (GMCH), Chandigarh, 15th – 17th March 2011 during which representatives from the Temasek Foundation and SingHealth were there to evaluate event. Of a total of 26 registered participants comprising of doctors (16), nurses (6) and hospital administration (2), 24 participants attended the entire 3-day course with all participants from either Postgraduate Institute of Medical Education and Research (PGIMER) and GMCH.

A total of 17 training sessions were conducted by eight trainers from PGIMER and GMCH, all of whom were doctors with the majority being Assistant and Associate Professors. All the trainers came from the first batch of TOT participants trained during 23rd – 26th May 2009 (India) and 17th – 20th June 2009 (Singapore). A wide range of topics that focused on evidence-based health care management were taught in the second short course. Lessons were well structured with a mix of lectures and group-interactive activities. The course reading articles and group exercises were related to hospital issues that were pertinent to the Indian setting. Overall, the short course trainers were eloquent and knew their materials well. They were confident in their presentations, and competent and knowledgeable in answering the many questions that followed in the Question and Answer (Q&A) session. The high level of enquiry from trainees was a great reflection of engaging lessons and also of the trainees’ enthusiasm to gain knowledge.

Due to overwhelming demand from the participants (nursing personnel from Chandigarh hospitals), the third short course was held in parallel with the forth one on 27th – 29th May 2011 in Chandigarh with one staggered half a day after the other. Due to the parallel sessions, the trainers had to conduct their respective training sessions twice. Nevertheless, these two short courses were among the most successful workshops that our Indian organizers had done. In total, 63 participants attended these two short courses with a few nurses being identified as potential trainers in subsequent short courses.

The fifth short course was held in Ajmer from 10th – 12th June 2011. 40 participants took part in this workshop with trainers from 2nd TOT graduates. Since majority of participants had a nursing background, a faculty member from SingHealth (Nurse Clinician Ang Shin Yuh of Singapore General Hospital) was there to share her nursing experience in Singapore and strategies to improve nursing services. Despite the unfavourable weather condition with the temperature reaching as high as 47°C, it was another well organized workshop.
**Internship Program**

We also provide internship opportunities (both short term and medium term) for both local and international students and actively work with Singapore schools to teach students through service learning projects the methods and techniques used in health services research. Care is taken to match the interests expressed by the student to the projects they are involved in. Students are also encouraged to work on projects of their own and to present their findings at conferences or publish their work in peer-review journals. In particular, the Centre has enjoyed a partnership with Meridian Junior College to provide short term internships for the Outstanding Student Volunteer Attachment Program (OSVAP) over the month of December and longer term internships of six months for Junior College Graduates for four years. Below is the list of interns who had undergone the internship programme with our Centre over the last work year.

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<th>Names</th>
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<td>Kong Mun Yeng</td>
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<td>Ruth Yeoh</td>
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## The Team

### Dr Chow Wai Leng
**MBBS (Singapore), GDFM (Singapore)**  
Assistant Director, CHSR

Wai Leng obtained her MBBS degree from NUS and is a Family Physician by training. She practised as a doctor for 7 years in the various SingHealth institutions before becoming a full-time administrator and health services researcher. Wai Leng previously held concurrent portfolios as Senior Manager of Department of Quality Management in SGH and Centre for Health Services Research at SingHealth from 2007 – 2009. She now heads the Centre for Health Services Research at SingHealth full-time.

Her research interests revolve around research into improving health care delivery to achieve an improvement in outcomes. She is currently involved in research that examines the quality of life of stroke survivors and their caregivers as well as that of breast cancer patients and their partners.

### Dr Oh Hong Choon
**BEng (Chemical), MEng, PhD**  
Manager, CHSR

Hong Choon is an engineering graduate with extensive research experience in domains of chemical supply chain network design, production-distribution planning & scheduling, maritime logistics optimization, and optimization under uncertainty. He joined the Centre for Health Services Research in December 2008 and he hopes to apply and broaden his research experience in the area of optimization, and contribute to healthcare research in fields where operations research is relevant.

Hong Choon graduated with B.Eng (Chemical), M.Eng and PhD from the National University of Singapore. Previously, he has worked as a product engineer in Hewlett Packard Singapore (Private) Limited as well as a research fellow at the National University of Singapore.
Zoe joined CHSR in June 2010 and has previously worked as a pharmacist in hospitals and retail pharmacies, as well as a health economist in the Ministry of Health of Singapore. Her key research areas are health-related quality-of-life studies, cross-cultural adaptation and validation of questionnaires as well as economic evaluation studies.

