HEALTH SERVICES & OUTCOMES RESEARCH

HSOR

The evidence behind your decisions

2009

National Healthcare Group
Adding years of healthy life

Foreword

The Health Services and Outcomes Research (HSOR) department of the National Healthcare Group (NHG) has continued to excel in what it was set up to do: improve the quality of healthcare by providing the best available evidence for decision making and knowledge translation.

It was established in 2005. The highest level of evidence-based decision support for stakeholders results from the untiring efforts to actively engage stakeholders in the research projects, enabling their findings to stay relevant, timely and virtually indispensable for both policy makers and clinicians. This year's Annual Report offers a glimpse of the diversity in research and decision support HSOR has offered.

2009 has been a busy and fruitful year for HSOR. Its completed projects span many disciplines: evaluation research, medical informatics, health economics and operations research. This has led to 17 publications in both local and overseas peer-reviewed journals: a testimony of its commitment to excellence in research. The Health Services Research (HSR) thematic issue in the Annals, Academy of Medicine, Singapore, received major contributions from the department, marking its dedication to advancing the science of HSR, and actively disseminating valuable HSR findings.

Three staff received the NHG Healthcare Manpower Development Programme (HMDP) overseas training award in the field of Operations Research, Spatial Science and Medical Informatics. The continuous training of our people has enabled the department to use the most updated methodology for its HSR projects.

As part of its steadfastness to build capacity and advance knowledge in Health Services Research, the team organised a HSR symposium held at NHG's 2009 Annual Scientific Congress. This received overwhelming response from the conference delegates. Many other courses organised by the department last year, such as the Operations Research Appreciation Course, were equally well-received by many colleagues within the healthcare setting.

I would like to congratulate the staff of HSOR department for another year of sterling work and dedication.

Prof Chee Yam Cheng
Assistant CEO (Clinical),
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“ Achieving excellence in
Health Services Research ”

Projects

"Health services research is the multidisciplinary field of scientific investigation that studies how social factors, financing systems, organisational structures and processes, health technologies, and personal behaviours affect quality, cost, utilisation and access to health care. The research domains involved include individuals, families, organisations, institutions, communities, and populations." (Academy Health, 2000)

Health services research covers a wide spectrum of activities. Some research may range from why people fall ill and how their conditions can be better managed, to how we can best organise our health services so that patients receive the best possible care. Other areas of study include the costs of health care needs and methodologies to improve health research.

HSOR collaborates with NHG institutions and other agencies to produce research relevant to the needs of decision makers and patients. The success of these efforts is made possible through a team of individuals from different disciplines with a wide variety of skills. Research projects are categorized into four areas that define the scope of our work:

1. Management of Diseases and Conditions
2. Organisation and Delivery of Services
3. Health and Welfare Economics
4. Research Design and Methodologies

HSOR is thankful to the many clinical and ancillary departments, individuals and healthcare leaders for the supportive partnerships and continued belief and confidence in the team.

Chronic care initiatives: What does the evidence show?

Chronic care management becomes a priority with an aging population and an increasing volume of people with long-term conditions. In 2005, a review commissioned by the Surrey and Sussex Health Community found that while initiatives such as disease management programmes, integrated care and self-management education were effective in improving some outcomes, others such as evidence-based care pathways and case management were inconsistent in their effects. In many cases, there were gaps in the literature and insufficient evidence to determine the effectiveness of an intervention on one or more outcomes.

New chronic care initiatives continue to be implemented and it was important to evaluate emerging evidence since the last review, to identify specific interventions or elements that contribute to a successful chronic care management programme.

The Pubmed database was searched from January 2005 to December 2008. Due to the time constraints and the sheer volume of studies, only systematic reviews in the English language were retrieved. 98 publications were included in the review. Majority were based on diabetes (34) and heart failure (16).

There continues to be support for broad managed care programmes and integrated care. Common components amongst effective programmes included a structured follow-up, multidisciplinary team approach, and shared care. Case management, in heart failure and diabetic patients, had a positive impact on patient experience and quality of care. In addition, follow-up systems such as disease registries that provide feedback to healthcare providers, and learning and sharing among health professionals were important components for effective chronic care management.

There was evidence to support that educational programmes on self-management for patients were beneficial in improving outcomes. The results for the type of setting (group or individual), educator (professional or lay person) and mode of delivery (face-to-face or technology) were inconsistent. The effectiveness of the intervention varied across different chronic conditions and outcomes studied. There was insufficient support to recommend involving patients in the decision making process.
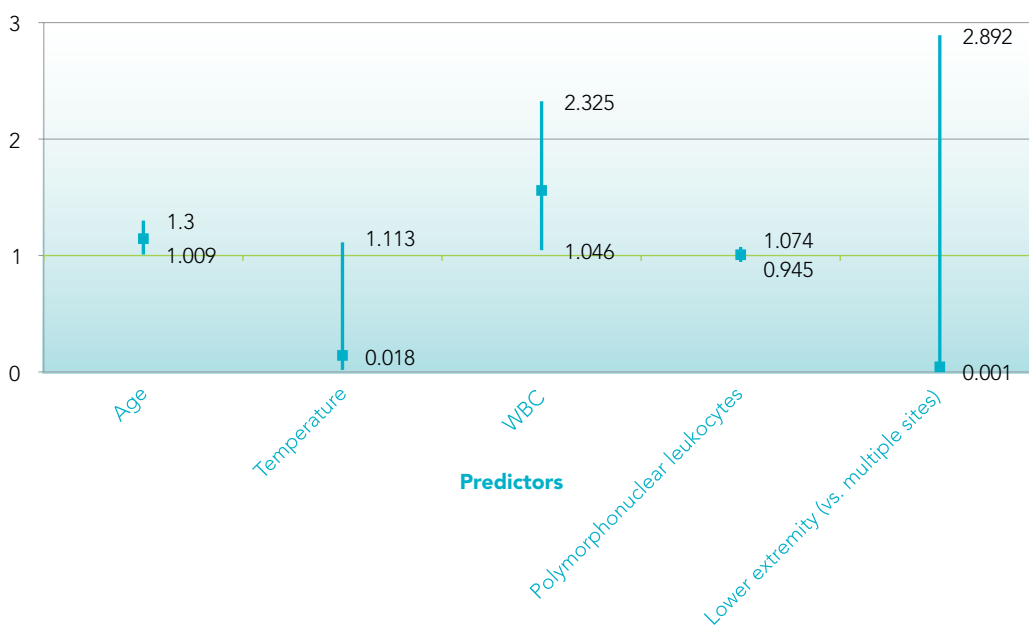
As the review was not exhaustive, some relevant literature may have been missed. Most of the evidence were based on diabetes and heart failure studies, evidence was lacking for other chronic conditions. Across studies, the terminology, heterogeneity, and brevity used to describe the interventions posed a challenge in pooling the evidence and identifying specific components which were effective. Components of an effective chronic disease management programme were identified, albeit broadly, details would require more studies on homogenous interventions, outcomes and populations.

Evaluation of cellulitis management at an observation unit

Cellulitis is a common condition which is relatively easy to manage. However, as antibiotic treatment is administered intravenously, it often requires a short hospital stay. Cellulitis is commonly included in the list of admissible conditions in observation units (OU) worldwide. This study aimed to describe the epidemiology of cellulitis, outcomes of cellulitis management, and predictors of a positive blood culture for cellulitis in an observation unit in the United States.

A primary study was conducted in an OU of an acute care hospital in the United States from January 2006 to December 2007. Data on the following independent variables were prospectively collected by an emergency department physician: demographic characteristics of patients with cellulitis, comorbidities, history of prior treatment, selected physical and laboratory findings. Data on the following dependent variables were likewise prospectively collected: cost, reattendance, treatment failure, and a positive blood culture.

There were 435 patients included in the study, 46% of whom were males and 54% females. The most common comorbidities observed were hypertension (35.0%) and diabetes (23.7%). Over 10% of patients with cellulitis had a history of failed prior treatment or recurrent cellulitis/abscess. Mean charges and net revenue were significantly greater for those admitted to the general ward than for those admitted to the OU. Multivariate analysis showed no significant difference in reattendance rates between patients admitted at the OU and those in the general ward (p>0.05). Increasing age and WBC were significantly associated with a positive blood culture.
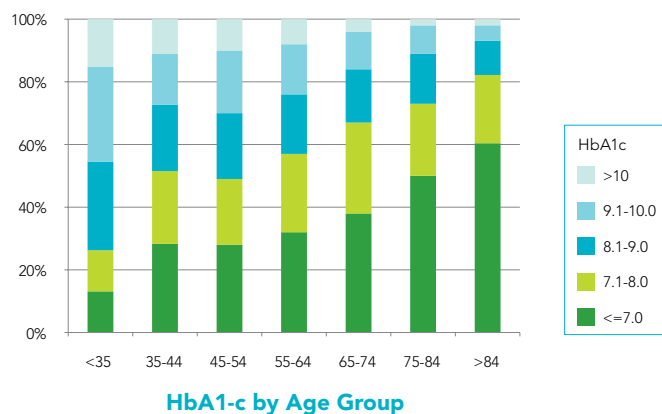

95% Confidence Intervals of Odds Ratios for Predictors of Positive Blood Culture in Patients with Cellilitis

Glycaemic and cholesterol control of Type 2 diabetic patients attending Specialist Outpatient Clinics in Singapore

The Specialist Outpatient Clinics (SOCs) of the three acute hospitals in NHG, treat over 11,000 patients with diabetes mellitus annually. The aim of this study was to determine the glycaemic and cholesterol control of patients with Type 2 Diabetes Mellitus (T2DM) at these SOCs.

