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*"Nothing is softer or more flexible than water;
yet nothing can resist it."*

Lao Tzu, (b. 6th century BCE)
Ancient Chinese philosopher

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Could the Devastation From Ebola Occur in Asia?

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Outbreaks originating from animal reservoirs continue to take the world by surprise. Whether it is a novel virus such as Middle East respiratory syndrome (MERS) or severe acute respiratory syndrome (SARS) or a novel epidemiologic course of a known virus such as influenza and Ebola, no two outbreaks are the same. No one predicted the current unrelenting progress of Ebola Zaire virus in West Africa which is devastating Liberia, Sierra Leone and Guinea. Usually, Ebola outbreaks occur in most years and are controlled within months locally. This time, however, the international response has not kept up with the epidemic. This is despite the “Herculean” efforts of non-government organisations led by Médecins Sans Frontières (MSF) and the World Health Organization (WHO), the latter in the wake of massive funding cuts in the last 5 years.

The spread of this Ebola epidemic is not consistent with estimated R_0 (reproductive) values of 1-2, i.e. each case infects 1 to 2 other people. Patients are rejected from Ebola Treatments Units as they are full and the inability to remove infected individuals from the community is driving transmission above usual transmission rates. The scale of the crisis means that even dead bodies are often not removed for days. We do not know the real transmission rates as epidemiologists there cannot even keep up with the numbers.

An estimated 20,000 cases of infections is predicted in the months to come. Ongoing transmission well into 2015 is inevitable. Desired infection control practices and social mobilisation activities are increasingly not possible. There is already a breakdown of what were already vulnerable healthcare systems. Major secondary consequences from the epidemic can be expected – malaria, tuberculosis,

maternal health, diabetes etc. If there follows a breakdown in essential services (power, water, food, communications), then a true humanitarian crisis will follow.

There is potential for an escalation of societal unrest already seen in isolated episodes. The region has experienced decades of civil wars which may have contributed to people being less willing to accept authority, and less willing to accept contact tracing, movement restrictions and attempted quarantine, so critical early in the outbreak.

Liberia, Sierra Leone and Guinea are home to over 20 million people. If Ebola were to establish in neighbouring Nigeria with an estimated 180 million population, the scenarios are beyond imagination. Nigeria has already experienced local spread in small numbers and Senegal has its first imported case, a known contact travelling against advice.

Control of this outbreak requires a significant divergence from the traditional response and this is happening with a major deployment of foreign medical teams. Furthermore an approach to management of Ebola in the community is necessary. It is happening there now and the population needs support. Liberia will soon be receiving a mass distribution of home care kits. Ebola Care Centres are being discussed for people to care for a family member away from the home (Fig. 1). These are indeed appearing spontaneously and community-driven.

There is also a call by several experts to fast track the introduction of experimental drugs and vaccines.¹ Many have been in development but none taken through to even phase 1 studies possibly because of the difficulties of establishing phase 3 trials during outbreaks and a non-

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*A/Prof Dale Fisher and Ms Sharon Salmon, Assistant Director of Nursing, were in Liberia early in the Ebola outbreak in April and at the time of publication had returned to assist in the international response. A/Prof Fisher was involved during SARS (receiving a courage foundation medal) and H1N1 with several Global Outbreak Alert Response Network (GOARN) deployments. He was recently appointed to the GOARN International steering committee. Both Fisher and Salmon have strong affiliations with GOARN and the World Health Organization (WHO), particularly in the area of facilitating outbreak response trainings.



Fig. 1. Community lead Ebola Care Centres appear spontaneously, given that the official Ebola treatment Units are full. Assistance was sought to find more appropriate sites such as this which is a closed vocational training centre.

viable business case for advancement. We are therefore now left with an inadequate understanding of whether such therapeutics are a worthy part of the response, or a distraction.

Preparedness plans and exercises are being undertaken by many distant countries globally. Asia is increasingly connected to West Africa and the consequences of an Ebola outbreak in a large Asian city with pre-existing suboptimal surveillance and infection control practices paints a bleak picture.² Still this “probably” won’t happen especially since people from the 3 most affected countries are not frequent travellers to Asia. Commercial air travel into and out of those 3 countries has also all but stopped. One could hypothesise that the most likely people to import the disease are those returning home to Asia, such as a recent scare from Philippines workers.

Ebola outbreaks start from a single animal to human jump. Typically, a bat reservoir sustains the virus until transfer to the accidental human host probably via another primate (but not always). Amplification then takes place via human-to-human spread. Fruit bats have been implicated as a reservoir in Africa and in the Philippines.³ In Bangladesh, 5 of 274 (3.5%) bats tested positive for antibodies against Ebola Zaire and Reston viruses but no virus was detected by polymerase chain reaction (PCR).⁴ Ebola Reston virus is likely non-pathogenic in humans after observation of several human infections. Pigs in the Philippines have tested positive for Reston virus and likely pig-to-human transmission of Reston virus was documented in 2009.

In China, 32 of 843 bat samples tested positive for Ebola antibodies.⁵ In Indonesia, orang utans showed specific IgG antibodies to all 5 Ebola species although they were apparently healthy. This raises the issue of primates being a potential reservoir or part of a multispecies reservoir for Ebola strains in the region.⁶

So while Ebola is known for regular animal-to-human transmission and subsequent outbreaks in Africa, we need to recognise the risk of such future “jumps” in Asia given that animal reservoirs clearly exist in the region. We have a poor understanding of the relationships between and movements of animals in the wild.⁷ We know that the continuous evolution of virus lines affects transmissibility, host tolerance and virulence. This occurs in a complex ecology involving wild animals and a more vulnerable human population due to urbanisation, overcrowding and easy and cheap travel.

Ebola and other viruses will continue to cause outbreaks. Given the worldwide awareness and the lessons learnt from the scale of the West African outbreak, a sporadic case being exported to Asia will unlikely produce significant local transmission in countries with strong healthcare systems. Though human Ebola in Asia may never happen, many countries remain vulnerable so long as the animal reservoirs remain.

The West African Ebola crisis is a reminder that as a global community, we need to be better prepared. There is a need for generic regional and global preparedness. The key to our “defence” is in the traditional infection control principles of surveillance and early detection and identification of outbreaks involving established or novel agents. Doing this and then proceeding to quickly establishing interventions is beyond the capabilities of many countries where such outbreaks may start. This outbreak represents a call to the healthcare leadership of Asia’s wealthy countries and its neighbours to further develop regional outbreak response capacity.

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Predicative Genetic Testing for Alzheimer's Disease

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Alzheimer's disease (AD) is one of the most common types of dementia worldwide and it is of tremendous concern to individuals and society at large. Current diagnostic criteria are based on the Diagnostic and Statistical Manual for Mental Disorders, 5th Edition (DSM-5), and they are coded as major neurocognitive disorders due to AD.¹ Risks of developing AD are associated foremost with genetic factors and age. Other contributing factors may include sex, education level, concurrent medical problems and lifestyle. Members of the general population are at an approximately 10% to 12% risk of developing AD in their lifetime, while those with a first-degree relative who has AD have a 2- to 4-fold increase in risk.² Risks are also much higher for those who have a family history of autosomal dominant AD. Therefore, asymptomatic individuals, especially those who have relatives with AD, may seek predicative genetic testing because of their concerns about early cognitive symptoms, advance planning for financial or personal affairs, and relief from anxiety.³

Autosomal dominant AD is a rare form of AD and estimated to be 1% to 5% of all AD cases. It usually manifests before the age of 60, and is considered a form of early onset AD (EOAD). Currently there are only 3 known deterministic genes in which mutations are associated with autosomal dominant AD — amyloid precursor protein (APP), presenilin 1 (PSEN 1) and presenilin 2 (PSEN 2). These mutations have close to complete penetrance but variable expressivity, i.e. virtually anyone who possesses 1 mutant allele will eventually get the disease, but severity may vary even between members of the same family with the same mutation.⁴ The risk of an individual who has a parent with autosomal dominant AD of getting the disease is 50%.

Far more common is late onset AD (LOAD). Despite massive efforts to uncover the genetic basis of LOAD, the only gene associated with AD that has been consistently

replicated in multiple genome-wide association studies is apolipoprotein E (APOE). Others reported in various studies include *BIN1*, *CLU*, *PICALM*, *CR1* and *TOMM40*. Only APOE will be discussed further as it is the only one with any risk data. The APOE gene encodes a protein involved in cholesterol transport and exists in three isoforms ($\epsilon 2$, $\epsilon 3$, $\epsilon 4$), differing only by single amino acid substitutions.⁵ Unlike the genetic mutations in autosomal dominant AD, APOE $\epsilon 4$ is a susceptibility gene, i.e. one that increases the risk of getting AD. There have been many publications concerning the extent of increased risk of possessing the APOE $\epsilon 4$ allele. The degree of risk varies depending on whether the individual carries one or two $\epsilon 4$ alleles. The lifetime risk of contracting AD may increase from 9% in $\epsilon 4$ -negative persons to 29% for carriers of a single $\epsilon 4$ allele.⁶ Compared with $\epsilon 3/\epsilon 3$ individuals, the odds ratio (OR) of developing AD have been estimated to be 3.2 (95% CI, 2.9 to 3.5) and 11.6 (95% CI, 8.9 to 15.4) for carriers of 1 or 2 $\epsilon 4$ alleles, respectively; and the appearance of AD symptoms in $\epsilon 4$ carriers may be accelerated by 1 to 2 decades.⁷ The conversion from mild cognitive impairment (MCI) to incipient AD has been shown to be expedited.⁸ Several studies have also suggested that the presence of an $\epsilon 2$ allele may play a protective role against developing AD.^{9,10} Other studies about the effects of the $\epsilon 4$ allele suggest that it influences the age at which AD occurs, rather than the overall lifetime risk for AD.^{11,12} Since the possession of the $\epsilon 4$ allele is neither necessary nor sufficient to cause AD, the sensitivity and specificity of APOE genotyping are insufficient for definitive AD diagnosis or prognosis. It is also difficult to convey such probabilistic risk effectively since the risk is usually reported as a population-based OR, which is difficult to translate into meaningful figures for individual counselling.¹³ Moreover most of the studies are on individuals of European or African-American descent and may not be generalisable to other populations.

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However, potentially modifiable AD risk factors have been shown to be affected by the presence or absence of the APOE $\epsilon 4$ allele.¹⁴ Knowing one's APOE status may prompt individuals to make lifestyle changes to reduce their risk. Besides, individuals who seek APOE testing for AD commonly cite disease risk reduction as a prime motivator.¹⁵ This is further supported by findings from the seminal Risk Evaluation and Education for Alzheimer's Disease (REVEAL) study. This study showed that individuals who were informed of a high AD risk estimate were more likely to modify health behaviours aimed at diminishing the perceived risk even if the effectiveness of the activities were not proven.¹⁶ The study also showed that disclosure of $\epsilon 4$ -positive status does not appear to confer psychological or social harm to asymptomatic individuals seeking personal AD risk estimation. The authors concluded that the identification of modifiable AD risk factors and the advent of effective interventions may enable clinicians to identify at-risk individuals who may thereby benefit maximally from such interventions.¹⁶⁻¹⁸

At present, the American College of Medical Genetics (ACMG), in its Practice Guidelines (2011), recommends that predictive testing be only done at the request of the individual if there is known family mutation in PSEN1, PSEN2 or APP.² This would occur in the context of pretest genetic counselling, risk evaluation, neurological and psychiatric evaluations, post-test results counselling and follow up. This protocol is similar to the Huntington Disease (HD) Society of America's Guidelines for Genetic Testing for Huntington Disease.¹⁹

Moreover the Practice Guidelines state that genetic testing for susceptibility loci (e.g. APOE) is not clinically recommended due to limited clinical utility and poor predictive value.² However, if an individual wishes to pursue testing, it can be done at the discretion of the clinician, who should still follow the above HD guidelines. Emphasis should be placed on the probabilistic nature of the results: individuals with 1 or 2 copies of the $\epsilon 4$ allele may not necessarily develop AD and those without any $\epsilon 4$ may still develop the disease. The clinician should also explore the motives and considerations for pursuing genetic testing, and also how the results, whether positive or negative, would impact their psyche, life plans and relationships.

AD, at this point of time, can neither be prevented nor cured, and the medical rationale to determine APOE genotype has been limited thus far. However, these recommendations may change in the future if we gain more knowledge into the pathogenesis of AD and the role of susceptibility genes, and if disease modifying interventions become available.

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A New Population-based Reference for Gestational Age-specific Size-at-birth of Singapore Infants

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Abstract

Introduction: There is currently a lack of representative data for local gestational age-specific size-at-birth percentile charts. Existing charts also suffer from limitations relating to the measurement of gestational age (GA) and an outdated population. We aim to construct reference values and charts for size-at-birth from 35 to 41 weeks, based on the healthy local population. **Materials and Methods:** Prospective observational birth cohort study which recruited pregnant mothers from the 2 major public hospitals with obstetric service in Singapore, at <14 weeks gestation and data was collected for birth weight, length and head circumference of infants born from November 2009 to May 2011. Percentile curves were created separately for male and female infants using the lambda-mu-sigma (LMS) method. The new percentile curves were then compared with other internationally published growth charts. **Results:** Smoothened curves for birth weight, length and head circumference centiles were created from 863 infants (460 males, 403 females). Male infants consistently exceeded female infants in all 3 variables at each GA. For a male and female Singapore infant at 38 weeks gestation, the 10-50-90th centile values for weight would be 2663-3096-3597 vs. 2571-2966-3417 grams, for length 46.4-48.6-51.1 vs. 45.6-48.0-50.4 cm, and for head circumference 32.0-33.5-35.2 vs. 31.4-32.9-34.6 cm. There was no statistically significant difference between ethnic groups. On comparing our birth weight curves with data from Finland across all gestations, birth weights in our term infants (GA ≥37 weeks) were found to be lower across the 10-50-90th percentiles. **Conclusion:** The new centile charts in this study may be used as reference charts for size-at-birth for a subgroup of near-term and term infants. The use of foreign charts may lead to misclassification of small for gestational age (SGA) or large for gestational age (LGA) infants.

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Key words: Birth head circumference, Birth length, Birth weight

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A New Population-based Reference for Gestational Age-specific Size-at-birth of Singapore Infants

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Introduction

Size-at-birth (birth weight, length and head circumference) is a simple clinical measure that is of importance to both neonatologists and obstetricians. It is commonly used in clinical practice to assess neonatal health. Birth weight and length have been demonstrated to be strong determinants of perinatal morbidity and survival;¹ they are important clinical indicators that are widely used for evaluation of prenatal growth and for identifying infants who are at higher risk of mortality.^{2,3} Head circumference is often used by clinicians to identify infants with malformations in the central nervous

system and it carries prognostic implications.⁴ Size-at-birth charts provide a basis for the assessment of growth and monitoring.

There are readily available size-at-birth for gestational age (GA) reference charts for newborns of several populations, such as Canada,⁵ Sweden,⁶ United States^{7,8} and United Kingdom.⁹ Despite evidence¹⁰⁻¹² to assume postnatal growth trajectories are similar across countries and ethnicity, there is insufficient data on whether size-at-birth for GA is comparable across countries and ethnicity.

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In addition, some of these suffer from limitations related to the measurement of GA. Some of the charts measured GA to the nearest week,¹³ rather than truncating it to completed weeks, as recommended by World Health Organization (WHO) guidelines.¹⁴ Even for charts that were measured in completed weeks, they are limited by using GA based on date of onset of last menstrual period¹⁵ which has been shown to underestimate those born preterm and overestimate those with post-term GA when compared with early ultrasound measurements.¹⁶

In this study, we have constructed GA-specific size-at-birth percentile charts, based on the Growing Up in Singapore Towards Healthy Outcomes (GUSTO) birth cohort study, which overcame some of the deficits discussed. GUSTO is a birth cohort study designed to capture both prenatal and infant growth predictors in a longitudinal fashion in Singapore. The aim of this paper is to present reference values and charts for size-at-birth from 35 to 41 weeks, based on the healthy GUSTO birth cohort members.

Methodology

Study Population

GUSTO is set up to examine developmental origins of health and diseases. Pregnant women aged 18 years and above in their first trimester were recruited from the 2 major public hospitals with obstetric service in Singapore, the KK Women's and Children's Hospital (KKH) and National University Hospital (NUH). Women approached were Singapore citizens or permanent residents who were of Chinese, Malay or Indian ethnicity with homogeneous parental ethnic background, had intention of delivering in NUH or KKH and residing in Singapore for the next 5 years. During recruitment, the eligibility criteria were designed to allow examination of differences between ethnically homogeneous groups, hence recruitment was completed with oversampling of Malays and Indians. Those who were on chemotherapy, psychotropic drugs or Type I diabetes mellitus were excluded from the study. Questionnaires were administered to capture demographics, socioeconomic status, lifestyle, maternal well-being, obstetrics and medical history, and use of medicines and supplements. This study was approved by both the National Healthcare Group Domain Specific Review Board and the SingHealth Centralised Institutional Review Board.