Zoe graduated with BPharm (Hons) and is a registered pharmacist in both Malaysia and Singapore. She was conferred the Ph.D degree by National University of Singapore with full support of the NUS Graduate Research Scholarship. Her thesis centered on the area of pharmacoeconomics and outcomes research, in particular among patients with hepatitis B.

Dr Tin received his master degree in public health from National University of Singapore Yong Loo Lin School of Medicine in 2007. He then has been working in the SingHealth Centre for Health Services Research (CHSR). Prior to join the CHSR, Tin worked as both public health physician and medical officer in a developing country, Myanmar for 6 years. His primary interests of research area are health outcomes, chronic disease management and ageing population.

Another academic area he is much paying attention to is biostatistics. He has been conducting a series of workshops related to research in SingHealth cluster: research study designs and application of biostatistics in medical research.
Ms Vivian Wang Wei
MASc (Health Informatics)
Analyst, CHSR

Vivian completed her master’s degree in Health Informatics from Nanyang Technological University (NTU) and was a recipient of NTU Research Scholarship. She also obtained a bachelor’s degree in Computer Science from Wuhan University, China.

As a former member of HP Labs, Vivian contributed to the design and development of the Shared Services Platform. Prior to HP, she was the Head of Product Development at DecisionWare, a computer simulation company based in National University of Singapore.

Vivian’s research interest lies primarily in health economics. Her current projects include economics evaluations related to HPV vaccination, diabetic retinopathy screening, genetic testing for colorectal cancer, gefitinib second-line treatment for lung cancer and transradial percutaneous coronary intervention.

Dr Zhang Dali
PhD in Operational Research (UK)
Analyst, CHSR

Dali completed his PhD degree in Operational Research from The University of Southampton. The PhD scholarship is supported by School of Mathematics and School of Management. He also obtained a Bachelor of Engineering and a Master of Engineering from Department of Automation, University of Science and Technology of China, Hefei, China.

Dali’s research experience is in domains of stochastic optimization and simulation, Nash equilibrium problem, and energy policy and markets. He joined Centre for Health Services Research in April 2011. He hopes to contribute his related research experience to healthcare sectors, and broaden his research topics in the area of optimization. Before joining the centre, he has worked as a research fellow in Department of Industrial and Systems Engineering, National University of Singapore. Currently, he is a member of Institute for Operations Research and Management Sciences (INFORMS), The International Association for Energy Economics (IAEE). He was a co-organizer of an invited session in The 8th International Conference on Computational Management Science (CMS2011), 28th–30th April 2011, University of Neuchatel, Switzerland. He is also a reviewer for several operations research journals.
Pavitar is a part-time Research Associate. Her interests are in multi-disciplinary qualitative work involving literature, language, health communication and chronic disease. She is drawn to the use of narrative analysis as a means of understanding the concerns of the chronically ill.

She worked at the Singapore Broadcasting Corporation as a Researcher/Producer previously. She is now undertaking a part-time PhD in Health Research with the Institute of Health Research at Lancaster University, UK, and her research topic is "Living with Inflammatory Bowel Disease: Coping Mechanisms in a Singaporean Population". Pavitar graduated at the top of her class for the BA (English) final exams at the University of Malaya, Kuala Lumpur and subsequently pursued an MA in Linguistics at the University of Leeds, UK.

Shirley joined Centre for Health Services Research as Administrative Assistant in August 2006. She provides general administrative support to the team responsible for doing health services research. She coordinates and trains the part-time surveyors for the many health surveys undertaken by the Centre. She enjoys learning from the young and the old and is excited to be able to contribute to the many projects.
The CHSR team would like to place on record sincere thanks to the CHSR Advisory Committee of Dr. Jeremy Lim, Prof. David Matchar, Prof. Stella Quah and Prof. Åke Blomqvist for the leadership and guidance during their term of service which concluded recently. The Centre is also grateful to the trust, goodwill and support received over the past year from the following project sponsors, partners and stakeholders as well as those whom we might not have mentioned in the list who have supported us in one way or other. Building on this foundation, we will continue our effort in advancing the cause of health services research and in improving healthcare delivery quality.

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