All patients with T2DM who attended the hospital SOCs in January 2009 were included in the study. These patients had been on follow-up at the same clinic for at least 12 months.

In total, there were 3,420 T2DM patients with more females (53%). There were disproportionately more Indians (14.1%) and fewer Chinese (66.3%) than the general population. The mean ages of male and female were 61.8 and 64.9 years respectively. The proportion of patients with "optimal" HbA1c ($\leq$7%) and LDL-c (<2.6mmol/L) control increased with age. The Chinese had better HbA1c and LDL-c control whilst the Malays and Indians had the poorest control for LDL-c and HbA1c respectively. There was no gender difference.

HbA1-c by Age Group

The control of HbA1c and LDL-c among T2DM patients improved with age. Younger patients and the Malay and Indian subgroups had greater potential to achieve "optimal" glycaemic and cholesterol control and reduce the risk of developing micro- and macro-vascular complications over time. While the older patients achieved better HbA1c control than younger ones, clinicians should remain mindful of side-effects such as hypoglycaemia among those with very tight glycaemic control.
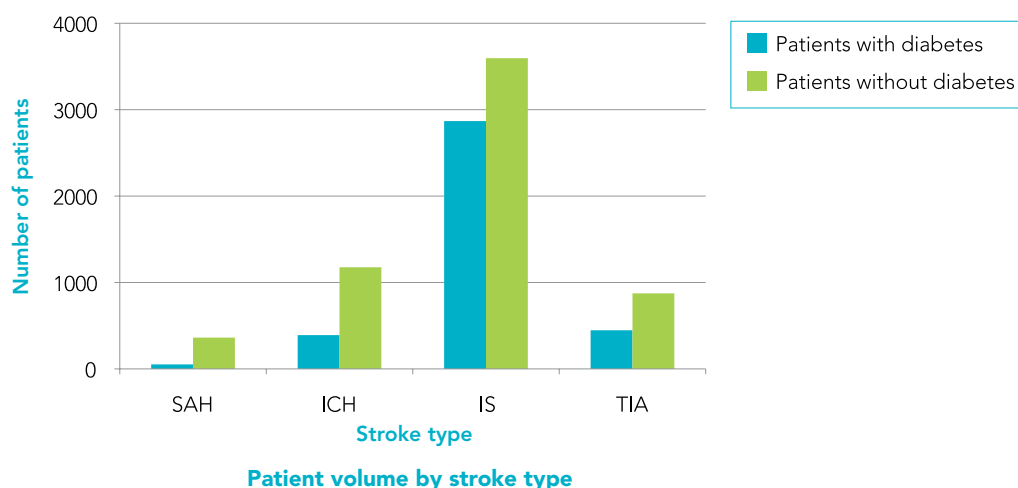
Impact of Diabetes Mellitus (DM) on the healthcare utilisation and clinical outcomes of patients with stroke in Singapore

Stroke is one of the leading causes of mortality and morbidity in developed countries. This study aimed to assess the impact of diabetes mellitus (DM) on the healthcare utilisation and clinical outcomes of patients with acute stroke.

A retrospective study was conducted. All patients who were admitted for the first time with a primary diagnosis of acute stroke to the National Healthcare Group (NHG) hospitals between January 2005 and June 2007 were included. The study population was divided into two groups: patients with and without DM, and were followed up for 1 year. Both univariate and multivariable analyses were applied to compare the hospital length of stay (LOS), hospitalisation costs, mortality, hospital readmissions, as well as stroke recurrence, between the DM and non-DM groups.

There were 9,766 patients and 38.5% had DM. For the index admission, ischaemic stroke (IS) and transient ischaemic attack (TIA) patients with DM stayed 1 day and 0.6 day longer, and incurred 10% and 26% higher hospital cost respectively, compared to their counterparts without DM. In the 1 year follow-up, IS and TIA patients with DM had more hospital readmissions. The mortality rate in IS patients with DM was 24% higher. After risk adjustment, subarachnoid haemorrhage (SAH) patients with DM had more readmissions. Intracranial haemorrage (ICH) and IS patients with DM had poorer outcomes in all but the stroke recurrence indicator.

This study showed that IS, TIA and ICH patients with DM as a co-morbidity had higher mortality, stayed longer in hospital and incurred higher hospitalisation costs within a year from their first stroke,compared to stroke patients without DM. With the exception of TIA, all stroke patients with DM were more likely to be readmitted within the first year post-stroke. Future studies and specific interventions should be targeted at reducing mortality and readmissions in stroke patients with DM.

Patient volume by stroke type

Predictors of frequent attenders of Emergency Department at an acute general hospital in Singapore
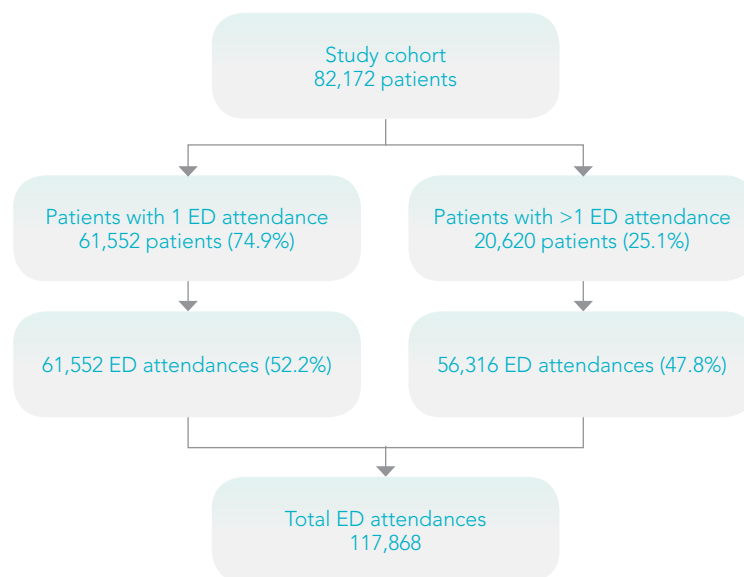
Globally, emergency department (ED) attendances have increased significantly over the years. In Singapore, EDs are facing a similar increasing trend in the number of attendances, frequent overcrowding and boarding.

Tan Tock Seng Hospital (TTSH), the second largest acute care hospital in Singapore, has the highest ED attendances. Not much is known about the extent of re-attendances and its contribution to the increasing workload. The aim of this study was to describe the extent and characteristics of ED re-attendances and identify factors associated with re-attendances. The results will also serve as a baseline for evaluation of future interventions.

Patients who attended ED from 1 January to 31 December 2006, without prior attendance in the preceding 12 months (index attendance), were tracked for 12 months. Variables included in the analysis were age, gender, race, date and time of attendance, patient acuity category scale, mode of arrival, distance to ED and diagnosis based on ICD-9CM code. Frequent attenders were patients who attended the ED five times or more for any diagnosis within 12 months.

There were a total of 82,172 patients in the study cohort, who accounted for a total of 117,868 visits within 12 months, of which 35,696 (30.3%) were repeat attendances. A total of 1,595 (1.9%) patients were frequent attenders responsible for 8% of all repeat attendances. Stepwise multivariate logistic regression found patients 75 years and older, males, non-Chinese ethnic groups; Sundays and Mondays, time of the attendance from 16 hours to midnight, distance to ED, COPD, heart failure and acute respiratory infections were significantly associated with frequent attendances.

Elderly patients with chronic medical conditions make up an increasing proportion of the workload of ED. A systems approach and disease and case management programmes are interventions recommended to stem this.