Assessment of GA

The method of determining GA was by ultrasonography. In all women, GA was first assessed in the first ultrasound dating scan when they were recruited during the first trimester. They returned to the hospital again at 19 to 21, 26 to 28 and 32 to 34 weeks gestation to have follow-up ultrasound

scans for assessment of fetal growth and size. Scans were conducted in a standard manner at both hospitals by trained ultrasonographers. GA was reported in completed weeks.

Anthropometry Measurements

Birth weight, length and head circumference were measured by trained hospital staff. During the first few hours after delivery, infant birth weight was recorded to the nearest gram using a calibrated scale (SECA 334 Weighing Scale, SECA Corp) for weighing the infant. Standard test weights of 1, 2, 5, 10 and 20 kg were used to calibrate the weighing scale. The variation for the SECA 334 weighing scale is between 5 to 10 g. Recumbent birth length was measured from the top of the head to the soles of the feet using an infant mat (SECA 210 Mobile Measuring Mat, SECA Corp) to the nearest 0.1 cm with the aid of 2 research staff. One person supports the infant's head and ensures that the head is positioned in the Frankfort horizontal plane. A second person aligns the legs by placing one hand gently but with mild pressure over the knees. Head circumference was also measured with the aid of 2 research staff. The infant is held by a health professional while the examiner uses a tape measure to measure the child's head. Maximum head circumference was measured across the frontal bones of the skull and over the occipital prominence at the back of the head, using a non-stretchable measuring band (SECA 212 Measuring Tape, Seca Corp).

Analysis Population

In order to give size-at-birth reference values based on a "healthy" population, we excluded deliveries with (a) stillbirths, (b) twins, (c) complications during pregnancy with potential effects on foetal growth (gestational diabetes mellitus, anaemia, pre-eclampsia), and (d) newborns with significant neonatal malformations. There were also a limited number of observations in the lower GA (less than 35 weeks); these data were also excluded from the analysis. Outlying data points more than 3 times the interquartile range were identified using Box-and-Whisker plots, by GA and gender for each variable. These data points were then cross-referenced against hardcopy data; incorrect entries were then rectified into the database to ensure that high quality data was used for analysis.

Statistical Analysis and Chart Development

The LMS method¹⁷ using maximum penalised likelihood was utilised to create anthropometric centiles for birth weight, length and head circumference. This method estimates anthropometric measurement centiles in terms of 3 age-sex specific cubic spline curves: L curve (measure of skewness based on the Box-Cox transformation), M curve

(median) and the S curve (coefficient of variation). The transformation creates a standardised variable:

$$z(t) = \frac{[y(t)/M(t)]^{L(t)} - 1}{L(t)S(t)}$$

where t represents GA and y represents anthropometric measurement. Knowing the values of the 3 parameters $L(t)$, $M(t)$ and $S(t)$, the 100α percentile is given by:

$$P_{100\alpha}(t) = M(t) [1 + L(t)S(t)Z_{\alpha}]^{1/L(t)}$$

where Z_{α} is the standard normal deviate that gives $100\alpha\%$ cumulative probability.

GA and sex-specific size-at-birth centile charts for 3rd, 10th, 25th, 50th, 75th, 90th and 97th percentiles were generated using LMS Chartmaker software (Medical Research Council, UK). The modelling process began with an initial set of “equivalent degrees of freedom” (EDFs) for the parameters L , M and S respectively and the transformation that gave the lowest deviance was preferred. The EDFs were then changed, first for M , then S and L , using the Generalised Akaike Information Criterion with a penalty constant of 3 [GAIC(3)] as a guide. Graphical examinations are then used to finetune and confirm the choice of parameters to be used.

Quantile regression models for size-at-birth variables for 10th, 50th and 90th percentiles were performed to assess their association with GA and ethnicity. The interaction effect between GA and ethnicity were also explored in above models which were stratified by gender.

Results

A total of 3335 women were screened for eligibility, out of which 1880 women were eligible, and 1163 pregnant women (62% of eligible women screened) were recruited. Anthropometric measurements were completed on the infants of the remaining 1163 mothers. A total of 300 infants were excluded from analysis as a result of being born with significant neonatal malformations, or born to mothers with pregnancy complications (gestational diabetes, anaemia, pre-eclampsia). Infants whose mothers had no oral glucose tolerance test (OGTT) data were also excluded in this study. After exclusion, 863 infants were included in the analysis. Table 1 summarises the characteristics of the mothers and study infants.

Table 2 shows the frequency distribution (n) of GA and the observed 3rd, 10th, 25th, 50th, 75th, 90th, 97th percentile of size-at-birth variables for male and female infants. At each GA, male infants consistently exceeded female infants in all 3 variables. The EDFs for the fitted LMS spline curves for both male and female infants were, respectively: 2, 3 and 1 for weight and head circumference; and 2, 2 and 1

Table 1. Characteristics of Mothers and the Study Infants

Measures	n	Mean (SD) or %
Maternal age (yr)	863	30.4 ± 5.1
Marital status (%)	845	
Married		96.1
Single		3.9
Highest education attained (%)	852	
Below ‘A’ levels/diploma		41.8
‘A’ levels/diploma or higher		58.2
Type of housing (%)	852	
Government		86.2
Private		13.8
Household income (%)	806	
Below \$6000		71.0
Above \$6000		29.0
Ethnicity (%)	863	
Chinese		58.7
Malay		26.3
Indian		14.9
Infant gender (%)	863	
Male		53.3
Female		46.7
Gestational age at delivery (weeks)	863	38.4 ± 1.2
Infant birth weight (g)	863	3109 ± 411
Infant birth length (cm)	863	48.7 ± 2.1
Infant birth head circumference (cm)	863	33.4 ± 1.8

for length. Increasing any of the LMS parameters by one EDF for birth weight, birth length and head circumference only increased the GAIC(3) score by 2.3, 2.5 and 2.9 units respectively. Table 3 lists the LMS values for each measurement by GA and gender. Figures 1 to 3 show the gestational age-specific smoothed percentile curves for birth weight, length and head circumference respectively, for each gender. The curves are smoothed and evenly spaced with no biologically implausible bumps preterm or flattening out post-term.

Quantile regression models for 10th, 50th and 90th percentiles of the size-at-birth variables showed no statistically significant evidence for association between the size-at-birth variables and ethnicity for both genders in models with quadratic terms for GA and ethnic-GA interaction terms (each $P > 0.05$). In more parsimonious models that excluded the statistical non-significant quadratic and interaction terms, out of 18 regression analyses (2 gender * 3 anthropometric variables * 3 percentiles), there was only 1 statistically significant ethnic difference: median head circumference was 0.5 cm shorter in Indian boys than Chinese boys ($P < 0.05$).

Table 2. Observed Percentile Values of Birth Weight (Gram), Birth Length (cm) and Birth Head Circumference (cm) of Male and Female Infants By Gestational Age (Week)

GA	Males										Females									
	Birth Weight										Birth Length									
	n	3 rd	10 th	25 th	50 th	75 th	90 th	97 th	n	3 rd	10 th	25 th	50 th	75 th	90 th	97 th				
35	6	2108	2234	2379	2566	2789	3027	3310	10	1907	2074	2241	2424	2604	2765	2921				
36	24	2248	2390	2552	2756	2990	3233	3509	18	2084	2252	2425	2620	2817	299	3177				
37	80	2376	2537	2716	2937	3182	3428	3697	51	2250	2418	2595	2800	3014	3215	3420				
38	142	2481	2663	2860	3096	3350	3597	3858	118	2404	2571	2751	2966	3196	3417	3650				
39	127	2576	2780	2996	3248	3511	3757	4010	127	2554	2719	2902	3125	3371	3615	3879				
40	75	2657	2888	3124	3391	3661	3907	4152	73	2708	2873	3058	3289	3552	3821	4123				
41	6	2731	2992	3250	3532	3810	4055	4294	6	2854	3018	3205	3444	3724	4020	4365				
Birth Length																				
35	6	43.7	44.5	45.4	46.5	47.7	49	50.5	10	42.0	43.2	44.3	45.5	46.7	47.7	48.7				
36	24	44.3	45.1	46.1	47.2	48.5	49.7	51.1	18	42.9	44.0	45.1	46.3	47.5	48.6	49.7				
37	80	44.8	45.8	46.7	47.9	49.2	50.4	51.7	51	43.7	44.8	45.9	47.2	48.4	49.5	50.6				
38	142	45.4	46.4	47.4	48.6	49.9	51.1	52.3	118	44.5	45.6	46.7	48.0	49.2	50.4	51.5				
39	127	46.0	47.0	48.1	49.4	50.6	51.8	53.0	127	45.2	46.4	47.5	48.8	50.1	51.2	52.4				
40	75	46.5	47.6	48.8	50.1	51.3	52.5	53.6	73	46.0	47.1	48.3	49.6	50.9	52.1	53.3				
41	6	47.0	48.3	49.5	50.8	52.1	53.2	54.3	6	46.8	47.9	49.1	50.4	51.8	53.0	54.2				
Birth Head Circumference																				
35	6	30.2	30.9	31.5	32.3	33.1	33.9	34.7	10	30.0	30.6	31.2	32.0	32.8	33.7	34.6				
36	24	30.7	31.3	32.0	32.7	33.6	34.4	35.2	18	30.3	30.9	31.5	32.3	33.2	34.0	34.9				
37	80	31.1	31.7	32.4	33.2	34.0	34.8	35.7	51	30.5	31.2	31.8	32.6	33.5	34.3	35.2				
38	142	31.4	32.0	32.7	33.5	34.3	35.2	36.0	118	30.7	31.4	32.1	32.9	33.8	34.6	35.5				
39	127	31.7	32.3	33.0	33.8	34.7	35.5	36.4	127	31.0	31.7	32.4	33.2	34.1	34.9	35.8				
40	75	32.0	32.6	33.3	34.1	35.0	35.8	36.7	73	31.4	32.1	32.8	33.7	34.5	35.4	36.2				
41	6	32.2	32.8	33.5	34.3	35.2	36.1	37.0	6	31.8	32.5	33.3	34.1	35.0	35.8	36.6				

GA: Gestational age

Table 3. LMS Coefficients By Gestational Age (Week) and Gender For the Anthropometric Measurements At Birth

GA	Birth Weight						Birth Length						Birth Head Circumference					
	Males			Females			Males			Females			Males			Females		
	L	M	S	L	M	S	L	M	S	L	M	S	L	M	S	L	M	S
35	-1.15	2566	0.12	1.19	2424	0.11	-4.12	46.5	0.04	2.07	45.5	0.04	-1.52	32.3	0.04	-2.68	32.0	0.04
36	-0.76	2756	0.12	0.81	2620	0.11	-3.07	47.2	0.04	1.68	46.3	0.04	-1.59	32.7	0.04	-2.23	32.3	0.04
37	-0.38	2937	0.12	0.43	2800	0.11	-2.01	47.9	0.04	1.35	47.2	0.04	-1.67	33.2	0.04	-1.78	32.6	0.04
38	0.02	3096	0.12	0.05	2966	0.11	-0.96	48.6	0.04	1.11	48.0	0.04	-1.75	33.5	0.04	-1.31	32.9	0.04
39	0.43	3248	0.12	-0.33	3125	0.11	0.09	49.4	0.04	0.96	48.8	0.04	-1.83	33.8	0.04	-0.83	33.2	0.04
40	0.83	3391	0.12	-0.71	3289	0.11	1.14	50.1	0.04	0.83	49.6	0.04	-1.91	34.1	0.04	-0.33	33.7	0.04
41	1.23	3532	0.12	-1.09	3444	0.11	2.19	50.8	0.04	0.71	50.4	0.04	-1.99	34.3	0.04	0.17	34.1	0.04

GA: Gestational age

Table 4. Comparison of the 10th, 50th and 90th Percentiles of Gestational Age (Week) Specific Birth Weights (Gram) of Singapore Male and Female Infants With From Those of Finland

GA	Male						Female					
	GUSTO			Finland			GUSTO			Finland		
	10 th	50 th	90 th	-1.28SD	Mean	+1.28SD	10 th	50 th	90 th	-1.28SD	Mean	+1.28SD
35	2234	2566	3027	2175	2731	3287	2074	2424	2765	2079	2642	3205
36	2390	2756	3233	2418	2991	3564	2252	2620	2997	2323	2899	3475
37	2537	2937	3428	2663	3239	3815	2418	2800	3215	2561	3132	3703
38	2663	3096	3597	2892	3456	4020	2571	2966	3417	2774	3326	3878
39	2780	3248	3757	3075	3625	4175	2719	3125	3615	2948	3483	4018
40	2888	3391	3907	3216	3766	4316	2873	3289	3821	3094	3624	4154
41	2992	3532	4055	3325	3883	4441	3018	3444	4020	3200	3735	4270

GA: Gestational age; GUSTO: Growing Up in Singapore Towards Healthy Outcomes

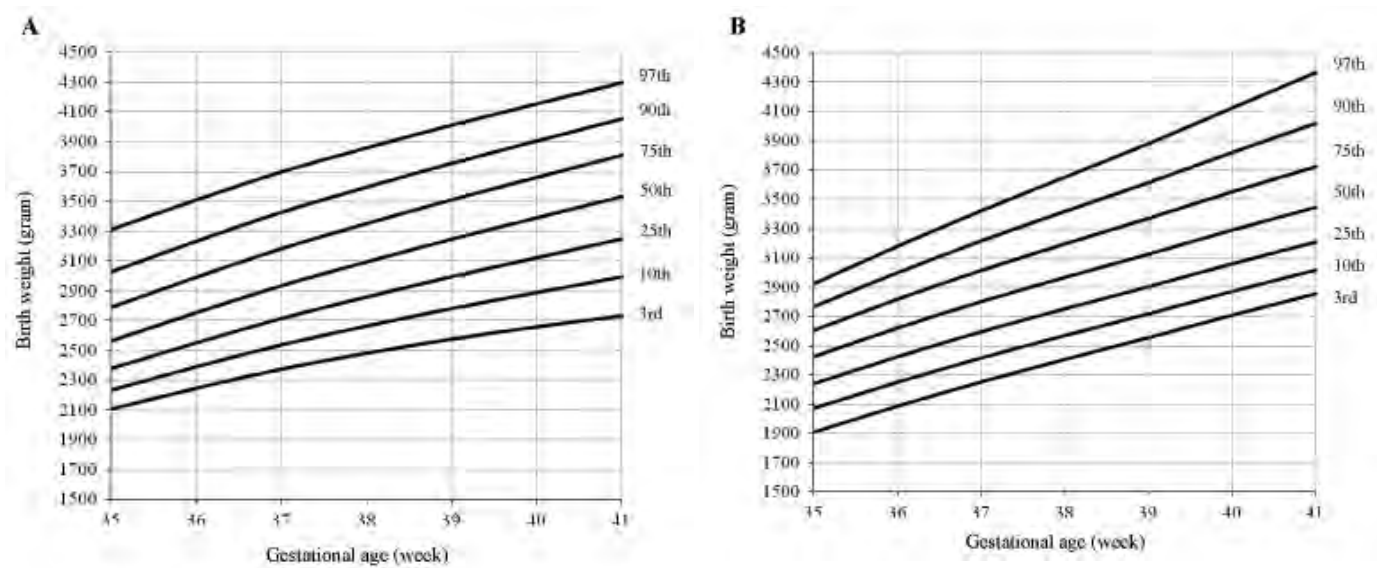


Fig. 1. Smoothed percentiles for birth weight. (A) Male infants, (B) female infants.

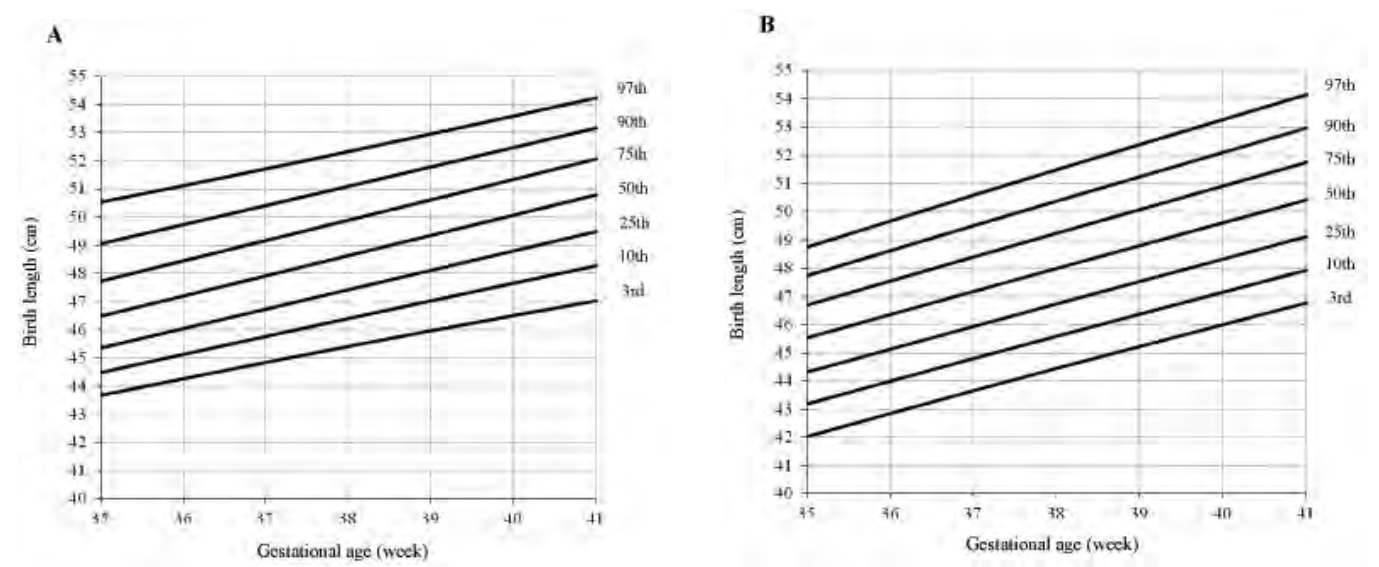


Fig. 2. Smoothed percentiles for birth length. (A) Male infants, (B) female infants.

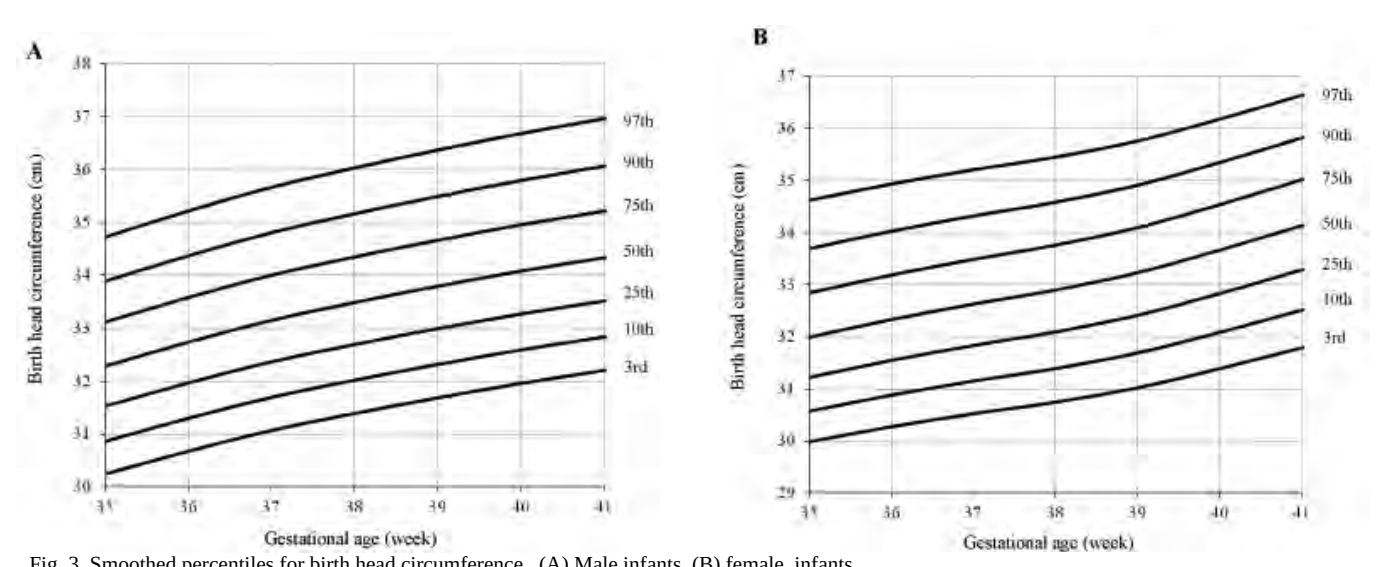


Fig. 3. Smoothed percentiles for birth head circumference. (A) Male infants, (B) female infants.

We also compared the birth weights of male and infants in our cohort with population-based references for singleton infants from Finland (Table 4).¹⁸ When compared with infants from the Finland cohort, GUSTO male term and preterm infants had birth weights between 28 to 423 g lower at the 10th, 50th and 90th percentiles (corresponding to -1.28SD, mean and +1.28SD for the Finland cohort) respectively. GUSTO female preterm and term infants had birth weights between 5 to 488 g lower at the 10th, 50th and 90th percentiles when compared with the Finland cohort.

Discussion

We report the percentiles and smoothened curves of size-at-birth variables in a cohort of Singapore neonates born at 35 to 41 completed weeks of gestation. Our study utilised more precise dating and measurement techniques which differed from population-based references. Also, the present sample is selected from GUSTO to form a “healthy” cohort for the purpose of providing growth standards. These charts assume optimal growth and can be used to identify near-term or term newborns at risk of adverse health outcomes associated with abnormal intrauterine growth. There has been much controversy on the inclusion of only “healthy newborns” in deriving growth charts. Ideally, a study population which includes both low- and high-risk pregnancies, and both normal and abnormal perinatal outcomes would be more suitable as a reference chart. Standard charts on the other hand are based on low-risk pregnancies with a normal outcome, and the growth curves would reflect optimal, healthy, linear growth of newborns who fully expressed their growth potential. When “population reference” and “standard” charts are applied to an individual foetus or infant, interpretation of the findings would differ. Using a population reference would yield a relative foetal size in relation to the total population; a standard will assess a foetal size in comparison to normally grown foetuses. Thus, a standard may have more clinical utility than a population reference.

The availability of local gestational age-specific size-at-birth percentile charts is essential for obstetricians and neonatologists in their perinatal practice. Earlier charts generated by Cheng et al¹³ for the Singapore population are now several decades old; this would not be reflective of infants that were born in more recent years, where there has been a rapid improvement in the quality of living and health indices. The GUSTO charts takes into account an improved standard of living, of which more than half of mothers in the cohort are better educated (completed at least GCE ‘A’ Levels or polytechnic education) and resided in better accommodation (at least 4- to 5-room Housing and Development Board (HDB) flats). The average maternal age of the GUSTO participants was 30.4 years, slightly

older than that reported in birth weight charts by Tan et al¹⁵ at 29.2 years; this appears to be reflective of the trend of delayed childbearing amongst women in Singapore.¹⁹ Our charts also pooled Chinese, Malay and Indian infants together into one chart. Earlier studies on birth weights in the Singapore population had identified that Indians have the highest proportion of low birth weight,^{20,21} and also tend to weigh lesser than their Chinese and Malay counterparts.²² Similarly, Indians in our study sample exhibited smaller birth weights compared to Chinese and Malays; however these differences were not statistically significant. Additionally, there was no statistical evidence to suggest that size-for-GA pattern was different between ethnic groups at the 10th, 50th and 90th percentiles. In a recent discussion about the cross-ethnic applicability of the WHO Multicentre Growth Reference Study (MGRS) child growth standards, it was suggested that a difference in median of less than +/- 0.4 SD is a clinically non-significant difference.²³ In the present study, there was a lack of clinical significance between the 3 ethnic groups. Comparing the statistically significant difference in median head circumference between Indian and Chinese boys and the statistically non-significant differences in medians of birth weight and length against the SD reflected by the M and S curves of the LMS models, there was no clinically significant difference across ethnic groups. These observations substantiate our pooling of the 3 ethnic groups together into one overall chart, rather than stratifying into ethnic-specific charts. These factors differentiate the GUSTO charts from other local published charts, hence providing a new reference for size-at-birth of Singapore newborns.

Despite evidence to assume postnatal growth trajectories are similar across countries and ethnicity,¹⁰⁻¹² there is much less data on whether size-at-birth is comparable across countries and ethnicity. We compared the birth weights of our infants with published gender-specific references for birth weight-for-GA from the Finland cohort; both the GUSTO as well the Finland study reported GA based on ultrasound assessment, and only “healthy newborn” infants were included. The time period of the Finland study was from 1996 to 2008, relatively closer with that of GUSTO and hence allowing for comparison of the growth curves between these 2 studies. GUSTO term infants were observed to be lighter across the 10th, 50th and 90th percentiles when compared with the Finland cohort. This implies that the use of non-local charts could lead to misclassification of small for gestational age (SGA) or large for gestational age (LGA) infants. Using the Finland charts with our data led to overestimation of SGA infants and underestimation of LGA infants; the consequence of which some infants appropriate for gestational age (AGA) would be wrongly identified as SGA and LGA infants would be overlooked as

AGA. This supports the suggestion that population-specific growth charts should be used for classification of infants into SGA, AGA or LGA; additionally, it seems that compared with Caucasian infants, Asian infants are smaller at birth.

The use of ultrasound for more precise dating of GA, performed at the first trimester period presents as a strength of this study. Ultrasound dating measurements are usually used to confirm last menstrual period dates or if menstrual history is unreliable.²⁴ Unlike other studies^{13,15} where GA was based on date of onset of last menstrual period, which can underestimate the number born preterm, and overestimate post-term GA, ultrasound dating helps to avoid erroneous estimation of GA.¹⁶ Some studies have used anthropometric data documented in birth records.²⁵ While this retrospective technique allows for inclusion of a large sample number of infants, it often necessitates statistical exclusion of extreme outliers arising from errors in documentation.²⁵⁻²⁷ Thus, the prospective nature of the GUSTO cohort adds strength to the study; it allows for accurate measurement of the anthropometric variables, hence exclusion of extreme outliers in data was not required.

Similar to most population-based references, our growth charts have one important limitation, which is the cross-sectional nature of the data. The data analysed in this study are based on size-at-birth anthropometrics of different newborns at different GA, which is not reflective of the intrauterine growth of the foetus. Hence, these charts would not be suitable for evaluation of foetal growth velocity. A longitudinal analysis of individual foetuses would be required for a more detailed study on intrauterine growth velocity. Another limitation of the present study is that the sample size of GUSTO was not estimated for the purpose of constructing size at birth reference charts. However, the use of modern analytic methods like LMS makes good use of data in that each data point contributes toward the estimation of the centiles of not only the GA interval it belongs to but also the adjacent GA. Hence the relatively small sample size was partially compensated by the relatively efficient statistical methods. Future studies with even larger sample size and for a wider range of gestational weeks will be useful. Additionally, the GUSTO sample in this study does not represent the local newborn population; practical logistic issues hindered obtaining samples from other maternity units, which could have further strengthened the applicability of the findings. The GUSTO data however, was collected from 2 of Singapore's major maternity units (NUH and KKH) which strengthened the applicability of the findings as compared to single centre studies.

Our study also lacks sufficient sample size at preterm (less than 37 weeks), as well as at post-term GA (41 weeks). Our cohort is also limited by the small sample size for the Indian population, which necessitates the need for further

research especially regarding the size-for-GA pattern for the Indian population. Whilst growth curves at the lower GA (24 to 34 weeks) would add significant clinical value, our charts would still be useful for clinicians and researchers; it represents a new reference for birth weight, length and head circumference based on a recent population of near-term and term infants, which would be crucial to evaluate birth size correctly. Population-based birth size references representing optimal foetal growth and based on the current population are sparse especially for Singapore, where existing charts are based on populations that are decades old. As changing social trends may influence birth size, birth size references based on a more recent population would be useful for correct evaluation of newborns SGA, AGA or LGA. Correct identification of SGA infants is important since these infants are at an increased risk of perinatal morbidity and mortality and long-term adverse consequences such as neurodevelopmental problems, adult-onset cardiovascular disease, and metabolic alterations. For researchers, our charts would allow for proper categorisation of groups of infants to study aetiologic determinants of birth size as well as short- or long-term prognosis.

Conclusion

Our study findings provide a new reference for size-at-birth of Singapore newborns at 35 to 41 weeks of GA. For clinicians, it allows for a more suitable classification of infants as SGA, AGA or LGA. Given the importance of the relationship between size-at-birth and future health risks, these charts would be useful for the care of newborns.

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Clinical Trial Registration

This study is registered under the Clinical Trials identifier NCT01174875; <http://www.clinicaltrials.gov/ct2/show/NCT01174875?term=GUSTO&rank=2>.

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Can Preoperative Scoring Systems be Applied to Asian Hip Fracture Populations? Validation of the Nottingham Hip Fracture Score (NHFS) and Identification of Preoperative Risk Factors in Hip Fractures

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Abstract

Introduction: Hip fractures in the elderly are a major cause of morbidity and mortality. Determining which patients will benefit from hip fracture surgery is crucial to reducing mortality and morbidity. Our objectives are: 1) to define the rate of index admission, 1-month and 1-year mortality in all hip fracture patients, and 2) to apply the Nottingham Hip Fracture Score (NHFS) to determine validity in an Asian population. **Materials and Methods:** This is a prospective cohort study of 212 patients with hip fractures above 60 years from September 2009 to April 2010 for 1-year. Sociodemographic, prefracture comorbidity and data on functional status was collected on admission, and at intervals after discharge. The main outcome measures were mortality on index admission, 1 month and 12 months after treatment. **Results:** In our study, the overall mortality at 1-month and 1-year after surgery was 7.3% and 14.6% respectively. Surgically treated hip fracture patients had lower odds ratio (OR) for mortality as compared to conservatively treated ones. The OR was 0.17 during index admission, 0.17 at 1-month, and 0.18 at 12-months after discharge. These were statistically significant. Adjustments for age, gender, and duration to surgery were taken into account. The NHFS was found to be a good predictor of 1-month mortality after surgery. **Conclusion:** Surgically treated hip fracture patients have a lower OR for mortality than conservatively managed ones even up to 1-year. The NHFS has shown to predict 1-month mortality accurately for surgically treated hip fracture patients, even for our Asian population. It can be used as a tool for clinicians at the individual patient level to communicate risk with patients and help plan care for fracture patients.

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Key words: Elderly, Femur neck, Geriatric, Intertrochanteric

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Can Preoperative Scoring Systems be Applied to Asian Hip Fracture Populations? Validation of the Nottingham Hip Fracture Score (NHFS) and Identification of Preoperative Risk Factors in Hip Fractures

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Abstract

Introduction: Hip fractures in the elderly are a major cause of morbidity and mortality. Determining which patients will benefit from hip fracture surgery is crucial to reducing mortality and morbidity. Our objectives are: 1) to define the rate of index admission, 1-month and 1-year mortality in all hip fracture patients, and 2) to apply the Nottingham Hip Fracture Score (NHFS) to determine validity in an Asian population. **Materials and Methods:** This is a prospective cohort study of 212 patients with hip fractures above 60 years from September 2009 to April 2010 for 1-year. Sociodemographic, prefracture comorbidity and data on functional status was collected on admission, and at intervals after discharge. The main outcome measures were mortality on index admission, 1 month and 12 months after treatment. **Results:** In our study, the overall mortality at 1-month and 1-year after surgery was 7.3% and 14.6% respectively. Surgically treated hip fracture patients had lower odds ratio (OR) for mortality as compared to conservatively treated ones. The OR was 0.17 during index admission, 0.17 at 1-month, and 0.18 at 12-months after discharge. These were statistically significant. Adjustments for age, gender, and duration to surgery were taken into account. The NHFS was found to be a good predictor of 1-month mortality after surgery. **Conclusion:** Surgically treated hip fracture patients have a lower OR for mortality than conservatively managed ones even up to 1-year. The NHFS has shown to predict 1-month mortality accurately for surgically treated hip fracture patients, even for our Asian population. It can be used as a tool for clinicians at the individual patient level to communicate risk with patients and help plan care for fracture patients.