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                    ┌─────────────────────┐
                    │    Study cohort     │
                    │   82,172 patients   │
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┌─────────────────────────┐      ┌─────────────────────────┐
│ Patients with 1 ED      │      │ Patients with >1 ED     │
│ attendance              │      │ attendance              │
│ 61,552 patients (74.9%) │      │ 20,620 patients (25.1%) │
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│ 61,552 ED attendances   │      │ 56,316 ED attendances   │
│ (52.2%)                 │      │ (47.8%)                 │
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                    │ Total ED attendances│
                    │      117,868        │
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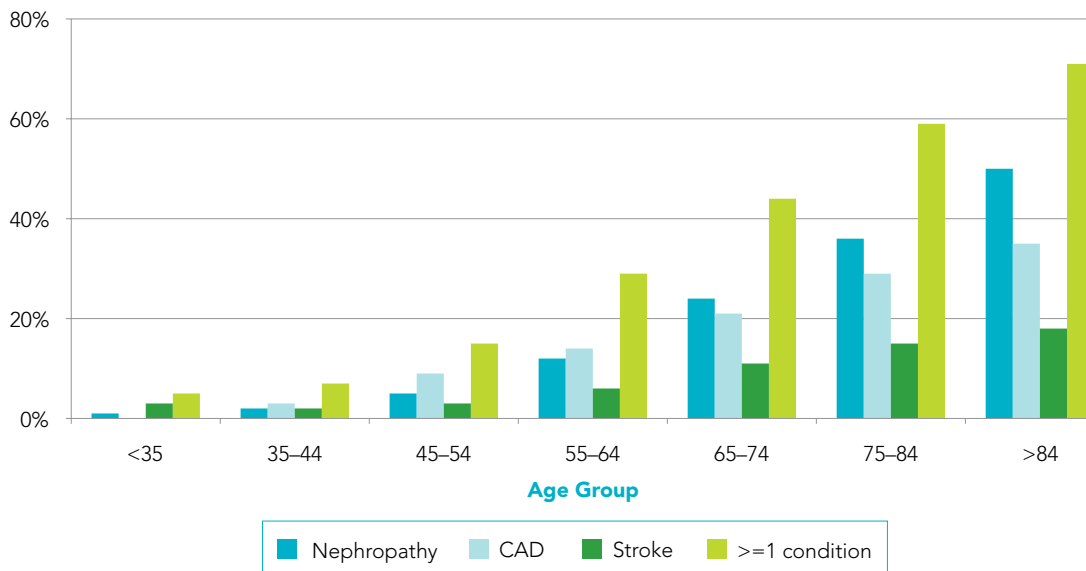
ED re-attendances by study cohort

Prevalence of vascular complications in Type 2 diabetic patients at public primary care clinics in Singapore

Coronary artery disease (CAD), stroke and nephropathy are preventable complications of diabetes mellitus. However, the prevalence rates of these complications among the patients with diabetes mellitus in Singapore are unknown. The aim of this study was to determine the prevalence of CAD, stroke and nephropathy among the patients with Type 2 Diabetes Mellitus (T2DM) attending the public primary care clinics in Singapore.

A cross-sectional study was conducted on all T2DM patients who attended the nine NHG polyclinics in January 2009. The patients had been on follow-up for diabetes care at the same clinic for at least 12 months. Data was extracted from the National Healthcare Group (NHG) Chronic Disease Management System (CDMS). The prevalence rates of CAD, stroke and nephropathy were compared by gender, ethnic group and age.

There were 18,118 T2DM patients with more females (55.3%). The prevalence of CAD, stroke and nephropathy were 18% (0-35%), 9% (3-18%) and 18% (1-50%) respectively. CAD and stroke prevalence rates were higher in males than females (21% versus 15%), but this was reversed for nephropathy prevalence (17% versus 20%). CAD, stroke and nephropathy prevalence rates were highest in Indians (22%), followed by Chinese (10%), then Malays (23%) respectively. 35% (6,332) of patients had at least one vascular complication. Prevalence increased with age.

Prevalence of CAD, stroke and nephropathy increased with age with different ethnic predominance. It is imperative to control cardiovascular risk factors well, especially in younger T2DM patients, to reduce the development of micro- and macro-vascular complications over time.

Prevalence of nephropathy, CAD and stroke in patients with T2DM.

A pure loss Queueing Model for endoscopy recovery bed planning

With an increasing patient workload, the Endoscopy Centre of Tan Tock Seng Hospital planned to expand the number of endoscopy theatres from four to six. Patients given sedation during the procedures would require post-recovery beds and close monitoring. Hence sufficient bed capacity would be essential for patient safety. This study aimed to compute the number of post-recovery beds needed.

5 days of data (318 records) were studied to analyse endoscopy patients' arrival rates, procedure and recovery time, and percentages of patients on sedation. A series of "M/G/s/s pure loss" queueing models were constructed to compute the probability that a patient could not find a bed post-procedure. This model was validated using current data.

The four endoscopy theatres were previously utilised by three departments for various procedures. On average, 60% of patients required sedation, and this could vary according to the different procedures performed by the different departments. Average procedure duration was 32 minutes and post-procedure recovery took 75 minutes. With six fully operating endoscopy theatres, a model without considering randomness would suggest 8.4 recovery beds (75/32*6*0.6). The queue model showed that 15 beds were needed to ensure most patients (>99%) would have a recovery bed post-procedure. When the percentage of patients on sedation varied from 30% to 80%, the number of beds needed changed from 10 to 19.

The queueing model allows one to address the randomness aspects, or else the true demand would be underestimated and patient safety compromised. Furthermore, the study also revealed that one way to reduce peak demand was via levelling of workload.

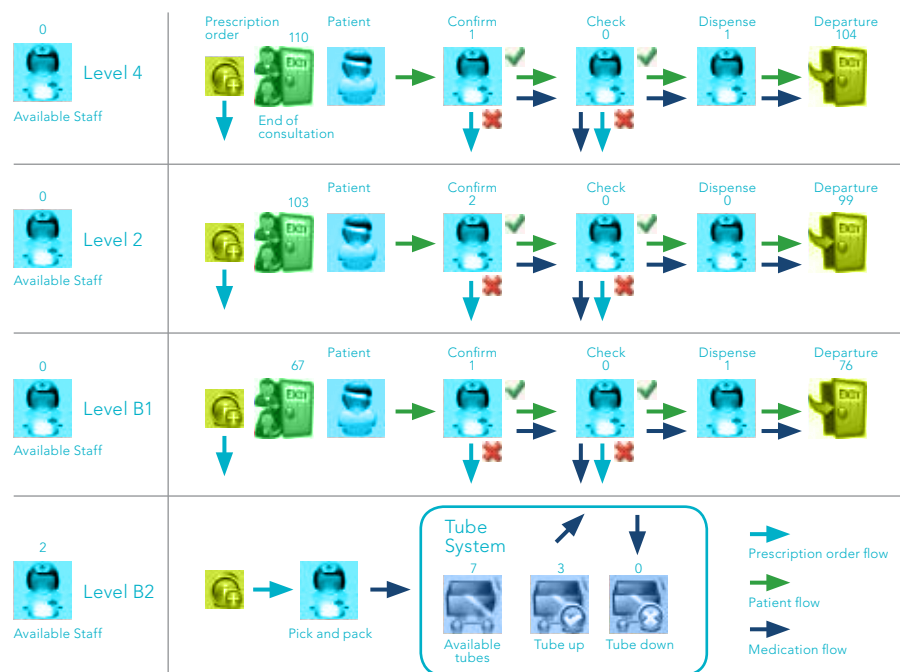| Prob of not finding a bed after Ops		Demand = # of theatres *% req beds * Recovery time/Ops duration						
		8	9	10	11	12	13	14
# of Recovery beds	22	0.0%	0.0%	0.0%	0.1%	0.3%	0.7%	1.2%
	21	0.0%	0.0%	0.1%	0.2%	0.6%	1.1%	2.0%
	20	0.0%	0.1%	0.2%	0.5%	1.0%	1.8%	3.0%
	19	0.0%	0.1%	0.4%	0.8%	1.6%	2.8%	4.4%
	18	0.1%	0.3%	0.7%	1.5%	2.7%	4.3%	6.3%
	17	0.2%	0.6%	1.3%	2.5%	4.1%	6.2%	8.6%
	16	0.5%	1.1%	2.2%	3.9%	6.0%	8.6%	11.5%
	15	0.9%	2.0%	3.6%	5.9%	8.6%	11.6%	14.8%
	14	1.7%	3.4%	5.7%	8.5%	11.7%	15.1%	18.6%
	13	3.1%	5.4%	8.4%	11.9%	15.5%	19.2%	22.8%
	12	5.1%	8.3%	12.0%	15.9%	19.9%	23.7%	27.5%
	11	8.1%	12.1%	16.3%	20.6%	24.8%	28.7%	32.4%
	10	12.2%	16.8%	21.5%	26.0%	30.2%	34.1%	37.7%

Look up table to check probability of Loss (not able to find an available bed after operation) with various demand and supply scenarios.

A simulation analysis of satellite pharmacy setup in Tan Tock Seng Hospital

Tan Tock Seng Hospital is exploring the options of setting up satellite pharmacies at every level of the Specialist Outpatient Clinics (SOC) for better accessibility. The aim of this study was to evaluate the impact of setting up satellite pharmacies on patient's wait time and manpower requirements to aid planning.

Discrete event simulation models were constructed using Simul8 2008 to simulate the workflows of having satellite pharmacies versus a centralised pharmacy. Data collected to input into the model included daily prescription load; time for receiving prescriptions, confirmation, picking and packing, checking, dispensing, and billing; timing of pneumatic tube system; and rework rate. Different manpower configurations were tested to ensure that the 95th percentile patient waiting time was within 15 minutes.

Workflow of the satellite pharmacy in the simulation model

Simulation results showed that additional staff would be needed to meet the target patient's wait time if packing were done at the satellite pharmacies rather than at the centralised pharmacy. Pre-packing significantly reduced the average patient waiting time but increased rework rate. A sensitivity analysis showed that pre-packing performed better when rework rate was less than 25%. The 95th percentile patient waiting time increased significantly when rework rate was high.

More manpower was needed in a satellite pharmacy set-up if the same level of patient's wait time was desired. Pre-packing was suggested to streamline the process only if the rework rate was relatively low.

Organisation & Delivery of Services

Application of Discrete Event Simulation in improving long waiting time/ overtime in Specialist Outpatient Clinics

Typical problems in the daily operations of Specialist Outpatient Clinics (SOC) include long patient queue/waiting time and long doctor's overtime hours. In this study, Discrete Event Simulation (DES) was applied to analyse the bottleneck of current workflow and evaluate new appointment schedules which were aimed to improve both patient queue/waiting time and doctor's overtime hours.

A DES model using *Simul8 2008 Professional* was built to simulate the workflow of a SOC in the National University Hospital (NUH). Three types of consultation room settings were considered: 1-doctor, 2-doctor and 3-doctor consultation rooms. Uncertainties considered in the DES model included variability in consultation time, patient arrival time and no-show rates. Performance of an appointment schedule was measured by the following key performance indicators: patient queue/waiting time, doctor's clinic utilisation hours and his/her overtime hours. Data from both the old and new appointment schedules were collected to conduct performance comparison.

Workflow of the SOC in the simulation model

The DES model identified two factors in old appointment schedules which caused long patient queue/waiting time and doctor's overtime hours: the uneven distribution of appointment slots within the session and workload imbalance across different sessions. The proposed new appointment schedules took these into consideration by adjusting the appointment slots and workload distributions accordingly. Implementation results showed that the new schedules significantly outperformed the old schedules.
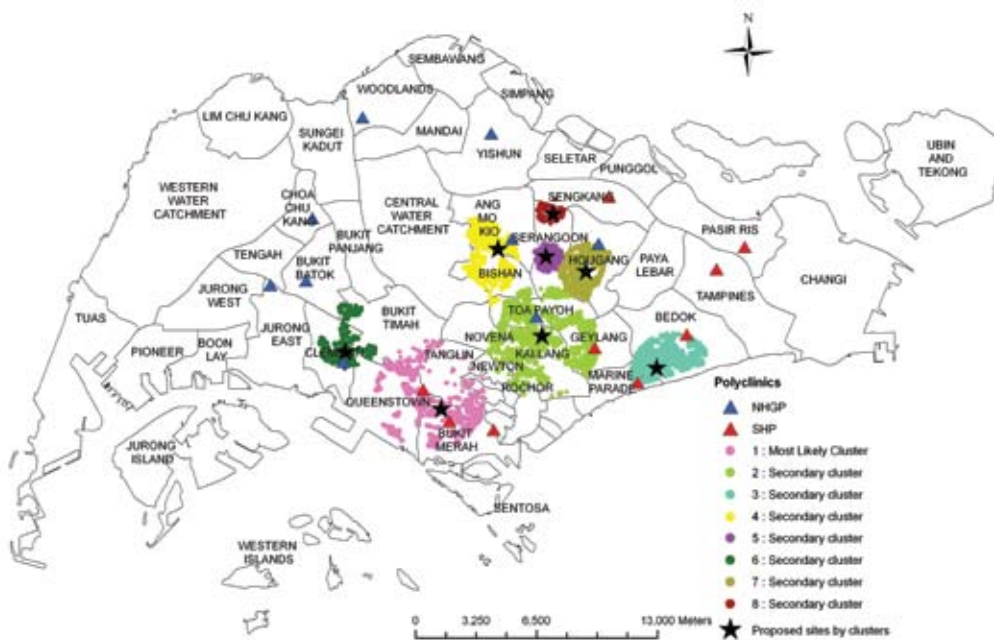
Detection of clustered sites of elderly polyclinic patients using Geographic Information System for future planning of health services

The majority of elderly patients with chronic diseases in Singapore are high utilisers of polyclinic services. Polyclinic services are important for elderly patients as they are affordable and easily accessible. This study aimed to identify clustered sites of elderly polyclinic patients using Geographic Information System (GIS) for future planning of health services.

A national database containing 3 million polyclinic consultations in 2006 were geo-analysed using ArcView GIS. Residential postal codes of patients aged 65 years and above were mapped by geographical zones. Global cluster analysis was performed to show spatial auto-correlation between geographical zones using Moran's I statistic. Local cluster analysis using Satscan v8.0 was further performed to identify the clustered sites of elder patients. In this study, we defined a spatial cluster as 50% of population within 3 kilometres radius from clustered grid points.

About 0.8 million (22.1%) polyclinic consultations were made by elderly patients aged 65 years and above in 2006. Their utilisation rate was four times higher than the reference group (aged 15–44years). Global cluster analysis using Moran's I confirmed the existence of clusters of elderly patients (Moran's I = 0.19; P<0.001). Local cluster analyses showed that the proportion of elderly patients belonging to clustered sites were mainly from Bukit Merah (13.9%), Toa Payoh (12.4%), Queenstown (10.9%), Geylang (8.5%), and Kallang (8.3%). The most likely cluster, which is the cluster least likely to be due to chance, and secondary clusters accounted for more than 330,000 polyclinic visits, implying that these were potential zones for future health facilities for elderly patients.

GIS offers location intelligence and it could be applied to detect clustered sites of specific target groups for siting of future new healthcare facilities; and for planning of right types of services at sites with known patient profiles.

Spatial distribution of clusters for elderly polyclinic patients by DGP zones, 2006

Estimating impact of service partitioning on patient wait time using Queueing Theory

Resources should be pooled and shared among competing demand, especially if the demand has significant variability. For example, inpatient beds, pharmacy units and imaging centers when centralised, will absorb ups and downs in demand that varies above and beyond the time of the day and day of the week. But partitions among inpatient beds are necessary for clinical, patient privacy and financial reasons, resulting in separation by disciplines, gender and class. And when additional partitions are enforced, the bed wait time will suffer further. Operations managers want to quantify the effect of this partitioning, and if necessary, estimate the additional inpatient bed capacity to restore bed wait times to acceptable levels. One such instance is the need to partition inpatient beds for nosocomial infection control. The purpose of this study was to quantify the operational impact due to Methicillin-Resistant Staphylococcus Aureus (MRSA) control.

Methods for analysis included actual controlled experiments or analytical tools that included mathematical tools like queueing analysis or computer based discrete event simulation. In this work, a simple queueing model was proposed to estimate the additional bed capacity required. Queueing models were based on a continuous time discrete state stochastic process. In general, the variation of the bed request time and length of stay were considered. Bed wait time, colonisation rate, bed capacity and average length of stay (ALOS) of cohorted and non-cohorted patients were compared.

The bed wait time and queues for patients will be longer as each patient waiting for admission will have to wait for a smaller pool of inpatient beds. Queueing analysis was applied to study the impact in a local hospital where the average Emergency Department bed wait time was 2 hours and overall ALOS was 5 days. When the cohorted patients formed about 5% and their ALOS was 8 days, and a cluster* level cohorting was implemented, an additional bed capacity of 5.4% was required to restore bed wait time back to 2 hours. Hospital level cohorting will require an additional bed capacity increase of only 1.6% due to greater pooling of resources.

Using the appropriate queueing model, the impact of bed wait time due to MRSA infection control in a typical hospital setting can be estimated. Queueing theory offers powerful techniques that relate variability in demand, capacity and patient wait time. They are useful for healthcare decision modeling in resource allocation where variation is significant.

Input parameters		Additional bed capacity req'd (%)	
Cohort demand (%)	Cohort ALOS	Scenario 1 Cluster* level cohorting	Scenario 2 Hospital level cohorting
5%	8	5.4%	1.6%
10%	12	7.7%	2.1%

Impact of different cohorting measures on bed wait time.
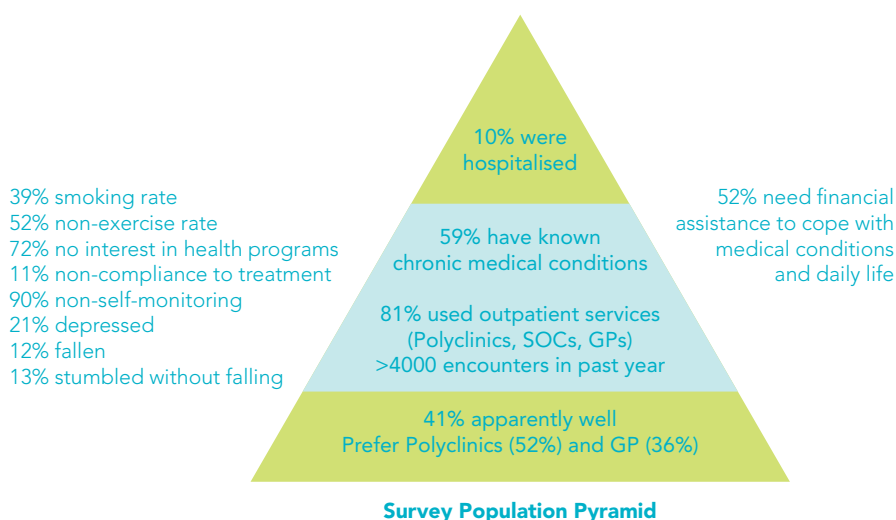*Cluster refers to the grouping of specialties within NUH, eg medicine, surgery and oncology*

Community-based survey of knowledge, self-empowerment and health-service utilisation for chronic diseases

Singapore's healthcare system evolved on the principle of ensuring that good and affordable basic medical services are available to all. Several medical schemes are available to help Singaporeans co-pay their medical expenses, yet the efforts are compounded by an aging population with increased healthcare needs, changing disease patterns and increasing cost of healthcare. The project aimed to provide underprivileged residents who require chronic disease management with structured, reliable and appropriate care.