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Introduction

Osteoporotic hip fractures are common and have significant consequences on mortality and functional capability which indirectly has familial, social and economic repercussions.¹ The inpatient mortality rates approach 4% to 12%,²⁻⁸ while 1-year mortality is between 12% to 37%.^{2, 4-14} Studies from Denmark,^{15,16} Italy,¹⁷ the United Kingdom (UK),¹⁸ and the United States (US)¹⁹ showed that the 1-year survival rate might be as low as 64% to 75%. Those from Sweden,²⁰ Greece,²¹ and Japan²² however revealed that the survival rate is around 80% to 90%. In Singapore, the mortality rates have been shown to be around 5.7% at index admission and between 15% and 26% at 1-year.²³⁻²⁶

The aims of hip fracture surgery are to prevent progression to disability and restore pre-existing functionality.²⁷ Singapore has an ageing population with 9% above the age of 65 years in 2010 and this is projected to increase yearly.²⁸ This places an increasing burden on healthcare resources as postfracture recovery and rehabilitation is often protracted, requiring tertiary healthcare and step-down facilities to handle the increase in patient demand. Wong et al²³ in 2002 estimated that each hip patient required S\$7367 to manage surgically. The costs have inflated over time, and hence government subsidies will become increasingly stretched.

Quickly identifying suitable patients for hip fracture surgery becomes important. It is better to identify patients

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who will do well in the long-term, as this may possibly reduce time to surgery and hence the duration of hospital stays. We know that earlier surgery has been associated with better functional outcome, shorter hospital stay, shorter duration of pain, and lower rates of nonunion, postoperative complications and mortality.²⁹⁻³⁵ Chronological age, gender, residence, cognitive function, pre-existing comorbidities all play a role in postoperative mortality and functional outcome.^{17,19,36-42} There are pre-existing scoring systems designed to risk stratify hip fracture patients, one of which is the Nottingham Hip Fracture Score (NHFS), which has been validated in the UK.^{43,44} To our knowledge, this score has not been validated in an Asian population.

Our hospital-based analysis looked at: 1) rates of mortality at index admission, 1-month and 1-year in hip fracture patients, 2) application of the NHFS to an Asian population to determine validity, and 3) identification of preoperative risk factors for mortality.

Materials and Methods

This was a prospective cohort study at a large public tertiary hospital in Singapore. A hip fracture database was set up from September 2009 which includes sociodemographic, prefracture comorbidity and data on functional status. Inpatient and outpatient data regarding treatment and complications was collected. Data collection after discharge was done via outpatient clinical notes and phone calls at 1-month, 3-month, 6-months and 1-year. Mortality was established by contacting the patient's family and hospital electronic records. We identified a consecutive series of all hip fracture patients above 60 years of age, identified from September 2009 to April 2010. Hip fractures sustained as a result of malignant pathological fractures were excluded.

Univariate analysis was performed to establish relationship between mortality and covariates. Where necessary, multivariate logistic regression was used to adjust for the necessary covariates. A *P* value <0.05 was considered significant. Data was analysed using STATA version 10 (Statacorp, College Station, Texas) and Microsoft Excel spreadsheets.

The NHFS was first developed and validated in the UK as published by Maxwell et al.⁴³ It is a weighted score with 7 independent admission variables which reliably predicts 30-day mortality (Table 1). The variables included age, gender, admission haemoglobin levels, admission mini-mental test scores, number of comorbidities, presence of malignancy, and premorbid place of residence. Each patient can have their predicted 30-day mortality calculated on admission. In this study, the risk score for each patient was calculated, then logistic regression was used to derive receiver operating characteristic (ROC) curves.

Table 1. Nottingham Hip Fracture Scores (NHFS)

Variable	Value	Score
Age (year)	<66	0
	66 – 85	3
	≥86	4
Sex	Male	1
Admission haemoglobin	≤10 g/dL	1
Admission MMTS	≤6 out of 10	1
Living in institution	Yes	1
Number of comorbidities	≥2	1
Malignancy	Yes	1

MMTS: Mini-mental test score

Note: Predicted 30-day mortality is calculated by substituting the total NHFS into the equation: 30-day mortality (%) $1/4100/1 + e^{(4.71822(\text{NHFS}/2))}$

Results

Over a 7-month period from September 2009 to April 2010, 212 hip fracture patients were recruited into the study, with 15 patients lost to follow-up. A total of 138 patients were treated surgically. Characteristics of the patients are shown in Table 2. A total of 70% of patients were treated surgically. The overall mortality rate was 7.3% at 1-month and 14.6% at 12-months after discharge.

The difference in mortality between the genders was not statistically significant. The average duration of index admission was 12 days and of note, 68.9% of our hip fracture patients were discharged to inpatient rehabilitation facilities (community hospitals). Of the 59 patients treated conservatively, 20 of them had declined surgery, while 29 were deemed medically unfit due to acute illness or pre-existing comorbidities. A total of 8 were pre-morbidly bed or wheelchair ridden, and would not benefit from surgery, while 2 did not have surgery for unknown reasons. The mortality rate for conservatively managed patients was 18.6% at 1-month and 32.2% at 1-year. We conducted a univariate analysis looking at individual preoperative factors. Results when analysing 1-month mortality are shown in Table 3.

In our study, surgically treated hip fracture patients had lower odds ratio (OR) for mortality as compared to conservatively treated ones. The OR was 0.17 during index admission, 0.17 at 1-month, and 0.18 at 12-months after discharge. These were statistically significant. Adjustments for age, gender, and duration to surgery were taken into account.

To validate the NHFS in our population, the score was only applied to surgically treated patients, as described by Maxwell in his original paper. This included all surgically treated hip fractures, as well as individual subgroups of neck of femur, and intertrochanteric fractures. ROC curves were

Table 2. Characteristics of Study Population (Standard Deviation)

Demographics	Surgical	Conservative
Age	78.78 (8.97)	82.95 (9.58)
Race (%)		
Chinese	87	89
Others	13	11
Gender (%)		
Male	48	41
Female	52	59
Fracture type (%)		
Neck of femur	52	69
Intertrochanteric	42	28
Subtrochanteric	6	3
Admission haemoglobin (g/dL)	11.64 (1.74)	10.92 (1.79)
Abbreviated mental test (AMT)	6.79 (3.31)	5.02 (2.38)
Charlson comorbidity index score (CCIS)	4.59 (1.88)	5.92 (1.99)
Days to surgery (median, range)	4.55 (3.56)	-
Number of falls last 12 months (median, range)	1.72 (1.63)	1.61 (1.46)
Community ambulant prior to fracture (%)	69	36
Walking aid not required (%)	59	30
Discharge destination (%)		
Community hospital	77	37
Own home	14	29
Nursing home	9	34

generated. An example for 1-month mortality is illustrated in Figure 1. Area under the curve (AUC) values from these curves are presented in Table 4. NHFS can be seen as a good predictor for mortality at 1-month.

Discussion

In our centre, hip fracture patients above 60 years of age are co-managed by a specialised multidisciplinary team of orthopaedic surgeons, orthogeriatricians, nurse managers, physiotherapists, occupational therapists, medical social workers and pharmacists. These patients are put on a hip fracture clinical pathway, which streamlines care, and allows each discipline to better understand and manage each patient.

This study boasts a relatively low mortality rate for both 1-month and 1-year follow-up, given that international hip fracture mortality rates published can range from 4% to 12% for the index admission and from 12% to 37% at 1-year. In our local setting, the resources such as community hospitals are available across the island; 68.9% of our study population was discharged to community hospitals for further rehabilitation. These centres have multidisciplinary management, led by rehab physicians. Each admission to a community hospital usually lasts 2 to 3 weeks. Upon discharge from a community hospital, patients will be better conditioned and confident of returning to their homes. Perioperative morbidity can also be identified early and referred back to the tertiary centre for specialist care. Our city state also allows for early referral to a tertiary centre, even if the patient rehabilitates at home. Continuity of care and easy access to medical facilities allows complications to be arrested and corrected early on. In the UK, only 26.5% of hip fracture patients are discharged to intermediate care, as compared with 86.6% in US hospitals.⁴⁵ Japan, interestingly,

Table 3. Odds Ratios for Various Preoperative Risk Factors; Mortality at 1-month

Factor	Value	Odds Ratio	P Value	95% Confidence Interval
Age	>66 – 85	0.35	0.23	0.06 – 1.96
	>85	1.21	0.81	0.22 – 6.47
Sex	Female	0.73	0.59	0.23 – 2.29
AMT	>5	2.58	0.17	0.66 – 10.0
Residence	Institution	1.24	0.84	0.14 – 10.5
Premorbid mobility	Homebound	1.01	0.98	0.33 – 3.03
Haemoglobin	>10	0.54	0.44	0.11 – 2.55
Site of fracture	Extracapsular hip fractures	0.59	0.40	0.17 – 2.0
Fracture management	Surgical	0.17	0.005	0.51 – 0.59
CCIS	>5	1.94	0.31	0.53 – 7.01
Comorbidities	≥2	0.79	0.68	0.25 – 2.45

AMT: Abbreviated mental test; CCIS: Charlson comorbidity index score

Table 4. All Hip Fractures Surgically Treated

Mortality (Month)	All Hip Fractures (AUC,* 95% CI)
1	0.800, 0.65 – 0.94
3	0.600, 0.40 – 0.79
12	0.607, 0.41 – 0.80

AUC: Area under the curve; CI: Confidence interval

*AUC values using the Nottingham Hip Fracture Score (NHFS) for 1-month, 3-month and 12-month mortality

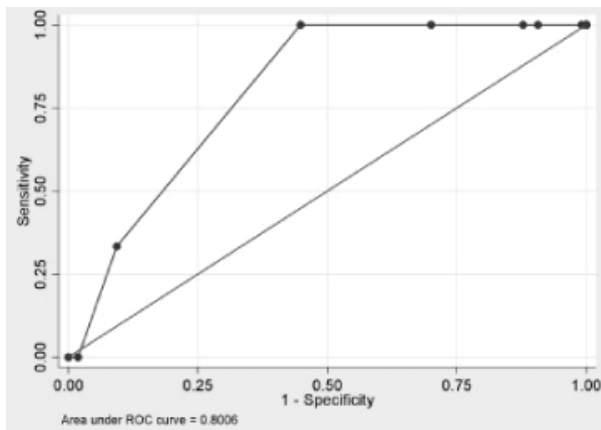


Fig. 1. Graph showing 1-month mortality ROC curves for surgically treated hip fractures.

has a longer average duration of stay than most European countries or the US (average of 48 days in 2001), and one of the lowest mortality rates of 10% at 1-year.⁴⁶ Most hospitals in Japan have both acute care and rehabilitation facilities combined; hence there is little need for further step-down community facilities. Differences in mortality between genders were analysed, but were not significant for age, treatment type or comorbidities.

Having studied various preoperative factors which might influence mortality, we can conclude that surgical treatment has a lower risk of mortality up to 1-year. We understand that there may be a bias due to possible selection of healthier patients for surgery. For example, patients of younger age, fewer comorbidities, faster time to surgery etc. may have benefited from surgery. We have observed that our conservatively managed patients tended to be older, have poorer premorbid function, lower abbreviated mental test (AMT) scores, lower haemoglobin levels, and higher Charlson comorbidity index score (CCIS) scores. Although we attempted to study these possible reasons through a multivariate model, the results were inconclusive. We postulate that surgical treatment allows early mobility, resulting in decreased morbidity from immobility. Neck of femur fractures treated with hemiarthroplasty can start

weightbearing a few days after surgery. Intertrochanteric and subtrochanteric fractures when surgically fixed, likewise allow early weightbearing or at least wheelchair mobility. Conversely, non-operated patients can have adverse outcomes from immobility, with poorer return to function and weightbearing as a result of prolonged bedrest, reduced muscle strength, limb length discrepancy and mal-alignment.

Factors which showed the highest OR for 1-month mortality included age >85, CCIS, and place of residence before admission. Although these scores were not significant, their OR trended towards higher risk for surgical treatment. This is reflected as well when computing NHFS scores, which includes these risk factors in the computation. Surprisingly, AMT scores >5 had a higher OR for 1-month mortality. This result unfortunately could not be explained.

International Scoring Systems for Hip Fracture Patients

Given that elderly patients with osteoporotic hip fractures can have significant comorbidities, it is important to stratify their risk of surgery. This helps to identify patients which would most likely benefit from surgical intervention. It is also necessary to provide quick and accurate risk counselling to the patient and their concerned families on admission.

Different scoring systems have been developed to attempt to predict mortality. Burgos et al⁴⁷ compared 6 different scoring systems: the American Society of Anesthesiologists (ASA) classification,⁴⁸ the Barthel index,⁴⁹ the Goldman index,⁵⁰ the Physiological and Operative Severity Score for the enUmeration of Mortality and Morbidity (POSSUM) scoring system,⁵¹ the Charlson index⁵² and the Visual Analogue Scale for Risk (RISK-VAS) scale.⁵³ Each system was unable to predict hip fracture mortality at 90 days. O-POSSUM scoring has been shown to over predict mortality in hip fractures,⁵⁴ while the Donati score shows a poor concordance when a range of risks is considered.⁵⁵ The Estimation of Physiologic Ability and Surgical Stress (E-PASS) score⁵⁶ was recently developed by a Japanese group to predict morbidity and mortality after hip fracture surgery. It has been shown to better predict morbidity and mortality than the O-POSSUM, however the scoring system requires intraoperative details such as the amount of blood loss, operating time, and the extent of skin incision to calculate the final risk score for the patient.

Maxwell et al's⁴³ original paper showed that the NHFS achieved an AUC of 0.719. This demonstrates a reasonable predictive value for the score. In comparison, ASA and Donati scores each show scores of 0.718 and 0.717 respectively.^{48,51} In a recent study published by Wiles et al⁴⁴ in January 2011, the NHFS was retrospectively calculated for 6202 patients who had undergone hip fracture surgery

in the UK. They found that survival was greater in the low-risk group (NHFS score ≤ 4 at 30 days) [96.5% vs. 86.3% ($P, 0.001$)] and at 1-year [84.1% vs. 54.5% ($P, 0.001$)]. In 2012, Moppett et al⁵⁷ further established the NHFS as a robust predictor of 30-day mortality in geographically distinct UK centres.

The NHFS is simple to use, and data required from each patient is available on admission. Based on our literature review, we are the first centre in Asia to attempt to validate this scoring system in our local population.

In our centre, hip fracture patients are encouraged to undergo surgery when possible, and this is reflected in our population where 70% of cases are managed surgically. Patients are managed conservatively if they will clearly not benefit from surgery (e.g. bedbound preoperatively), patients and family decline surgical intervention, or they have overwhelming medical conditions that do not allow surgical intervention. As such, only surgically treated hip fractures are included in the application and analysis of the NHFS.

Our results show that the NHFS with an AUC value of 0.800 suggests good accuracy for predicting 1-month mortality when applied to all operated hip fractures. Unfortunately, the AUC values for 3-month and 12-month mortality are poor. These values indicate that there are other confounders possibly pre and postoperative, which are yet unknown.

Factors that predict 12-month mortality may very well differ from factors predicting 1-month mortality in our population. There could be subtle differences in the preoperative characteristics between populations. In his original paper to develop and validate the NHFS, Maxwell et al⁴³ shows that for surgically operated patients, the average admission haemoglobin level was 12.3 g/dL while 23% of patients were previously living in an institution. For conservatively managed patients, they had an average haemoglobin level of 11.7 g/dL, while 40% were living in an institution. Both Maxwell and Wiles conducted studies for patients treated at Queen's Medical Center, Nottingham, which they believe is representative of the general population in the UK. In comparison with our study group, only 7.7% of patients were living in an institution and had a haemoglobin of 11.4 g/dL. Both haemoglobin levels and prefracture residence have been shown in earlier research to be positively associated with mortality in hip fractures. Our mortality rates for surgically treated patients also differ: 3.6% at 1-month and 7.5% at 1-year while Wiles et al quotes mortality at 8.3% for 1-month and 29.3% at 1-year.

Given the lower mortality rates in our study, we feel that we should increase our study cohort to better validate the NHFS. We were also unable to calculate the AMT scores for a small percentage of patients, as they were unable to

communicate effectively to give an accurate score. Hence their NHFS scores cannot be determined and these patients were excluded from the scoring. Future research should attempt to apply the NHFS in a prospective study to assess its validity.

Conclusion

In this study, surgically treated hip fracture patients have a lower OR for mortality than conservatively managed ones even up to 1-year. The NHFS has shown to predict 1-month mortality accurately for surgically treated hip fracture patients, even for our Asian population. It can be used as a tool for clinicians at the individual patient level to communicate risk with patients and help plan care for fracture patients.

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Stroke Literacy in Singapore: Data From a Survey of Public Housing Estate Residents

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Abstract

Introduction: Knowledge of stroke symptoms is associated with seeking medical attention early, and knowledge of risk factors is an essential factor in stroke prevention. In this study, we evaluated the level of stroke literacy in Singapore. **Materials and Methods:** A cross-sectional study of Singapore citizens and permanent residents aged 21 years and above was conducted in a public housing estate. Participants were randomly sampled using multi-stage stratified sampling. Assessment of awareness of stroke symptoms and risk factors was performed using open-ended questions. In total, 687 respondents were recruited, with a response rate of 69.7%. **Results:** Overall, 52.4% of respondents identified the brain as the source of pathology, and 47.6% could cite at least 1 of the 3 FAST symptoms (facial droop, arm weakness and speech difficulty), while 40% could name 2 or more of 7 established risk factors for stroke (high blood pressure, high cholesterol, cigarette smoking, diabetes mellitus, older age, previous heart attacks and stroke). Respondents at higher risk of stroke (older individuals and those with stroke risk factors) did not have greater awareness of stroke symptoms and risk factors. The majority of respondents reported they would seek immediate medical care if they experienced stroke symptoms. Only 59.4% knew the emergency ambulance service telephone number. **Conclusion:** In a sample of Singaporean adults residing in a public housing estate, we found evidence of poor stroke literacy, highlighting the need for comprehensive population-based education efforts. There is a role for opportunistic education among those at higher risk of stroke.

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Key words: Health education, Health promotion

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Introduction

Stroke is a leading cause of adult disability worldwide¹ and the second most common cause of disease burden for Singaporeans aged 65 years and older.² Acute thrombolytic treatment with intravenous tissue plasminogen activator (rtPA) within 4.5 hours of stroke onset is proven to reduce poststroke disability.^{3,4} However its utilisation in many parts of the world, including Singapore, is very low,⁵ with the main reason being delayed arrival to hospital due to patients' failure to recognise stroke symptoms and realise the urgency of the situation.⁶ Stroke risk can be reduced with control of known modifiable risk factors such as

hypertension and healthy lifestyle measures.⁷ Hence improved stroke literacy can reduce stroke incidence and improve stroke outcomes, but there are currently limited data on stroke literacy in Singapore. So far, there has only been one published study comparing public awareness of sepsis and stroke in Singapore.⁸ However, this study did not explore comprehensively the various dimensions of stroke literacy (for example using vignettes to explore participants' responses to specific stroke-related scenarios), nor did it explore comprehensively potential factors associated with stroke literacy. We aimed to study the level of awareness

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of stroke symptoms and risk factors among Singapore residents in a public housing estate and its associations with sociodemographic factors, and personal and family medical history.

Materials and Methods

A population-based cross-sectional study of Singapore citizens and permanent residents aged 21 years and above was conducted among public housing residents in the Bishan housing estate, a large centrally-located estate of public apartments in Singapore. This study was designed and implemented in February 2013 and March 2013 by medical students from Yong Loo Lin School of Medicine, National University of Singapore (NUS), under faculty supervision. Institutional Ethics Board approval was obtained prior to conducting this study.

A multi-stage random sampling process was used to select participants. In the first stage, public housing apartment blocks were enumerated, 30% of which were randomly selected. In the second stage, 40% of floors in each selected block were randomly chosen, and every unit on those floors was included in the sampling frame. Within each selected unit, all individuals who fulfilled the inclusion criteria were enumerated, and one individual from each participating household was randomly selected via a Kish table (Fig. 1). Up to 4 visits were performed before the household or individual was considered uncontactable.

The survey was administered in the 4 major languages of Singapore – English, Mandarin, Malay and Tamil. It was first drafted in English, then translated into the other 3 languages, with back-translation as a check for accuracy. The survey was administered by trained medical students via face-to-face interviews. Assessment of awareness of stroke symptoms and risk factors were performed through open-ended questions, which were then coded by the medical students. The questions used were obtained from the Stroke Awareness Questionnaire (SAQ)⁹, and were phrased as follows: “What do you think are the symptoms and warning signs of a stroke? Try to tell me as many as you can.” and “What do you believe are the risk factors associated with stroke? By risk factors, I mean anything that increases a person’s chances of having a stroke. Try to tell me as many as you can.” A pilot study was conducted prior to study implementation to assess the feasibility and to permit coding of common responses to the open-ended questions.

Overall awareness of stroke symptoms and risk factors were assessed. Cut-offs were used to divide respondents into “greater awareness” and “lesser awareness” groups in order to evaluate factors associated with stroke literacy. We defined “lesser awareness” of stroke symptoms as not knowing any of the symptoms of the FAST (Face, Arm,

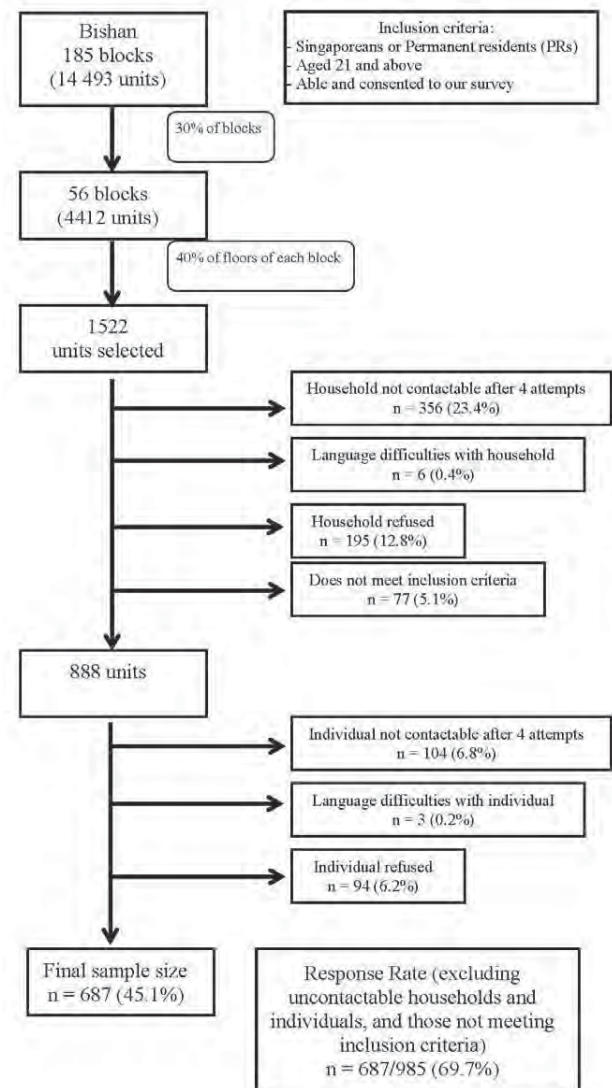


Fig. 1. Flow chart of the sampling procedure undertaken in the study, with corresponding numbers of participants and response rates at each stage.

Speech and Time) stroke message,¹⁰ which include facial droop, arm weakness, and speech difficulty and “greater awareness” as knowing at least 1 of the symptoms. We considered the following to be established stroke risk factors: high blood pressure, high cholesterol, cigarette smoking, diabetes mellitus, older age, previous heart attacks and stroke, based on existing literature on stroke literacy.¹¹⁻¹⁶ We defined “lesser awareness” of stroke risk factors as knowing less than 2 of the 7 risk factors and “greater awareness” as knowing 2 or more of the risk factors. Additional data collected included information about family history of diabetes mellitus, high blood pressure, high cholesterol, dementia, previous heart attacks, other heart problems, previous stroke, and cancer; being a caregiver of someone with a chronic illness or permanent disability; and having a family member who is a healthcare

professional. We obtained further information about the participant's personal medical history of diabetes mellitus, high blood pressure, high cholesterol, dementia, heart attacks, stroke, and heart rhythm problems. We obtained self-reported health behaviours of smoking, leisure-time exercise, fruit and vegetable consumption, adding salt or sauces to prepared food, health supplement consumption, and history of health screening. Hypothetical scenarios were also formulated to assess responses to medical emergencies. These scenarios probed the participant's reported actions to various scenarios such as having severe chest pain, sudden weakness on one side of the body, being unable to speak or understand speech, having cough or runny nose, and if someone they knew had symptoms or signs of stroke that rapidly improved or disappeared.

Associations between sociodemographics and health-related factors with awareness of stroke symptoms and risk factors were evaluated using logarithmic binomial regression. Prevalence rate ratios (PRR) and 95% confidence intervals (CI) were calculated for these associations. Age and ethnicity were adjusted for multivariate analyses. All analyses were performed on IBM Statistical Product and Service Solutions (SPSS) Statistics 20.

Results

From the 1522 households approached, the household response rate was 58.3% (888/1522). Among the eligible individuals in the households who agreed to participate, the individual response rate was 77.4% (687/888). The overall individual response rate was 69.7% (687/985) after excluding non-contactable and ineligible individuals and households (Fig. 1).

The majority of the 687 interviews were conducted in English (n, 77.6%), with 152 (22.2%) interviews conducted in Mandarin, 1 in Tamil and 1 in the Chinese dialect Hokkien. The mean age of the 687 respondents was 48.0 ± 15.0 years, 393 (57.2%) were females, and the ethnic distribution was 584 (85.1%) Chinese, 26 (3.8%) Malays, and 64 (9.2%) Indians (Table 1). Among the respondents, 174 (25.3%) had a monthly household income of more than \$7000 and 586 (85.3%) had received postprimary school education.

With regard to personal and family history of medical conditions, 257 (37.9%) respondents suffer from less than 1 of the following medical conditions which are predisposed to stroke: diabetes mellitus, high blood pressure, high cholesterol, previous acute myocardial infarction, previous stroke, and heart rhythm problems, and 547 (79.6%) respondents have a family member with less than 1 of these conditions.

Nearly all respondents (98.5%) had heard of stroke, with the majority able to identify stroke as preventable (89.7%),

Table 1. Sociodemographic Data of the Study Population (n = 687)

	n (%)
Age (in years) (n = 685)	
(Mean: 48.02 ± 14.99)	
21 – 34	144 (21.0)
35 – 44	134 (19.6)
45 – 54	171 (25.0)
55 – 64	135 (19.7)
65 and above	101 (14.7)
Gender (n = 687)	
Females	393 (57.2)
Males	294 (42.8)
Race (n = 686)	
Chinese	584 (85.1)
Malay	26 (3.8)
Indian	64 (9.3)
Others	12 (1.8)
Marital status (n = 687)	
Single	139 (20.2)
Married	516 (75.1)
Divorced/separated	12 (1.8)
Widowed	20 (2.9)
Highest level of educational qualification (n = 687)	
No formal education/primary education to PSLE	101 (14.7)
ITE certification, GCE 'N' levels, 'O' levels/'A' levels*	245 (35.6)
Polytechnic diploma†	116 (16.9)
University graduate/postgraduate degree holders‡	225 (32.8)
Gross monthly household income (n = 687)	
Less than \$3000	153 (22.3)
\$3001 – \$7000	221 (32.2)
More than \$7000	174 (25.3)
Declined to answer	58 (8.4)
Do not know	81 (11.8)
Occupation (n = 684)	
Working‡	487 (71.2)
Homemaker	86 (12.6)
Retired/unemployed	111 (16.2)
Housing type (n = 685)	
HDB 1- & 2-room flat	0 (0.0)
HDB 3-room flat	28 (4.1)
HDB 4-room flat	383 (55.9)
HDB 5-room flat/executive flats/maisonette	274 (40.0)
Others	0 (0.0)
Language used for interview (n = 686)	
English	532 (77.6)
Mandarin Chinese	152 (22.2)
Malay	0 (0.0)
Tamil	1 (0.1)
Hokkien	1 (0.1)

*Considered as secondary and higher secondary education

†Considered as tertiary education

‡Includes those working full time, part time, on contract work, self employed, National Servicemen and students

non-infectious (94.8%), and a life-threatening condition (92.9%). However, only 52.4% correctly localised stroke as a condition affecting the brain with 17.5% wrongly citing the heart as the source of pathology. About two-thirds of respondents (68.7%) knew that treatments were available for stroke. Many were aware that it was possible to lower the risk of subsequent strokes following an initial stroke (81.1%).

When respondents were asked to cite stroke symptoms, the common responses were speech disturbances or

slurred speech (26.2%), one-sided limb weakness (23.9%), non-specific numbness (23.1%), one-sided facial weakness (21.8%), and non-specific weakness (20.4%) (Table 2). Less than half of the respondents (47.6%) were able to name 1 or more of the 3 stroke symptoms in the “FAST” message, with only 19.2% knowing more than 1 symptom. It is noteworthy that some relatively commonly cited responses by respondents when asked for stroke symptoms were those related to acute myocardial infarction rather than stroke, such as chest pain (12.4%), breathlessness (8.4%) and diaphoresis (6.1%).

Table 2. Awareness of Symptoms and Risk Factors of a Stroke (n = 687)

Warning Symptoms	n (%)	Risk Factors	n (%)
Slurred speech*	180 (26.2)	High blood pressure†	335 (48.8)
One-sided weakness in the arms/legs*	164 (23.9)	Poor diet	288 (41.9)
Numbness	159 (23.1)	High cholesterol†	268 (39.0)
Weakness of one side of the face/corner of mouth droops down*	150 (21.8)	Low level of physical activity	190 (27.7)
Weakness	140 (20.4)	Stress/insufficient rest	147 (21.4)
Dizziness	131 (19.1)	Cigarette smoking†	116 (16.9)
Chest pain	85 (12.4)	Diabetes mellitus†	92 (13.4)
Loss of consciousness	79 (11.5)	Overweight	92 (13.4)
Headache	69 (10.0)	Family history/genetics	87 (12.7)
Breathlessness	58 (8.4)	Excessive alcohol consumption	78 (11.4)
Numbness on one side of the body	54 (7.9)	Advanced age†	43 (6.3)
Hypertension	43 (6.3)	Previous heart attacks†	30 (4.4)
Sweating/cold sweats	42 (6.1)	Non-specific heart problems	22 (3.2)
Difficulty understanding/sudden confusion	32 (4.7)	Heart rhythm problems	21 (3.1)
Blurring of vision	31 (4.5)	Atherosclerosis/blocked vessels	15 (2.1)
Severe headache	19 (2.8)	Blood disorders	11 (1.6)
Nausea/vomiting	17 (2.5)	Previous strokes†	7 (1.0)
Pain in limbs	14 (2.0)	Drinking coffee	2 (0.3)
Other vision disturbances	7 (1.0)	Not able to identify any risk factors at all	62 (9.0)
Not able to identify any symptoms at all	64 (9.3)		
Levels of knowledge of established warning symptoms		Levels of knowledge of established risk factors	
Knows all 3 established symptoms	35 (5.1)	Knows 6 – 7 established risk factors	0 (0.0)
Knows 2 established symptoms	97 (14.1)	Knows 5 established risk factors	4 (0.6)
Knows 1 established symptoms	195 (28.4)	Knows 4 established risk factors	23 (3.3)
Do not know any established symptoms	360 (52.4)	Knows 3 established risk factors	77 (11.2)
		Knows 2 established risk factors	168 (24.5)
		Knows 1 established risk factor	212 (30.8)
		Do not know any established risk factors	203 (29.6)
Dichotomised groups for levels of knowledge for established symptoms		Dichotomised groups for levels of knowledge for established risk factors	
Greater awareness of established symptoms‡	327 (47.6)	Greater awareness of established risk factors	272 (39.6)
Lesser awareness of established symptoms§	360 (52.4)	Lesser awareness of established risk factors¶	415 (60.4)

*Established warning symptoms of a stroke, as defined by the FAST criteria, according to Singapore NNI

†Established risk factors of a stroke, as defined from various studies, review papers and guidelines from NINDS

‡Respondents who were able to identify >1 established warning symptoms of a stroke

§Respondents who were unable to identify any established warning symptom of a stroke

||Respondents who were able to identify >2 established risk factors of a stroke

¶Respondents who were able to identify <2 established risk factors of a stroke

In unadjusted analyses, the proportion of people with greater awareness of stroke symptoms was higher in the middle-aged groups of 35 to 44 years old (PRR 1.32, 95% CI, 1.11 to 1.71) and 45 to 54 years old (PRR 1.34, 95% CI, 1.05 to 1.72) as compared to the youngest age group of 21 to 34 years old (Table 3). Compared to Chinese respondents, those of other ethnicities had greater awareness of stroke symptoms (PRR 1.27, 95% CI, 1.05 to 1.53). There was no association with gender or language of interview. After adjusting for age and ethnicity, a family history of stroke-predisposing conditions was associated with greater awareness of stroke symptoms (PRR 1.39, 95% CI, 1.10 to 1.76), although this was not observed for personal history of stroke risk factors (PRR 0.94, 95% CI, 0.78 to 1.13). Caregivers of patients with chronic illnesses also had greater awareness of stroke symptoms (PRR 1.34, 95% CI, 1.07 to 1.69).