The survey was conducted on a target cohort of Toa Payoh residents living within four chosen blocks of 1-2 room HDB flats. The survey's objectives were to determine, the prevalence of eight chronic diseases (hypertension, diabetes, hypercholesterolemia, heart disease, stroke, renal failure, asthma and chronic obstructive pulmonary disease), ability to self-manage one's chronic diseases, extent of and barriers to health service utilisation, prevalence of risk factors, functional status and risk of falls and, receptiveness to proposed health programmes.

A total of 778 residents participated in the survey. 48% (376) had at least one of the eight chronic diseases, 11% (85) had other chronic diseases such as mental and musculoskeletal conditions. 41% (317) had no known medical conditions. Residents with chronic diseases mainly sought treatment at the polyclinic (61%) for cost and accessibility reasons. Contrastingly, residents with other chronic conditions sought treatment at Specialist Outpatient Clinics (54%) because of doctor-related factors and the belief that their condition can be better managed.

While majority of the residents were functionally independent, 35% (130) with chronic diseases had fallen or stumbled without falling in the past 1 year. 27% (100) often felt sad or depressed. 36% (282) were willing to participate in at least one health programme. The common reasons for non-willingness to participate in health programmes were that they were not interested or had no time.
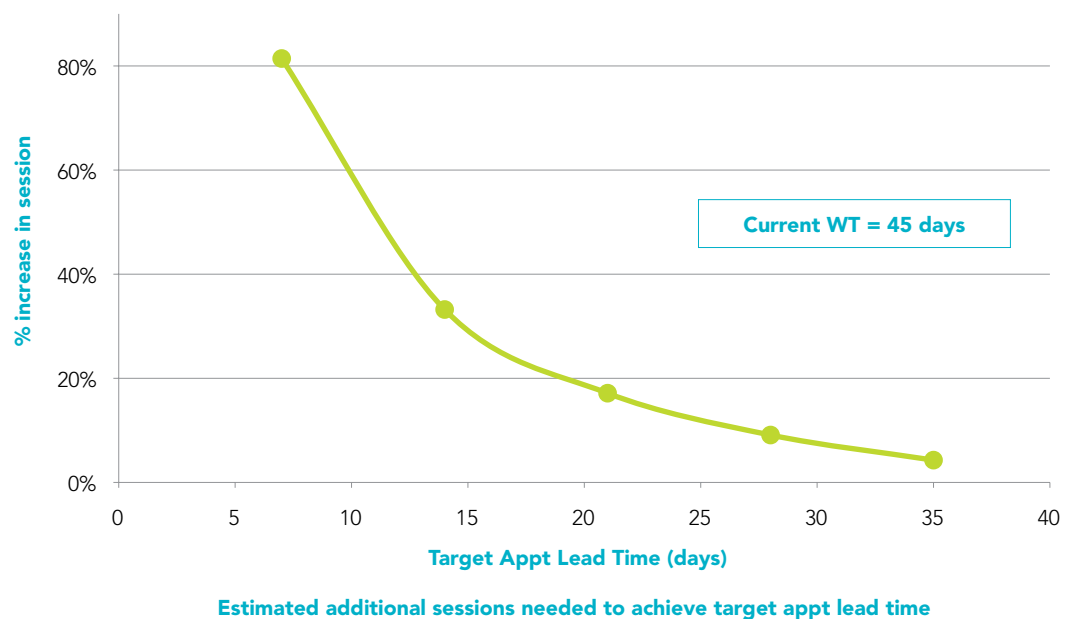

39% smoking rate
52% non-exercise rate
72% no interest in health programs
11% non-compliance to treatment
90% non-self-monitoring
21% depressed
12% fallen
13% stumbled without falling

10% were hospitalised

59% have known chronic medical conditions

81% used outpatient services (Polyclinics, SOCs, GPs) >4000 encounters in past year

41% apparently well Prefer Polyclinics (52%) and GP (36%)

52% need financial assistance to cope with medical conditions and daily life

Survey Population Pyramid

Specialist Outpatient Clinics (SOC) capacity planning

Queueing theory is the study of waiting lines using mathematical techniques. It can be used to estimate capacity needed to achieve certain waiting time targets. In the healthcare setting, Specialist Outpatient Clinics (SOC) generally have a high appointment lead time (waiting time for first appointment). With an ageing population, the demand for SOC workload is expected to increase. The purpose of this study was two-fold. The first part was to estimate the increase in demand for Tan Tock Seng Hospital (TTSH) SOC in 2015, taking into consideration the opening of Khoo Teck Puat Hospital (KTPH) in 2010. The second part was to estimate the additional capacity needed to reduce the current appointment lead time for TTSH.

Organic growth due to population increase and ageing was first computed. Then catchment loss due to the opening of KTPH was estimated using the Geographical Information System (GIS). It was projected that by 2015, there would be a 20% increase in demand for SOC from 2008. The queueing model was then applied to find the capacity needed to reduce the appointment lead time.

Using the current median appointment lead time of about 45 days as a baseline for estimation, the SOCs will need another 10% more sessions to decrease the lead time to 28 days, and 33% more sessions to decrease the lead time to 14 days. A range of 30% to 60% more sessions would be needed to reduce the appointment lead time to between 10 and 15 days. The queueing model showed that the relation between utilisation and lead time was a nonlinear one.

Estimated additional sessions needed to achieve target appt lead time

Using spatial accessibility to identify polyclinic service gaps and volume of under-served population in Singapore using Geographic Information System

Primary care services are the first level of contact between community and the national health system, providing the continuity of care. Accessibility to primary healthcare facilitates overall population health; it is important to address spatial inequality that exists in a healthcare system and identify service gaps, if any. This study aimed to examine spatial accessibility to polyclinics, and to identify service gaps and optimal sites using the Geographic Information System (GIS) as an aid for future planning.

A national database containing 3.6 million polyclinic visits in 2006 were geo-analysed using ArcView GIS. Patients' travel impedance to the nearest polyclinic was computed to identify areas with the lowest spatial accessibility and highest volume of under-served population. In areas with high volume of under-served population, central sites with the minimum accumulated distance impedances to the selected residences were identified using GIS as optimal locations for future new polyclinics.

The geographical catchment of every polyclinic was highly localised, 73.5% patients visited the nearest polyclinic. Patients' average travel distance to the nearest polyclinic was 2.4 kilometres. About 0.4 million visits were contributed by patients who had to travel more than 4 kilometres for the nearest polyclinic services. Of these, Jurong West and Sembawang patients constituted 27.8% and 14.1%, respectively, which signaled the existence of service gaps. ArcGIS was used to identify optimal sites with the minimum accumulated distance impedances to this under-served population. If new facilities were set up at these identified sites, volume of visits by Jurong West and Sembawang patients who could access the nearest polyclinic within 4 kilometres Euclidean distance from their residence would total at 123,000 and 93,000, respectively.

Jurong West and Sembawang were ranked as top areas with poor spatial accessibility to polyclinic services, future efforts in polyclinic planning should take this into consideration to maximise patients' benefits.