Commonly cited stroke risk factors by respondents included high blood pressure (48.8%), poor diet (41.9%), high cholesterol (39.0%), physical inactivity (27.7%), stress/insufficient rest (21.4%), smoking (16.9%), diabetes mellitus (13.4%) and being overweight (13.4%). Among respondents, 29.6% were unable to name any of the 7 established risk factors and 39.6% had greater awareness of stroke risk factors using our threshold of knowing at least 2 risk factors.

In unadjusted analyses, age, gender, ethnicity and interview language were not associated with awareness of risk factors. After adjusting for age and ethnicity, a family history of stroke-predisposing conditions was independently associated with greater awareness of stroke risk factors (PRR 1.62, 95% CI, 1.21 to 2.17), but a personal history of risk factors was not (PRR 1.19, 95% CI, 0.96 to 1.49). Caregivers of patients with chronic illnesses also had greater awareness of stroke risk factors (PRR 1.41, 95% CI, 1.08 to 1.85).

The majority of respondents reported that they would seek medical care immediately if they experienced stroke symptoms of unilateral weakness (81.8%) or an inability to speak clearly or understand speech (90.0%) (Table 4). Only 408 (59.4%) participants knew the number for an emergency ambulance in Singapore. When presented with the scenario of what they would do if someone they knew presented with symptoms of stroke, 546 (79.5%) respondents said that they would either call an ambulance (67.1%) or bring the person by taxi/car (12.4%) to an accident and emergency (A&E) department. However, if the symptoms of stroke had resolved spontaneously, only 473 (68.9%) respondents would advise the person to see a doctor immediately or on the same day.

Discussion

This study found that stroke literacy in this study population of Singapore residents was poor. There was a general lack of awareness of stroke symptoms and risk factors which was not limited to any particular sociodemographic subgroup. Less than half of respondents knew of at least 1 established stroke symptom, and less than half knew of at least 2 risk factors. Of note, subgroups at higher risk of stroke such as the elderly and respondents with stroke-predisposing conditions also had poor awareness of both symptoms and risk factors of stroke. Our findings suggest that there is a need to improve public education on stroke, particularly among those at higher risk of stroke.

A previous study⁸ of stroke literacy in Singapore (which used telephone survey methods) reported higher rates of stroke literacy than our study (77% of respondents correctly citing at least one stroke symptom, compared with 47.6% in our study). However, in contrast to our study which used FAST criteria, this study used broader criteria for “acceptable” symptoms including any numbness, weakness or dizziness. The numbers of respondents who could cite at least 1 stroke risk factor was similar (75% versus 70.4% in our study).

Studies conducted in other countries suggest that the level of awareness of stroke symptoms and risk factors worldwide is poor.¹¹⁻¹⁷ Direct comparisons between studies can be misleading when different question formats have been used, and where different criteria have been applied for defining high stroke literacy. We found 2 studies in the literature that used an open-ended design similar to our study, where participants were asked to respond to open-ended questions without any prompts. In a study conducted in Ireland, 30.7% of respondents were able to cite at least 2 out of 8 stroke symptoms, and 71.1% were able to cite at least 2 out of 5 stroke risk factors.⁹ Another in Korea¹⁷ found that 61.5% of respondents were able to cite at least 1 out of 5 stroke symptoms, and 56.1% were able to cite at least 1 out of 8 stroke risk factors. In comparison, our study population also had low literacy levels, with 47.6% able to cite at least 1 out of 3 stroke symptoms, and 39.6% able to cite at least 2 out of 7 stroke risk factors.

The lack of association of awareness of stroke symptoms and risk factors with older individuals, despite their higher risk of stroke, is consistent with previous studies.¹⁵ Further, we observed that those with a personal history of stroke-predisposing medical conditions did not have better stroke literacy. Unusually, stroke literacy was better in individuals with a family history of a stroke-predisposing condition or who were caregivers of family members with medical conditions. A possible reason for this could be the strong role the family plays in an individual’s medical care in Singapore,¹⁸ which may result in more interaction and education opportunities with healthcare professionals.

Table 3. Factors Associated with Awareness of Stroke Symptoms and Risk Factors

	Greater Awareness of Symptoms† (Unadjusted)			Greater Awareness of Symptoms† (Adjusted)*			Greater Awareness of Risk Factors‡ (Unadjusted)			Greater Awareness of Risk Factors‡ (Adjusted)*		
	Prevalence Rate Ratio	95% Confidence Interval	Prevalence Rate Ratio	95% Confidence Interval	Prevalence Rate Ratio	95% Confidence Interval	Prevalence Rate Ratio	95% Confidence Interval	Prevalence Rate Ratio	95% Confidence Interval	Prevalence Rate Ratio	95% Confidence Interval
Age (years)	21–34	1			1		1		1			
	35–44	1.32	1.11–1.71				1.13	0.86–1.48				
	45–54	1.34	1.05–1.72				0.96	0.73–1.26				
	55–64	1.22	0.93–1.59				0.98	0.73–1.30				
	65 and above	1.08	0.79–1.46				0.84	0.60–1.17				
Gender	Female	1			1		1		1			
	Male	0.95	0.81–1.12	0.96	0.82–1.12	0.91	0.75–1.10	0.90	0.75–1.09			
Ethnicity	Chinese	1			1		1		1			
	Malay	1.43	1.07–1.92				0.77	0.43–1.38				
	Indian	1.23	0.97–1.55				0.98	0.71–1.35				
	Others	1.09	0.62–1.94				1.04	0.53–2.05				
	Chinese	1			1		1		1			
	Non-Chinese	1.27	1.05–1.53				0.93	0.71–1.22				
Education	No education/PSLE	0.80	0.61–1.07	0.75	0.53–1.05	0.83	0.61–1.13	0.91	0.63–1.32			
	GCE 'N' level, 'O' level, 'A' level, ITE	1.11	0.93–1.33	1.04	0.83–1.30	0.96	0.77–1.19	1.01	0.79–1.29			
	Polytechnic Diploma	0.88	0.68–1.13	0.87	0.67–1.12	0.93	0.71–1.22	0.95	0.73–1.25			
	University graduate/postgraduate	1		1		1	1		1			
	Less than \$3000	1		1		1	1		1			
Income	\$3001–\$7000	1.24	0.99–1.56	1.28	1.01–1.62	1.20	0.90–1.60	1.18	0.87–1.60			
	More than \$7000	1.23	0.97–1.56	1.33	1.04–1.71	1.41	1.06–1.88	1.39	1.03–1.89			
	Working/national service/student	1		1		1	1		1			
Occupation	Homemaker	1.20	0.98–1.47	1.16	0.94–1.43	1.00	0.76–1.32	1.02	0.77–1.35			
	Retired/unemployed	0.74	0.57–0.97	0.70	0.52–0.93	0.82	0.62–1.09	0.86	0.63–1.17			

*Adjusted for age and ethnicity

†Respondents who were able to identify >1 established warning symptoms of a stroke

‡Respondents who were able to identify >2 established risk factors of a stroke

\$Includes diabetes mellitus, high blood pressure, high cholesterol, previous acute myocardial infarction (AMI), previous stroke, and heart rhythm problems

||Includes diabetes mellitus, high blood pressure, high cholesterol, previous acute myocardial infarction (AMI), previous stroke and other heart problems

Table 3. Factors Associated with Awareness of Stroke Symptoms and Risk Factors (Cont)

	Greater Awareness of Symptom† (Unadjusted)			Greater Awareness of Symptom† (Adjusted)*			Greater Awareness of Risk Factor‡ (Unadjusted)			Greater Awareness of Risk Factor‡ (Adjusted)*		
	Prevalence Rate Ratio	95% Confidence Interval		Prevalence Rate Ratio	95% Confidence Interval		Prevalence Rate Ratio	95% Confidence Interval		Prevalence Rate Ratio	95% Confidence Interval	
Marital status	1		Single	1			1			1		
	1.14	0.92 – 1.41	Married	1.20	0.95 – 1.53		1.09	0.85 – 1.39		1.19	0.91 – 1.55	
	1.18	0.65 – 2.14	Divorced/separated	1.30	0.70 – 2.43		2.04	1.38 – 3.03		2.17	1.50 – 3.24	
	1.41	0.94 – 2.12	Widowed	1.58	1.00 – 2.49		0.82	0.40 – 1.65		0.98	0.46 – 2.08	
Language used for interview	1		English	1						1		
	0.83	0.67 – 1.02	Other languages	0.82	0.65 – 1.04		0.98	0.79 – 1.23		1.03	0.81 – 1.32	
Being a caregiver	1.32	1.05 – 1.67	Yes	1.34	1.07 – 1.69		1.40	1.07 – 1.83		1.41	1.08 – 1.85	
	1		No	1			1			1		
Significant past medical history§	0.98	0.83 – 1.15	Yes (>1 significant personal medical condition(s))	0.94	0.78 – 1.13		1.08	0.90 – 1.31		1.19	0.96 – 1.49	
	1		No	1			1			1		
Significant family history	1.42	1.12 – 1.80	Yes (≥1 significant family history of medical condition(s))	1.39	1.10 – 1.76		1.63	1.21 – 2.18		1.62	1.21 – 2.17	
	1		No	1			1			1		

* Adjusted for age and ethnicity

† Respondents who were able to identify >1 established warning symptoms of a stroke

‡ Respondents who were able to identify >2 established risk factors of a stroke

§ Includes diabetes mellitus, high blood pressure, high cholesterol, previous acute myocardial infarction (AMI), previous stroke, and heart rhythm problems

|| Includes diabetes mellitus, high blood pressure, high cholesterol, previous acute myocardial infarction (AMI), previous stroke and other heart problems

Table 4. Reported Actions by Respondents to Hypothetical Scenarios of Suspected Stroke and other Medical Emergencies and Their Knowledge of Emergency Medical Services (n = 687)

	n (%)
Immediate action if they suspected that a colleague/friend was having warning symptoms of a stroke	
Call an ambulance*	461 (67.1)
Send to A&E department by car/taxi*	85 (12.4)
Bring the person to a general practitioner (GP)	54 (7.9)
Call a family member or friends for help	6 (0.9)
Prick finger and let the blood drain	6 (0.9)
Encourage person to exercise/change diet	5 (0.7)
Wait and see if the symptoms resolve on their own	2 (0.3)
Bring the person to the A&E department by Mass Rapid Transit (MRT)/bus	2 (0.3)
Bring the person to a traditional physician	2 (0.3)
Bring the person to a specialist	2 (0.3)
Initiate cardiopulmonary resuscitation	2 (0.3)
Send the patient for acupuncture	2 (0.3)
Apply medicated oil	2 (0.3)
Do not know what to do/will not do anything	2 (0.3)
Give the person medications	1 (0.1)
Immediate action if they suspected that somebody had signs of stroke which subsequently resolved	
Go to the doctor immediately/on the same day*	473 (68.9)
Lifestyle advice (change diet, encourage exercise, take medications/control illnesses)	65 (9.5)
No further action; wait to see if symptoms come back	64 (9.3)
Go to the doctor in a few days' time	40 (5.8)
Tell the doctor the next time he/she sees him for another medical problem	11 (1.6)
Self-medicate/take vitamins	10 (1.5)
Go to a traditional physician	3 (0.4)
Go for health screening/full body check	3 (0.4)
Action when there is sudden weakness on one side of the body (n = 681)	
Immediately*	557 (81.8)
Wait for a few hours to see if symptoms resolve	82 (12.0)
Wait till the next day to see if symptoms resolve	30 (4.4)
Would not seek medical care	12 (1.8)
Action when suddenly unable to speak clearly or understand speech (n = 681)	
Immediately*	613 (90.0)
Wait for a few hours to see if symptoms resolve	36 (5.3)
Wait till the next day to see if symptoms resolve	23 (3.4)
Would not seek medical care	9 (1.3)
Number to call for an ambulance in Singapore (n = 687)	
995*	408 (59.4)
999†	98 (14.3)
911	45 (6.6)
1777†	3 (0.4)
Others/did not know	133 (19.3)

*Correct answers for the condition- and symptom-specific scenarios

†In Singapore, the police hotline is 999 and the private ambulance hotline is 1777

Although majority of respondents reported that they would seek medical help immediately if someone they knew had symptoms of a stroke, local studies have found substantial delays in hospital presentation.^{19,20} In a 2009 study of Singapore stroke patients, the mean time of hospital arrival from stroke onset was over 20 hours, with only 15% presenting within the time window for consideration for thrombolysis.²⁰ This inconsistency between reported intentions and actual behaviour is striking. One possible explanation is social desirability bias, as medical students had been the ones who administered the survey, and thus respondents may have overestimated their willingness to seek medical assistance. Alternatively, the inconsistency may be due to the difficulty in recognising stroke symptoms when they occur, and assessing whether these symptoms are serious or severe enough to warrant medical attention, an issue that has been highlighted in other studies.^{9,16} Further research with in-depth qualitative interviews of stroke patients and their family members is needed to better understand the reasons for this inconsistency.

The overall low level of stroke awareness in Singapore highlights the need for systematic and comprehensive population-based education efforts, as well as opportunistic education by healthcare providers of older patients and patients with stroke-predisposing medical conditions. There is published evidence that such education efforts can improve public stroke literacy.²¹⁻²³ Higher stroke literacy is associated with earlier hospital presentation of stroke patients,²⁴ which will allow for greater utilisation of proven acute stroke management strategies such as thrombolysis. This is particularly important in Singapore where the burden of stroke is expected to rise, given its rapidly ageing population²⁵ and relatively high prevalence of stroke-predisposing conditions such as diabetes.²⁶ In planning an education programme, it is necessary to consider carefully the target audience, the specific message being communicated, and the media through which communication will take place, in order to maximise the impact of the programme. It is well-known that a gap exists between information and behaviour change, so any programme developed must attempt to bridge this gap. Finally, a robust evaluation programme should be set up; it should assess the effectiveness of the education programme implemented, using appropriate and objective measures that focus on actual behaviour change. Well-designed stroke awareness programmes have been shown to be able to successfully improve stroke literacy, both in terms of knowledge, and in terms of actual observed behaviour, although the success of these programmes depend on choosing the right message and the right medium for any target group.²⁷ Although most stroke programmes have focused on adults and at-risk individuals, some programmes have successfully targeted children who then transfer this knowledge to their

adult relatives.²⁷ Opportunistic promotional efforts can be conducted during routine medical appointments for patients with stroke-predisposing conditions like hypertension and diabetes. These efforts can focus both on improving literacy, and on controlling risk factors for stroke.

There are 2 main sets of limitations in this study – one with regard to the questionnaire used, and the other with regard to the population surveyed. The use of open-ended questions tends to result in lower reported stroke literacy rates^{15,16} compared to close-ended questions, but it is not certain how this relates to actual literacy. There is no widely accepted standardised questionnaire to measure awareness of stroke. Comparisons between studies are difficult in view of differing question formats. We modified the SAQ questionnaire that has been validated in other countries, but not in Singapore. Furthermore, although language translations included back-translation and piloting, the translated versions of the questionnaire were also not formally evaluated for validity. Further, our dichotomisation of the study population into “lesser awareness” and “greater awareness” was arbitrary, although we believed that the cut-offs used were reasonable and adequately discriminated between people based on their level of stroke literacy. The survey population used may limit the generalisability of our findings. A single public housing estate was sampled and respondents living in private housing (which represents about 18% of all dwellings in Singapore)²⁸ were not included. Our study was small, and included few respondents belonging to ethnic minorities or to very low socio-economic groups.

Conclusion

In this study of residents living in a public housing estate in Singapore, the level of awareness of stroke symptoms and risk factors was low, highlighting the need for public education efforts to improve stroke literacy in Singapore.

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Clinical Outcome and Cost Comparison Between Laparoscopic and Open Appendicectomy

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Abstract

Introduction: Local data comparing laparoscopic appendicectomy (LA) and open appendicectomy (OA) is lacking. We perform a cost and outcome comparison between LA and OA. **Materials and Methods:** A retrospective review of all appendicectomies performed for suspected appendicitis from July 2010 to December 2010 was conducted. Patient demographics, duration of surgery, complication rates, total cost of stay (COS) and length of stay (LOS) were compared between LA and OA. **Results:** A total of 198 patients underwent appendicectomy during the duration of study; 82 LA and 116 OA. There were 115 males (58.1%) and 83 females (41.9%). Median age was 33 years. Patients who underwent LA were significantly younger ($P < 0.001$) with a greater proportion of females ($P < 0.0001$) and were more likely to be negative appendicectomies (18.3% vs. 6.9%, $P = 0.023$). Duration of surgery was significantly longer in LA patients (86 min vs. 74 min, $P = 0.003$). LOS in the LA group was shorter by 1.3 days compared to OA (2.0 days vs. 3.3 days, $P < 0.0001$). The differences in operative duration and LOS between LA and OA remained significant on multivariate analysis ($P = 0.001$ and $P = 0.008$, respectively). The COS ($P = 0.359$), wound infection rates ($P = 0.528$) and complication rates ($P = 0.131$) were not significantly different between the 2 groups. **Conclusion:** LA is associated with a shorter LOS while its cost is equivalent to OA. From the perspective of utilisation of healthcare resources, LA appears to be superior.