**Polyclinic patients with road distance to the nearest polyclinics
>4km and proposed sites for new polyclinics**
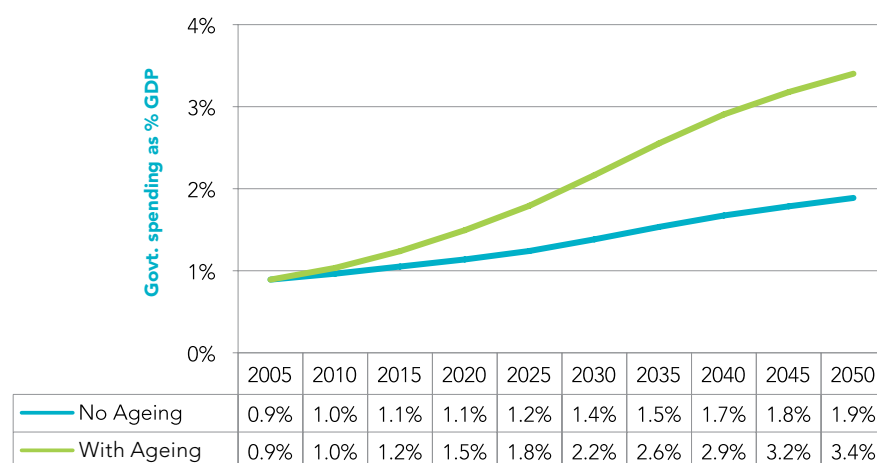
" Improving quality
of healthcare "

Impact of an ageing population on government healthcare expenditure in Singapore

Singapore is unique amongst developed countries in achieving excellent health outcomes at a low fiscal cost. In 2005, Singapore spent 3.7% of Gross Domestic Product (GDP) on healthcare, of which 25% was contributed by the government. With the share of persons aged 65 years old and above estimated to increase from the current 8.5% to 19% in 2030 and to 27% in 2050, we estimated the growth in the public health care burden by projecting public healthcare spending as a share of GDP in Singapore over the period 2005 to 2050.

In this study, public healthcare spending and GDP were modelled as functions of their structural determinants within a growth accounting framework. The results of the model suggest that public healthcare expenditure as a share of GDP will double by 2030 and increase by almost three-fold by 2050. As the last of post-war baby boomers move into the 65 years or older in 2030, population ageing is estimated to account for between 43% and 61% of increase in government healthcare burden between 2005 and 2050. Baseline projections show that government spending will reach 1.8% in 2025 and 3.4% of GDP in 2050. This is lower than countries with similar share of 65 years or older population and is approximately half of the current OECD average of 6.4%.

Sensitivity analyses showed that higher fertility rates will have little impact on the health care burden while medical inflation and the rate of expansion of health care services such as the addition of new surgical procedures or pharmaceutical drugs will significantly influence public health care spending.

In conclusion, although population ageing is irreversible and will cause a rise in the public healthcare burden, the results suggest that the government can play an active role in keeping the healthcare burden sustainable through prudent assessment of new health technologies and effective cost containment.

	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
No Ageing	0.9%	1.0%	1.1%	1.1%	1.2%	1.4%	1.5%	1.7%	1.8%	1.9%
With Ageing	0.9%	1.0%	1.2%	1.5%	1.8%	2.2%	2.6%	2.9%	3.2%	3.4%

Impact of Ageing on Public Healthcare Expenditure

Self-monitoring of blood glucose in Type 2 Diabetes Mellitus: A systematic review of economic evidence

Good control of blood glucose is crucial to the prevention and delay of diabetes-related illnesses. Self-monitoring of blood glucose (SMBG) is an intervention which helps improve glycaemic control by collecting detailed information pertaining to blood glucose levels, at many time points, to aid adjustment of therapeutic regimes and to help individuals adjust their dietary intake, physical activity and insulin doses. Much literature examining the effectiveness of SMBG in Type 2 Diabetes Mellitus (T2DM) exists. Economic evidence surrounding the use of SMBG in T2DM, however, is lacking. The objective of this study therefore was to perform a systematic review of economic evaluations of SMBG in T2DM patients.

An extensive and exhaustive search to identify published reports was conducted for the time period between January 1990 and January 2009. To be included, studies had to meet the following inclusion criteria:

- Study participants had to be adults suffering from T2DM.
- The study intervention was the use of SMBG as an intervention to control blood glucose.
- The study had to make an attempt to compare, in terms of costs and outcomes, strategies involving SMBG compared with no SMBG in the management of T2DM.
- The study outcomes were in terms of cost-effectiveness and cost-utility i.e. cost per life year saved or cost per quality adjusted life year (QALY) saved.

Five studies met the review criteria. Three of the studies were model-based analyses assessing the long-term cost-effectiveness of SMBG (8–40 year analyses) and all of them concluded that SMBG was cost-effective in their various settings. Two further analyses were conducted as primary economic evaluations and assessed short-term cost-effectiveness (1 year). Conversely, their results found SMBG to be more costly with no associated improvement in blood glucose.

The economic evidence surrounding SMBG in Type 2 diabetes remains unclear. For the most part, included studies found SMBG to be cost-effective though the long-term analyses were extremely sensitive to data inputs, the time-frame considered and model assumptions. Conversely, results of the primary economic analyses showed unfavourable cost-effectiveness results. Data were reported by subgroup and it is likely that SMBG in drug and insulin treated patients may be cost-effective. The current evidence-base, with its lack of consensus and small number of well-conducted studies, should be viewed as hypothesis generating rather than providing conclusive evidence of the cost-effectiveness of SMBG.

Agreement between hospital medical records and patient-reported functional status

Physical function has been demonstrated in previous studies to be important risk-adjustors for hospital outcomes for elderly patients. Routine documentation in medical records while easily accessible may contain inconsistent and incomplete information for adequate adjustment. This study aimed to determine the agreement between patient-reported physical functional status and the documentation by clinicians in the medical record.

Patients (aged 65 and older) admitted to the General Medicine department of an acute care hospital between April and October 2008 were studied. Patient-reported pre-morbid and at-admission functional status measured based on dependency in any of the five activities of daily living (ADLs) items (feeding, dressing, grooming, toileting and bathing), transferring and walking, were compared with those extracted from the medical notes. Results were reported using positive and negative agreement, and kappa statistics.

A total of 1,402 patients were studied. Due to incomplete documentation in medical records, missing data ranged between 1.3% and 12.7% across the three measures. Positive agreement was 81%, 82% and 42% for pre-morbid dependency in five ADLs, transferring and walking respectively while negative agreement was 90%, 93% and 82%. Kappa statistics were 0.71 (95% confidence interval [CI] = 0.67, 0.75), 0.75 (95% CI = 0.71, 0.79) and 0.53 (95% CI = 0.48, 0.57) for each of the three measures. For functional status at admission, positive agreement ranged between 50% and 71% whereas negative agreement ranged between 45% and 49% for dependency in the five ADLs, transferring and walking respectively. Kappa statistics were correspondingly 0.24 (95% CI = 0.21, 0.27), 0.20 (95% CI = 0.15, 0.20) and 0.26 (95% CI = 0.23, 0.30). Concordance between medical notes and patient-reported functional status tended to be higher for patients with lower levels of disease burden.

The concordance between medical records and patient-reported functional status varied across measures and time period. The results indicated that medical records provide reliable information regarding pre-morbid dependency in the five ADLs and transferring. Low rates of agreement were however found for pre-morbid ambulation and dependency in mobility and personal care at admission. This would have important implications for studies that rely on the abstraction of such information from medical records.

Research Design & Methodologies

Interpreting in-hospital mortality among older hospitalised persons: Do we need to adjust for physical function and social support?

In-hospital mortality is an important performance measure for quality improvement. To ensure equitable comparison across healthcare providers, proper risk adjustment is necessary. This study aimed to test whether functional status and social support are important predictors of in-hospital mortality for older patients.

Patients (aged 65 and older) admitted to the General Medicine department of an acute care hospital between April and October 2008 were studied. Data entered into the baseline in-hospital mortality risk model included patient demographics, primary and comorbid diagnoses, and admission to intensive care or high dependency units. Physical function and social support indicators collected during a prospective survey were added independently. Multivariate logistic regression analysis was performed. C-statistics were calculated to evaluate model performances.

A total of 1,402 patients were studied. In-hospital mortality rate was 6.0% Significant risk-adjustors in the baseline model included age, primary diagnoses (acute myocardial infarction, pneumonia, sepsis and renal failure) and the Charlson Comorbidity Index (CCI) scores. Compared to fully independent patients, patients who required moderate assistance (OR 2.6; 95% CI 1.3-5.3) and those who were totally dependent were at greater risk of in-hospital mortality (OR 9.0; 95% CI 4.5-17.9). C-statistics were 0.772 for the baseline model and 0.832 for the model that included functional status. A 10-fold cross validation showed stable results (C-statistic 0.815). Social support variables such as marital status, nursing home residency and co-residence with family caregivers were not significant.

The inclusion of physical functional status at admission substantively improved the prediction of in-hospital mortality for older patients.

	Model 1*	Model 2*
	Age + Primary Diagnosis + CCI	Age + Primary Diagnosis + CCI + Functional Status
	Odds Ratio (CI)	**Odds Ratio (CI)**
Age	1.048 (1.018 – 1.078)	1.022 (0.992 – 1.053)
Acute Myocardial Infarction Yes [No]	8.191 (3.007 – 22.313)	8.133 (2.857 - 23.148)
Pneumonia Yes [No]	4.145 (2.488 – 6.905)	3.160 (1.850 – 5.396)
Sepsis Yes [No]	7.604 (2.624 – 22.031)	5.338 (1.766 – 16.134)
Renal Yes [No]	5.415 (1.872 – 15.669)	4.789 (1.551 – 14.794)
Charlson Comorbid Index [≤ 3] > 3	2.353 (1.475 – 3.754)	2.220 (1.361 – 3.622)
No. of ADL impairment [0] 1-6 7	- -	2.614 (1.281 – 5.336) 8.956 (4.488 – 17.875)
Constant	0.001	0.002

Dependent variable : Inhospital Mortality
[.]: Reference group
CI: confidence interval
*Using backward selection (likelihood ratio) method

Logistic Regression Results

Measuring comorbidities in older patients: Can administrative data replace medical records data in outcomes research?

Comorbidity information is important for risk adjustment when comparing health outcomes. Collection of this information from medical records is resource-intensive. Administrative databases provide a ready alternative, but their validity for comorbidity identification has not been determined in Singapore. This study sought to compare comorbidity measures obtained from both sources, and to observe their performance in a real world example of risk adjustment.

A retrospective review was conducted of patients aged 55 years and older, hospitalised for pneumonia at three acute hospitals in 2007. For 32 comorbidity measures, agreement of administrative and medical records data with kappa values were quantified. Logistic regression was performed to compare 30-day mortality for community-acquired pneumonia (CAP) adjusted for pneumonia severity index (PSI) using comorbidity information from both data sources.

For 3,987 hospital admissions, kappa values for individual comorbidities ranged from 0.003 to 0.785. Uncomplicated diabetes (κ=0.785), complicated diabetes (κ=0.675) and metastatic cancer (κ=0.708) achieved good agreement. Eight others (including chronic pulmonary disease, congestive heart failure, hypertension, liver disease, peripheral vascular disorders, and dementia) showed fair agreement (κ= 0.406-0.542).

The observed mortality rates for CAP in the three hospitals ranged from 19.3% to 23.7%. The expected mortality adjusted for PSI using both data sources, and the standardised mortality ratios are shown in the table below.

Hospital	Medical records-derived			Administrative records-derived		
	Observed mortality, %	Expected mortality, %	O/E ratio	Observed mortality, %	Expected mortality, %	O/E ratio
1	23.7	21.5	1.10	23.7	22.4	1.06
2	19.3	22.1	0.87	19.3	22.2	0.87
3	20.2	19.5	1.04	20.2	19.2	1.05

Administrative data may be used to identify selected comorbidities on account of reasonable agreement with medical records data, thereby making data collection less cumbersome. Comorbidity information generated from either data source did not result in significant differences in risk-adjusted CAP mortality.

> Building capacity and advancing knowledge

Publications

1. *Cham G, Sun Y, Heng BH, Seow E.*
Predicting positive blood cultures in patients presenting with pneumonia at an Emergency Department in Singapore. Annals Academy of Medicine Singapore 2009;38:508–541.

2. *Heng BH, Cheah JTS, Seow E.*
Health services research: Why it matters to health policy makers and clinicians. Annals Academy of Medicine Singapore 2009;38:467–469.

3. *Lee VJ, Lye DC, Sun Y, Leo YS.*
Decision tree algorithm in deciding hospitalisation for adult patients with dengue haemorrhagic fever in Singapore.
Tropical Medicine and International Health 2009; 14(9):1154–1159.

4. *Lye DC, Lee VJ, Sun Y, Leo YS.*
Lack of efficacy of Prophylactic Platelet Transfusion for Severe Thrombocytopenia in adults with acute uncomplicated dengue infection. Clinical Infectious Diseases 2009;48(9):1262–1265.

5. *Molina JAD, Heng BH.*
Global trends in cardiology and cardiothoracic surgery — An opportunity or a threat? Annals Academy of Medicine Singapore 2009;38:541–545.

6. *Molina JAD, Jiang GZW, Heng BH, Ong BKC.*
Venous thromboembolism at the National Healthcare Group, Singapore. Annals Academy of Medicine Singapore 2009;38:470–477.

7. *Molina JAD, Lim GH, Seow E, Heng BH.*
Effects of survey mode on results of a patient satisfaction survey at the observation unit of an acute care hospital in Singapore. Annals Academy of Medicine Singapore 2009;38:487–493.

8. *Ng CWL, Lim GH, Seow E, Heng BH.*
Patient satisfaction in an observation unit: The CAHPS Hospital Survey.
Emergency Medicine Journal 2009;26:586–589.

9. *Sun Y, Heng BH, Seow YT, Seow E.*
Forecasting daily attendances at an Emergency Department to aid resource planning.
BMC Emergency Medicine 2009;9:1–9

10. *Sun Y, Toh MPHS.*
Impact of Diabetes Mellitus (DM) on the health–care utilisation and clinical outcomes of patients with stroke in Singapore. Value in Health 2009;12(c3):S101–S105

11. *Tan WS, Chua SL, Yong KW, Wu TS.*
Impact of pharmacy automation on patient waiting time: An application of computer simulation. Annals Academy of Medicine Singapore 2009;38:501–507.

12. *Tan WS, Heng BH, Chua KS, Chan KF.*
Factors predicting inpatient rehabilitation length of stay of acute stroke patients in Singapore. Archives of Physical Medicine and Rehabilitation 2009 Jul;90(7):1202–1207.

13. *Tan WS, Phang JSK, Tan LK.*
Evaluating user satisfaction with an Electronic Prescription System in a primary care group.
Annals Academy of Medicine Singapore 2009;38:494–500.

14. *Toh MPHS, Leong HSS, Lim BK.*
Development of a diabetes registry to improve quality of care in the National Healthcare Group in Singapore. Annals Academy of Medicine Singapore 2009;38:546–551.

15. *Teow KL.*
Practical operations research applications for healthcare managers. Annals Academy of Medicine Singapore 2009;38:564–566.

16. *Wong LY, Toh MPHS.*
Understanding of Diabetes Mellitus and health–preventive behaviour among Singaporeans.
Annals Academy of Medicine Singapore 2009;38:478–486.

17. *Zhu ZC, Heng BH, Teow KL.*
A simulation study of the optimal number of planned appointments for Specialist Outpatient Clinics. International Journal of Simulation Modelling 2009;8(3):156–165.

“ Providing evidence for
decision making and
knowledge translation ”

Conference Presentations

November | **6th Health Services and Policy Research Conference, Brisbane**

1. **Risk adjustment for evaluating acute geriatric care: Focus on pneumonia.**
   Ding YY, _Tan WS_, _Wong LY_.

Joanna Briggs Institute International Convention, Adelaide

2. **Self-monitoring of blood glucose in Type 2 Diabetes: A systematic review of economic evidence.**
   De Verteuil R, _Tan WS._

October | **ISPOR 12th Annual European Congress, Paris**

3. **Age and the control of HbA1c and LDL cholestrol among patients with Type 2 Diabetes Mellitus at Specialist Outpatient Clinics in Singapore.**
   Lim BK, Toh MPHS, Sum CF, Jong M, Chionh SB, Cheah JTS.

8th NHG Annual Scientific Congress, Singapore

4. **A pure loss Queuing Model for endoscopy recovery bed planning.**
   Teow KL, Chia YP, Tan HH, _Zhu ZC_, _Heng BH_.

5. **A simulation analysis of satellite pharmacy setup in Tan Tock Seng Hospital.**
   Zhu ZC, Lim HY, Yang EX, Chia A, _Teow KL_.

6. **Factors associated with frequent Emergency Department attendance at Tan Tock Seng Hospital.**
   Paul P, _Molina JAD_, _Heng BH_, Tay SY, Seow E.

7. **Factors predicting revisit at an Emergency Department (ED) within 7 days and within 1 year following an initial visit.**
   Sun Y, _Heng BH_, Tay SY, Seow E.

8. **Interpreting in-hospital mortality among older hospitalised persons: Do we need to adjust for physical function and social support?**
   Tan WS, Ding YY, _Heng BH_, Tay JC, Tan JY.

9. **Measuring comorbidities in older patients: Can administrative data replace medical records data in outcomes research?**
   Chong WF, Ding YY, _Heng BH_.

10. **Patient assessment of a nurse-led Chronic Illness Care Programme in primary care.**
    Yeo LS, _Tan WS_, _Chong WF_, Liew D.

11. **Patients' willingness to pay at a subsidised National Healthcare Group (NHG) polyclinic.**
    Molina JAD, Choo JL, Hwang CH.

12. **Prevalence of vascular complications in Type 2 Diabetic patients at public primary care clinics in Singapore.**
    Toh MPHS, Lim BK, Tang WY.

13. **Site analysis using Geographic Information System for identification of service gaps and planning of resources.**
    Wong LY, Heng BH, Cheah JTS, Tan CB.

14. **The National Healthcare Group Diabetes Registry – Stock-taking Type 2 Diabetes Mellitus.**
    Sun Y, Heng BH, Cheah JTS.

September | **OR 51, Warwick**

15. **Mathematical programming to optimise bed occupancy by smoothing elective against emergency admissions.**
    Teow KL, Sim J, Heng BH, Chong Y.