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Key words: Complications, Cost utility, Singapore

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Introduction

Acute appendicitis is one of the most common causes of acute abdominal pain requiring surgical intervention.^{1,2} The traditional operation of choice was the open appendicectomy (OA) pioneered by McBurney in 1894.³ In 1981, the laparoscopic technique was introduced by Kurt Semm and since then, laparoscopic appendicectomy (LA) is increasingly being performed in place of OA.^{4,5} While there is an abundance of published data comparing the pros and cons of LA and OA from overseas, local data is lacking. To the best of our knowledge, there has only been one local publication specifically comparing outcomes between LA and OA. However, this paper was published close to 20 years ago when LA was still a relatively new procedure.⁶ In particular, there is no data comparing the cost difference

between LA and OA in the local context. This is important as cost analysis from foreign publications may not be applicable in our local setting as healthcare economics vary between countries. In the current era where healthcare resources are spread thinly nationwide, such data is crucial for us to determine the more cost-effective technique for the treatment of a common surgical pathology. We thus aim to perform a cost analysis and compare the clinical outcomes between LA and OA in the local setting.

Materials and Methods

We conducted a retrospective review of medical records of all consecutive cases of appendicectomies performed for

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suspected appendicitis from July 2010 to December 2010 in a 1500-bed tertiary hospital. Cases with pathologies which eventually required a formal laparotomy with bowel resection were excluded from the analysis.

Patient demographics, the type of appendicectomy (laparoscopic or open) performed, the use of computed tomography (CT) during evaluation, perforation status, the duration of surgery, final histology, cost of stay (COS) and length of stay (LOS) were recorded in a standardised data collection sheet. Medical records were reviewed up to 12 months from discharge and postoperative complications were recorded when applicable.

The choice of procedure (LA or OA) was decided based on patient preference and clinical factors. OA was performed via a right lower quadrant Lanz or gridiron incision, even in patients with previous laparotomy. LA was performed via 3 laparoscopic ports. A 10 mm umbilical camera port was first inserted using the open Hasson technique. Pneumoperitoneum was achieved to a pressure of 10 to 12 mm Hg using carbon dioxide. Two 5 mm working ports were next inserted under direct vision in the left lower quadrant and the suprapubic region. The appendix was dissected free and the appendicular artery ligated using 3 Hem-o-lok® clips (2 proximal and 1 distal) and divided. The appendicular base was secured using 3 Endoloop® (2 proximal and 1 distal) and divided. The appendix specimen was retrieved using the Endo Catch™ pouch via the umbilical port. Operative time was defined as the time from skin incision to skin closure. LOS was defined as the duration (days) from time of surgery completion to discharge. COS was defined as the total hospitalisation bill incurred by the patient in Singapore dollars during admission before government subsidies were taken into consideration. The presence of appendicitis was defined based on final histology. Negative appendicectomy was defined as patients who underwent surgery with the clinical impression of acute appendicitis but with no features of appendicitis on histology. In our institution, patients who underwent diagnostic laparoscopy were also consented preoperatively for LA. These patients will have a LA performed even in the presence of a normal-appearing appendix. These patients were included during the analysis of negative appendicectomies. Perforation status was defined based on histological findings. Complications were defined as any deviation from the normal postoperative course for an appendicectomy.⁷ These include wound infections, postoperative ileus, postoperative intestinal obstruction, intra-abdominal abscesses, pulmonary complications and incisional hernias.

The main outcome measures, namely, operative duration, LOS, COS, wound infection rate and complication rates, between the LA and OA groups were compared.

These were adjusted for differences in demographic characteristics, previous abdominal surgery, American Society of Anesthesiologists (ASA) status, CT evaluation status, presence of appendicitis and perforation status using multivariate analysis. Patients with intraoperative conversion from LA to OA were analysed under the LA group based on intention to treat analysis.

Statistical analyses were performed using Statistical Package for the Social Sciences (SPSS) version 17. Categorical variables were compared using Chi-square analysis. Parametric variables were compared using t-test while non-parametric variables were compared using Mann-Whitney U test. Linear and logistic regression analyses were used for multivariate analysis of continuous and categorical variables, respectively. A *P* value <0.05 was regarded as statistically significant.

Results

A total of 204 patients underwent appendicectomy during the duration of study. Six patients were found intraoperatively to have pathologies which warranted a formal laparotomy. Five patients had a right hemicolectomy performed due to caecal tumour (1 patient), perforated caecal diverticulitis (1 patient) and unhealthy base of appendix (3 patients). The remaining patient had a concomitant small bowel resection for Meckel's diverticulitis noted intraoperatively. These 6 cases were excluded from analysis. Excluding these 6 patients, there were 198 patients who underwent routine appendicectomy. Eighty-two were LA (41.4%) and 116 were OA (58.6%). Comparison of demographic characteristics between the groups with LA and OA is shown in Table 1.

Twelve cases out of 82 attempted LA were converted to OA (14.6%). The reasons for conversion include dense adhesions (3 patients), difficulty in maintaining pneumoperitoneum (3 patients), impaired visibility due to bleeding from the appendicular artery (2 patients) and concerns regarding the integrity of the appendiceal stump (4 patients).

A comparison of outcomes between LA and OA is shown in Table 2. Laparoscopic appendicectomy was associated with an increased operative duration (86 min vs. 74 min, *P* = 0.003) and a shorter postoperative LOS of 1.3 days compared with OA (2.0 days vs. 3.3 days, *P* <0.001). The differences in duration of surgery (*P* = 0.001) and LOS (*P* = 0.008) remained significant on multivariate analysis. COS, wound infection and complication rates were not significantly different between the 2 groups.

Complications developed in 17 patients (8.6%), none of which occurred intraoperatively. Majority of these were due to superficial wound infections (10 patients). Intra-abdominal abscesses developed in 3 patients, 2 in OA

Table 1. Comparison of Demographic Characteristics Between Laparoscopic and Open Appendectomy

	Overall (n = 198)	Laparoscopic Appendectomy (n = 82)	Open Appendectomy (n = 116)	P Value
Median age				
Years	33	30	37	<0.001*
Range	13 – 83	15 – 67	13 – 83	
Gender (%)				
Male	58.1	40.2	70.7	<0.001*
Female	41.9	59.8	39.3	
Previous abdominal surgery (%)	8.6	2.4	12.9	0.009*
ASA status (%)				
ASA 1	66	72	62	0.173
ASA 2	30	27	33	
ASA 3	3	0	4	
ASA 4	1	1	1	
CT evaluation (%)	42.9	30.5	51.7	0.004*
Negative appendectomy rate (%)	11.6	18.3	6.9	0.023*
Perforated appendicitis (%)	9.1	6.1	11.2	0.316

*Denotes statistically significant results

ASA: American Society of Anesthesiologists; Computed tomography

Table 2. Comparison of Outcomes Between Laparoscopic and Open Appendectomy

	Overall (n = 198)	Laparoscopic Appendectomy (n = 82)	Open Appendectomy (n = 116)	Univariate Analysis P Value	Multivariate Analysis P Value
Mean duration of surgery					
Minimum	79	86	74	0.003*	0.001*
Range	30 – 170	30 – 170	30 – 143		
Mean postoperative length of stay					
Days	2.7	2.0	3.3	<0.001*	0.008*
Range	1 – 34	1 – 6	1 – 34		
Median cost of stay (\$)					
Cost	4087	3893	4158	0.359	0.636
Range	2430 – 44,843	2646 – 7651	2430 – 44,843		
Wound infection rate (%)	5.1	3.7	6	0.528	0.958
Complication rate (%)	8.6	4.9	11.2	0.131	0.113

*Denotes statistically significant results

and 1 in LA. The patient with intra-abdominal abscess in the LA group was successfully managed conservatively with antibiotics. In the other 2 cases in the OA group, 1 resolved with conservative management while the other required percutaneous drainage. The remaining 4 patients had other complications such as intestinal obstruction or incisional hernias.

Discussion

In our study, LOS in LA was significantly shorter by 1.3 days compared with OA, with the difference remaining significant on multivariate analysis. This is similar to findings in other studies comparing LA and OA.^{5,8-10} In terms of cost comparisons between the 2 techniques, findings in literature are mixed, with most demonstrating an increased

Table 3. Comparison of Cost of Stay Between Laparoscopic and Open Appendectomy After Taking Into Consideration CT Evaluation Status

	Laparoscopic Appendectomy	Open Appendectomy	P Value
Median cost of stay in patients with preoperative CT evaluation (n = 85) (\$)			
Cost	4794	4725	0.721
Range	3775 – 7651	2863 – 44,843	
Median cost of stay in patients without preoperative CT evaluation (n = 113) (\$)			
Cost	3549	3368	0.170
Range	2646 – 6737	2430 – 10,474	

CT: Computed tomography

cost associated with LA.⁹⁻¹⁵ The perceived higher cost incurred with LA is a major reason why the minimally-invasive approach is not preferred to conventional OA in many institutions. Contrary to this belief, our data actually shows that overall cost incurred was similar between the 2 techniques. One may argue that the increased use of preoperative CT evaluation in the OA group may have inflated overall hospitalisation cost and masked any cost differences between LA and OA. However, even after CT evaluation status was taken into consideration, the overall COS between LA and OA remained comparable (Table 3). This appears counterintuitive since the additional consumables incurred in LA increases overall operating cost when compared to OA. Our findings may be explained by the cost savings from reduction in LOS that could have offset the additional operating costs incurred in LA. Various publications have also revealed that the reduction of time spent away from work with LA may lead to further economic savings which were not assessed in our study.^{16,17} Thus, from the perspective of cost analysis, LA appears to be superior to OA.

In terms of comparisons of other outcomes, duration of surgery was significantly longer in LA compared with OA, as is consistent with the findings in other studies.^{8,14,18} Wound infection rates and complication rates were, however, similar between the 2 groups in our study. This differs from the data of 3 recent meta-analyses comparing LA and OA, which revealed a lower incidence of wound infection and postoperative complications among patients who received LA.^{8,14,18} We acknowledge that, unlike these meta-analyses, our study is likely underpowered to detect these differences between the 2 groups of patients.

There are several limitations resulting from the retrospective nature of our study. Firstly, there were distinct differences in terms of demographic characteristics between the 2 groups of patients (Table 1) which may have confounded findings from comparisons of outcomes (Table 2). This was addressed by performing multivariate

analysis, which showed that the outcomes that were significantly different between LA and OA (operative duration and LOS) remained significant after adjusting for these variables. Secondly, patients analysed in the LA group included clinically equivocal cases which were subjected to diagnostic laparoscopy. Ideally, these cases should be excluded from the study as they could have minimal disease which would translate to a shorter LOS. Unfortunately, due to inadequacies in documentation, it is often difficult to identify cases of LA which were performed with the original intent of diagnostic laparoscopy. Thirdly, our study may be underpowered to detect differences such as rates of wound infections and pelvic collections between LA and OA, which the other meta-analyses have managed to show. Nonetheless, we have managed to dispel the notion that LA costs significantly more than OA, as the cost comparison from our study was comparable between the 2 groups. In addition, LA offers the benefit of a shorter LOS compared to OA. Thus, from the perspective of utilisation of healthcare resources, LA appears to be the superior technique.

Conclusion

Compared to OA, LA was associated with a shorter LOS with equivalent cost. It appears superior from the perspective of utilisation of healthcare resources.

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Limiting the Use of Primary Endocrine Therapy in Elderly Women With Breast Cancer

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Abstract

Primary endocrine therapy (PET) is often included as a treatment option in elderly women with operable breast cancer. Elderly women tend to have pre-existing comorbidities and are often reluctant to undergo surgery. The benefit of surgery needs to be weighed against a relatively higher potential for operative morbidity and mortality, and a limited life expectancy. But while PET can provide relatively good locoregional control, it is not curative in nature and the possibility of local complications and metastasis remains. We retrospectively reviewed the outcome of PET in a series of 19 elderly women, older than 70 years of age, who had presented with operable non-metastatic breast cancer. Only about a third of these women were deemed medically unfit for surgery; the rest had declined surgery. Compliance was an issue, with almost half of these patients defaulting treatment and follow-up. Local control was achieved in most patients, but disease progression did occur in 5 patients. Three of these patients received additional treatment; which included surgery in 1 patient. PET should therefore not be considered an equivalent alternative to surgery in elderly women who were fit to undergo surgery. However, having observed that only 1 of the 6 deaths in our study was related to breast cancer, PET does have a role in women whose life expectancy is more likely to be limited by coexisting morbidities than the breast cancer itself.

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Key words: Local control, Non-operative management, Tamoxifen

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Introduction

There is a tendency to opt for non-surgical interventions in elderly women with breast cancer. Although surgery offers the most effective form of locoregional control, there is concern that increased operative risk from existing comorbidities and a limited life expectancy outweigh the benefits of surgery.^{1,2} Primary endocrine therapy (PET) appears as a viable alternative. Tumours in the elderly are often hormone responsive and tend to progress slowly, making them particularly amenable to hormonal therapy.³ Although not curative, PET can confer fairly good locoregional control to allow for a reasonable quality of life. This is particularly relevant in women whose life expectancy is limited by serious comorbidities and who are expected to die with the breast cancer. PET is especially appealing to elderly Asian women, who often believe themselves to be too old and frail to undergo surgery. In this study, we

reviewed our experience with PET in a series of elderly women with operable breast cancer, focusing particularly on disease control and compliance to treatment.

Nineteen patients older than 70 years of age who had received PET were identified from clinical records spanning from 1 January 2002 to 31 December 2009. All tumours were histologically confirmed and deemed operable. Male patients and those presenting with metastatic disease were excluded. Treatment endpoints included tumour response, the need for additional locoregional treatment and the development of distant metastasis. Patient demographics, tumour characteristics and disease outcome during follow-up were obtained from the clinical records. The criteria defining human epidermal growth receptor (HER)-2 status was modified in 2007 following changes in the American Society of Clinical Oncology (ASCO) guideline

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recommendations. A test was considered positive if more than 30% of the tumour cells exhibited uniform intense membrane staining. Prior to this, a test was considered positive if strong complete membrane staining was observed in more than 10% of tumour cells.

Details of the 19 patients are included in Table 1. Median patient age was 84 years (range, 70 to 98 years). All 19 patients had at least 1 significant comorbidity; with hypertension, ischaemic heart disease and a previous history of stroke being the most common. Skin involvement (ulceration or fixation to the overlying skin) was present in 3 patients but none were associated with significant bleeding or discharge. Ipsilateral axillary nodes were palpable in 2 patients. Most patients (12 of 19) had stage II disease. All tumours were strongly estrogen receptor (ER) positive; a median of 90% of cells stained positive with an intensity of 3. Nine tumours were also progesterone receptor (PR) positive. HER-2 receptor status was not known in majority of the patients. Of these 19 patients, only 7 were documented as being medically unfit for surgery due to the severity of pre-existing comorbidities. The median follow-up interval was 28 months (range, 2 to 94 months).

Eighteen patients received tamoxifen as the first-line hormonal agent, and 1 patient received letrozole. Median duration of first-line hormonal therapy was 20 months (range, 1 to 60 months). At the end of the follow-up period, only 1 patient had completed 5 years of therapy and 4 others were still on tamoxifen. Six (32%) patients had died. Five died from causes unrelated to breast cancer and 1 from lung metastasis; none of these 5 patients had completed 5 years of tamoxifen. Seven patients (37%) had defaulted on treatment and follow-up, after a median duration of 29 months (range, 5 to 33 months). The patient on letrozole was switched to tamoxifen after 3 months because of intolerable musculoskeletal side effects but defaulted soon after. She presented again 6 months later with disease progression.