August | **4th Public Health & Occupational Medicine Conference, Singapore**

16. **Agreement between hospital medical record and patient-reported functional status.**
    Tan WS, Ding YY, Chong WF, Heng BH, Tan JY, Tay JC.

17. **Comparing hospital performance on inpatient care: How adequate is administrative data for report cards on pneumonia?**
    Ding YY, Chong WF, Heng BH, Abisheganaden J, Lim TK.

18. **Detection of clustered sites of elderly polyclinic patients using Geographic Information System for future planning of health services.**
    Wong LY, Heng BH, Cheah JTS, Tan CB.

19. **Discrete Event Simulation for Healthcare Decision Modeling: A case study of improving SOC appointment scheduling.**
    Zhu ZC, Sim J, Teow KL, Heng BH.

20. **Estimating impact of service partitioning with demand variability using Queuing Theory.**
    Palvannan RK, Teow KL, Zhu ZC, Heng BH.

21. **Prediction rules for patients at high risk of inpatient admission within 1 year of discharge from Emergency Department.**
    Sun Y, Heng BH, Seow E.

22. **System Dynamics for Healthcare Decision Modeling.**
    Teow KL, Palvannan RK, Zhu ZC, Heng BH.

July

7th International Health Economics World Congress, Beijing

23. **Impact of an ageing population on government health care expenditure in Singapore.**
   Tan WS.

June

Academy Health's Annual Research Meeting (ARM), Chicago

24. **Patient Centered Counseling (PCC): Understanding the processes.**
   Govinda Raj A, Ng CWL, Chong WF, Yeo LS, Liew D.

25. **The effects of general practice size on quality of care.**
   Ng KP, Ng CWL, Tan WS.

6th Annual Meeting of HTAi, Singapore

26. **Effectiveness of portable bladder ultrasound protocols.**
   Ng KP, Chong WF.

27. **Systematic review of the effectiveness of the single, two and three field retinal photography for screening Diabetic Retinopathy.**
   Govinda Raj A, De Verteuil R, Heng BH.

"
Disseminating
valuable findings
"

Awards & Grants

AWARDS

Poster Presentations

8th NHG Annual Scientific Congress, Singapore, 16-17 October 2009.
Best Poster (Quality, Health Services Research)
Ms Wong Lai Yin
Site analysis using Geographic Information System for identification of service gaps and planning of resources.

8th NHG Annual Scientific Congress, Singapore, 16-17 October 2009.
Merit (Quality, Health Services Research)
Ms Robyn de Verteuil
Self-monitoring of blood glucose in Type 2 Diabetes: A systematic review of economic evidence.

8th NHG Annual Scientific Congress, Singapore, 16-17 October 2009.
Merit (Quality, Health Services Research)
Dr Joseph Antonio D Molina
Patients' willingness to pay at a subsidised National Healthcare Group (NHG) polyclinic.

4th Public Health & Occupational Medicine Conference, Singapore, 27-28 August 2009.
Best Poster (Public Health)
Dr Sun Yan
Prediction rules for patients at high risk of inpatient admission within 1 year of discharge from Emergency Department.

GRANTS

Research Grants

NHG Small Innovative Grants

Healthcare utilisation and clinical outcomes of stroke patients with Diabetes Mellitus (DM) vs without DM
Dr Sun Yan (Principal Investigator)
Dr Matthias Toh, NHGP (Co-investigator)
Dr Heng Bee Hoon (Co-investigator)
Dr Zhu Zhecheng (Collaborator)
Amount: $48,950

Very old patients hospitalized for acute medical illnesses: Are their outcomes better when under the care of geriatricians?
A/Prof Ding Yew Yoong, TTSH/ Geriatric Medicine (Principal Investigator)
Ms Chong Wai Fung (Site Principal Investigator)
Dr Sun Yan (Co-investigator)
Dr Heng Bee Hoon (Collaborator)
Dr Tay Jam Chin, TTSH/ General Medicine (Collaborator)
Dr Jackie Yu-Ling Tan, TTSH/ General Medicine (Collaborator)
Amount: $49,950

Training Grants

NHG Healthcare Manpower Development Programme

Ms Wong Lai Yin (Spatial Science)
Dr Sun Yan (Medical Informatics)
Mr Teow Kiok Liang (Operations Research)

Engaging and
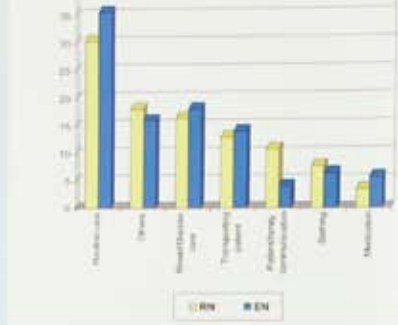supporting stakeholders

Training & Education

■ **Health Services Research methods & implementation**
■ **17 October**

HSOR TRAINERS: TEOW KIOK LIANG, DR ZHU ZHECHENG, PRADEEP PAUL G GUNAPAL, NG KOK PING, DR JOSEPH ANTONIO D MOLINA, WONG LAI YIN, DR SUN YAN

PROFESSOR DAVID B MATCHAR
Programme Director, Health Services Research, Duke-NUS
Professor, Duke University Medical Center
Director, Centre for Clinical Health Policy Research, Durham, NC

PROFESSOR ALAN PEARSON
Executive Director, Joanna Briggs Institute

MR JOE SIM
CEO, National University Hospital

ASSOCIATE PROFESSOR DING YEW YOONG
Senior Consultant, Geriatric Medicine, Tan Tock Seng Hospital
Visiting Consultant, HSOR

MR WU TUCK SENG
Deputy Director, Pharmacy, National University Hospital

DR JOHN GOH
Associate Consultant, Emergency Medicine, Tan Tock Seng Hospital

DR GREGORY CHAM
Senior Consultant, Emergency Medicine, Tan Tock Seng Hospital

The HSR symposium, organised as part of the NHG Annual Scientific Congress, aimed to disseminate health services research findings, demonstrate the application of different health services research techniques to answer real world questions, and to promote collaborative projects between researchers and clinicians. The symposium consisted of two plenary and three tracks, namely "Health Services Research and Evidence Based Decision Making", "Decision. Model. Insights." and "Multiple Methods with HSR."

Discrete Event Simulation and System Dynamics
23 – 24 September

PROFESSOR SALLY BRAILSFORD
Programme Director, MSc in Management Science, University of Southampton
Associate Dean (Graduate School), Faculty of Law, Arts and Social Sciences, University of Southampton
Vice President, UK O.R. Society

The two-day workshop sought to describe the process of undertaking a simulation project with a healthcare client organisation. Key stages involved in the modeling process were identified, starting from the problem structuring phase through method selection, model development, testing, experimentation and implementation. The first day of the workshop focused on Discrete Event Simulation (DES) and points to introduction to System Dynamics (SD), and included a hands-on computer session building a simple model using the SD software Vensim.

Introduction to Health Services Research
29 July

HSOR TRAINERS: DR HENG BEE HOON, PRADEEP PAUL, PALVANNAN KANNAPIRAN, TEOW KIOK LIANG, DR ZHU ZHECHENG, ANUSHA GOVINDA RAJ, ROBYN DE VERTEUIL, DR JOSEPH D MOLINA

ASSOCIATE PROFESSOR DING YEW YOONG
Senior Consultant, Geriatric Medicine, Tan Tock Seng Hospital
Visiting Consultant, HSOR

The course aimed to provide an overview of the basic concepts, rationale, general and discipline-specific methods used in carrying out health services research. Designed to cover a broad range of topics at an introductory level, the main objective was to familiarise participants with a repertoire of methods that were often encountered in the conduct of health services research.

Medical Informatics
26 February

HSOR TRAINER: DR SUN YAN

ASSOCIATE PROFESSOR DING YEW YOONG
Senior Consultant, Geriatric Medicine, Tan Tock Seng Hospital
Visiting Consultant, HSOR

Medical informatics is an emerging discipline that deals with all aspects of understanding and promoting the effective organisation, analysis, management, and use of health care information to improve decision making. This half-day workshop introduced participants with the use of the health care databases to improve decision making. The short course focused on research and evaluation using databases as well as the development of medical decision making system using predictive modeling. Both conceptual and practical aspects were covered.

Operations Research Appreciation Course (ORAC)
19 – 20 January

HSOR TRAINERS: TEOW KIOK LIANG, DR ZHU ZHECHENG, PALVANNAN KANNAPIRAN

As a problem solving technique, Operations Research (OR) is both a science and an art. The scientific element lies in providing mathematical techniques and algorithms for solving appropriate decision problems. OR is also an art because success in all the phases that precede and succeed the solution of a mathematical model, depends largely on the creativity and personal abilities of the decision maker. The two-day course focused on building intuition around theory, walked through illustrative examples and showed insights from results that supported and informed decision making. Case studies also demonstrated real applications of OR techniques as well as the process of problem solving during the engagement with the decision maker.

HSOR
The evidence behind your decisions