Local control was achieved in 14 of 19 patients (74%). Clinical tumour regression was noted in 8 patients, and the tumour remained stable in size in the other 6 patients. Among the 7 patients who had defaulted, clinical reduction in tumour size was documented in 3 patients and stable disease in the remaining 4. The primary tumour progressed in the remaining 5 patients, with skin ulceration and tumour fungation occurring in 2 patients. Progression had been documented after a median interval of 15 months from the time of diagnosis (range, 2 to 29 months). In 4 cases, the tumour had remained stable up until the time of progression; in the remaining case, progression was documented at the next review. One patient underwent mastectomy and axillary clearance, and continued with tamoxifen postoperatively after she declined a switch to aromatase inhibitors. The other patient received whole breast irradiation for local

Table 1. Details of Patient and Tumour Characteristics (n = 19)

Characteristic	n (%)
Median age (years)	84 (70 – 98)
Ethnicity	
Chinese	17 (89.5)
Malay	2 (10.5)
Comorbidities	
Yes	19 (100)
No	0
Median tumour size (mm)	45 (10 – 70)
Disease stage at presentation	
I	2 (10.5)
IIa	7 (36.8)
IIb	5 (26.3)
IIIa	2 (10.5)
IIIb	3 (15.9)
IV	0
Oestrogen receptor (ER) status	19 (100)
Positive	0
Negative	
Progesterone receptor (PR) status	9 (47.4)
Positive	10 (52.6)
Negative	
HER-2 status	
Positive	2 (10.5)
Negative	5 (26.3)
Unknown	12 (63.2)
Reasons for no surgical intervention	
Medically unfit for surgery	7 (36.8)
Declined surgery	12 (63.2)

HER-2: Human epidermal growth receptor-2

control when the tumour progressed despite a switch from letrozole to tamoxifen; she subsequently received megestrol acetate following radiotherapy. Three of these 5 patients had also developed distant metastasis; 2 patients developed bone metastases and one developed lung metastases. The patient with lung metastases received no further treatment and died 24 months later; patient and family had declined further treatment including PET. One patient with bone metastases received radiotherapy to the left shoulder for pain control, while the other remained asymptomatic and was continued on hormonal therapy alone. Both patients declined a switch to aromatase inhibitors and continued to receive tamoxifen. Both were alive at the end of the follow-up period.

Discussion

As the average life expectancy increases, clinicians can expect to encounter more elderly women with breast cancer. Many elderly women are reluctant to undergo surgery.

Some are fearful of the potential operative morbidity, others have a fatalistic outlook and there are those who are not convinced of the need for treatment given the absence of bothersome symptoms such as pain. PET is therefore often included in discussions regarding management. Similar to other published reports, adequate locoregional control, without the need for additional local therapy, was achieved in the majority of our patients.⁴⁻⁷ The tumour response rate observed in our study was similar to that reported in a study from the Netherlands.⁸ On the other hand, Osborn et al had reported lower rates of disease progression, but several differences in the study design preclude a direct comparison.⁹ The study had included only patients treated by a single consultant and compared to ours, many more patients had received an aromatase inhibitor. PET may slow distant progression to some extent as well, since only 3 patients in our study developed distant disease. Our observation that more women died from non-breast cancer specific causes strengthens the case for PET in women who are more likely to die from pre-existing comorbidities than from the breast cancer.¹⁰ Overall, PET was well tolerated and none of the patients reported serious adverse reactions.

However, compliance appeared to be a major issue. Excluding those who died, close to half of the remaining patients defaulted treatment and follow-up. Many may disregard the need for treatment given the absence of worrisome symptoms. Also, lack of tumour regression, even if it remains stable, may sometimes be misinterpreted as ineffective hormonal therapy. Defaulting treatment leaves open the possibility of these women re-presenting later with uncontrolled disease, when further hormonal therapy alone is often no longer effective. Surgery may eventually be needed for locoregional control; however, the extent of resection may be so extensive as to require skin cover of the postmastectomy defect. Radiotherapy is an alternative, but complete pathological response is rare and radiation cannot be given past a maximum dose. Furthermore, surgery on postirradiated skin is associated with more frequent wound complications.

As observed from our study, more than half the women who received PET were in fact medically fit to undergo surgery. Avoiding surgery and more definitive locoregional control at the start may in fact make later management more difficult since many of these women would survive long enough to develop complications from disease progression. It is probably prudent for the clinician to attempt to address the reasons behind this reluctance to undergo surgery rather than offer PET upfront. A review of our records showed that over the same period, 261 women older than 70 years of age had undergone curative surgery without major complications. This is significantly lower than that reported in a study from the Netherlands where overall, 12%

to 29% of women older than 75 years of age were treated with PET during a 20-year period from 1988 to 2008; this varied significantly between hospitals, ranging from 9% to 44%.⁸ Mastectomy, and even axillary clearance, can be safely performed under thoracic paravertebral anaesthesia should the risks of general anaesthesia be considered to be too high in selected patients¹¹. Apart from reducing the operative risk, paravertebral anaesthesia also provides excellent pain control and facilitates recovery¹².

Conclusion

In conclusion, we found that PET offered adequate disease control and was generally well tolerated in elderly women with operable breast cancer. However, compliance appeared to be a significant issue. Furthermore, we observed that many women who opted for PET were in fact fit to undergo surgery. Since PET is not curative and complete pathological response is uncommon,¹³ disease progression remains possible and these women may eventually still need surgery or other local treatments. PET should therefore be recommended as an alternative to surgery only to those women who are deemed more likely to succumb from pre-existing comorbidities than from the breast cancer itself. Continued follow-up and close monitoring remains important in these patients to allow for early detection and second-line treatment in the event of disease progression, in order to avoid a poor outcome and preserve the quality of life.

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Attitudes to Psychiatry Can Change But What About Stigma?

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For many doctors, the only exposure to psychiatry is during a rotation in medical school. The knowledge, interest, and attitudes formed in those few weeks will hopefully last throughout their medical careers. Unless they choose to specialise in psychiatry or other related disciplines that include aspects of psychological care, this exposure is very much dependent on the individual doctor's subsequent conscious acquisition of knowledge in this area to support patient care. This is important, as psychological care is a crucial component of holistic care, viz. the World Health Organization (WHO) dictum, "there is no health without mental health".¹ Attitudes to psychiatry affect personal and professional behaviours, even amongst psychiatrists and mental health nurses who have been found to hold the same prejudices as primary care teams about schizophrenic patients.^{2,3}

Fifteen years ago, Feifel et al, in studying the declining interest in choosing psychiatry as a career amongst US medical graduates, found that students entering medical school already viewed psychiatry as "distinctly and consistently less attractive than other specialties".⁴ They recommended that underlying false beliefs be actively targeted for remediation in the medical school curriculum. Studies have also shown that mentally ill patients provoke less favourable responses that were unaltered by furthering education in medical students.⁵ The findings of Fischel et al that attitudes amongst medical students in different cities did not significantly change following a psychiatry rotation led Richard Balon, editor of *Academic Psychiatry*, to decry, "no matter what we do, what we teach and how we do it, we are basically doomed and students do not like us!".^{6,7}

Yet, some studies still reveal positive attitudinal changes following a psychiatry rotation. Kuhgnik and Taryan, for example, found that the educational and personal experience from direct patient contact and observing psychiatrists interacting with patients not only enhanced students' clinical skills, but also contributed to positive attitudinal change.^{8,9}

Our study in 2008 using the same Attitudes to Psychiatry (ATP) scale revealed similar findings amongst medical students at the National University of Singapore (NUS) ($n = 146$, $P = 0.002$); students recognised and appreciated the efficacy of psychiatric treatment and they could transfer the knowledge and attitudes to other disciplines.¹⁰ However, we found no changes in some areas, in particular, the perception that psychiatrists and psychiatry make little use of medical training, raising concerns about collegiality and professional conduct in care delivery.

Five years on, the psychiatry curriculum at the National University of Singapore (NUS) has undergone significant revisions. The psychiatry rotation is now a complete 6-week programme in Year 4, with opportunities for electives for clinical and research work. Psychiatry pedagogy is now focused on developing competencies in clinical skills through the introduction of observed clinical interviews and standardised patients for skills training, improving the breadth and depth of experience. Didactics are centralised with large group lectures and small group teaching, and skills are developed through team-embedding. ATP, reviewed in 2013, using a new version of ATP, the modified Attitudes to Psychiatry Scale (mAPS),¹¹ again revealed significant attitudinal improvements at the end of the rotation ($t [99] = -2.89$, $P = .006$). These improvements were specifically in the following 2 domains: recognising the merits of psychiatry as scientific medicine ($Z = -3.09$, $P = .022$) and the effectiveness of psychiatric treatment ($Z = -4.74$, $P < .001$); however there were no improvements in a new domain specific to the mAPS: stigma of psychiatry ($Z = -0.52$, $P = .60$). Additionally, longer-term follow-up assessments were not conducted for both studies, so the sustainability of the positive changes has not been established.

This is possibly the underlying problem: we have focused on attitudes, not stigma. Attitudes are only one component of stigma; the others of the tripartite model

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being knowledge and behaviours.¹² While the revised curriculum has enhanced attitudes, it has not, like many medical education programmes, addressed stigma, which is more deeply rooted and related to societal, cultural, and religious beliefs. Stigma is much more pervasive, associated with discrimination, and is described as a “primary barrier to treatment and recovery”, with far reaching negative consequences and quality of life impairments for patients.¹³

Although programmes have been established to reduce the stigma associated with psychiatry and mental illnesses, progress has been slow unfortunately, amongst mental health professionals themselves.¹⁴ In fact, psychiatrists, often from clinical experiences with difficult, challenging, and treatment-resistant patients, may hold more “pessimistic views” of psychiatric illnesses.¹⁵ Patients with medical problems and psychiatric comorbidity and those with dual psychiatric conditions face greater challenges and may be doubly burdened.

The WHO calls for greater mental health advocacy at the general public health level and with other healthcare professionals and particularly medical students—a challenge psychiatrists need to undertake. The National Mental Health Policy and Blueprint drawn in 2007 led to an extensive build-up of services across the age spectrum, but we need to ensure our patients avail themselves to these and that there is greater awareness of the services and programmes amongst our medical colleagues.¹⁶ A pilot project involving secondary school students in the UK found that mental health education sessions with adolescents were useful in challenging the development of stereotypical attitudes towards mental health problems.¹⁷ This bodes well for greater attention to the issue in medical schools.

Secondly, it appears that conventional psychiatric education alone will not reduce stigmatising attitudes;¹⁸ knowledge to correct misinformation needs to particularly focus on actively shaping medical students’ perspectives on mental illnesses and addressing stereotypes. Papish et al have suggested that focusing on students’ “internal experiences” in caring for people with mental illness might be “an integral factor in modulating perceptions”.¹⁹ Pinfold has suggested that contact-based educational strategies are especially effective in facilitating this.¹⁶

Students should have the opportunity to interact with and hear patients’ stories about their mental illness experience and then the opportunity to discuss these experiences with tutors. As NUS develops community health programmes for medical students, interactions with those who are mentally ill could be included for greater opportunities to understand mental illnesses. In so doing, the necessary steps taken to address the gaps in misinformation will hopefully erode the discrimination and stigma.

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A Total Workplace Safety and Health Service – What Are the Implications for the Employees and Employers?

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A total workplace safety and health (TWSH) service is one where the elements of safety, health and well-being are considered, implemented and integrated at the workplace.

There is an increasing need for a TWSH service to both protect and promote the health of the workforce in Singapore. Over the last few decades, protecting the health of the workforce has generally focused more on occupational diseases and safety at work. Workers' medical needs are catered to by the general healthcare provider which may not focus much on occupational health i.e. the mutual relationship between work and health – how health can affect work and how work can affect health. Workplace health promotion and well-being activities are usually isolated, stand-alone programmes without a concerted understanding and consideration of the unique safety and health issues for the participating workplace.

We argue that it would be useful to implement a TWSH service in Singapore to not only keep the workers safe, but also healthy. Singapore is facing a rapidly ageing population. The official retirement age has been increased. The prevalence of chronic diseases in the workforce is rising and expected to rise further. We will have to shed the outdated notion that the management of chronic diseases is not a problem of employers but of society or government because it will no longer be true that people develop these diseases after retirement. The age of onset of chronic diseases has shifted from the late 50s and 60s to the 40s and 50s when people would still be active in the workforce. Hence, an acknowledgement of the prevalence of common chronic diseases among employees is important not only because such diseases are becoming more prevalent, but the age of onset of these diseases is also much earlier. These two trends point to rising healthcare costs for employers.

If not well managed, chronic diseases will reduce productivity through sickness absenteeism, increase healthcare costs and reduce employees' working capacity

and inherent motivation. In countries and industries which face labour shortages, management of chronic diseases among employees has become an imperative.

As the workplace is a “captive audience”, it makes sense to implement programmes that detect and manage chronic diseases in the workforce, as well as prevent or delay the onset of associated complications. This approach is likely to be a win-win for both employers and employees. Employees with chronic diseases will benefit from having better control of the diseases, resulting in fewer complications and a better quality of life. For employers, this translates into enhanced productivity and lower healthcare costs for the company. In the interim, medical costs may be higher as workers with chronic diseases will need to be treated and managed after being diagnosed, but benefits will accrue in the medium to long-term.

Health insurance premiums will be higher for companies with a larger proportion of staff with chronic diseases. Some insurance companies already offer longer term medical policies that incentivise (with lower insurance premiums) companies with programmes that screen at-risk groups for chronic diseases and manage them early to prevent or delay the complications associated with these diseases. These preventive measures result in lower complication rates and treatment, which in turn, translate to lower claims for specialist and tertiary care. In the longer term, there may well be further cost savings as the complications arising from chronic diseases will either be prevented or delayed as a result of earlier detection and appropriate management of the diseases.^{1,2}

The selective use of health screening improves cost-effectiveness and diagnosis rates, providing a platform upon which chronic diseases can be managed earlier and more effectively by reducing complications.³⁻⁵ Other reports about the cost saving benefit of early detection of chronic diseases are less conclusive. The reason for this may lie

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in the different population groups as well as the different health systems across the studied groups.¹ In a local study, a multinational company which was very supportive of an integrated WSH programme engaged a healthcare group to run a comprehensive chronic disease programme (CCDP) through early detection of diseases over a 5-year period. They demonstrated at least a 40% year-on-year reduction in the past 2 years in tertiary care costs which result from complications arising from chronic disease after the chronic disease programme was in place. After the CCDP was implemented, the mean medical certification (MC) leave per employee fell from 2.57 MC in 2010 to 2.17 in 2012. That translates to a saving of 1924 man-days per year (personal communication). With clear, objectively measurable benefits, companies may be more willing to pay for such programmes.

There are other considerations besides cost to motivate businesses to adopt TWSH. Besides the older retirement age, the nature of work has also changed. As employees move towards less physical work and more desk-bound or mobile work, the health risks may shift accordingly. For example, office workers face increased health risks from long hours of sedentary behaviour. This is more pronounced in Singapore, which has consistently ranked high among countries with the longest work hours in the world. Hence a TWSH programme can be seen as a proactive way of managing business risks from employee ill-health. The increasing burden of chronic diseases is worrisome for businesses, especially from the perspectives of corporate sustainability and responsibility. Clearly, a workforce that is ageing and less healthy is less sustainable and may face threats to continuity. Businesses also face increasing scrutiny and heightening expectations of their corporate responsibility towards stakeholders (including employees). Recent changes to Singapore's Code of Corporate Governance put the responsibility for a company's social performance squarely in its Board's hands. Properly managed, a TWSH service can contribute towards a company's responsibility ratings and even win it praise and recognition for being an enlightened employer. This could be the start of a virtuous cycle that sees the company gaining a reputation as an employer of choice, and attracting better talent.

Now that the business case for health has been made, we turn to the problems in the everyday execution of the idea. We need doctors who are trained to manage chronic diseases and who understand the interaction between work and health. We do have designated workplace doctors and occupational physicians. But more could be done to train especially the medical students which presently have minimal teaching on occupational medicine. Human resource (HR) policies should clearly address the outcomes of health screening. Employees found to have chronic or

any other diseases should not face discrimination. HR policies should also address the clinical management of conditions and provisions for medical treatment and follow-up. Some companies only pay a yearly fixed amount to the employees for medical claims and the individual employee is responsible for his own medical insurance. What if some individuals do not purchase medical insurance and now have to pay for this additional medical expense? It is important for this group of individuals to understand that the early detection of the diseases also ensures appropriate management and reduces morbidity and complications associated with the disease. Therefore, the company should encourage this group of employees to obtain personal medical insurance if the employer does not provide for it.

The challenge for us now is to implement TWSH at work, to understand its benefits and constraints. A further challenge, after we learn and improve from these initial attempts, will be to spread TWSH across companies. Only then will we be ready for the challenges of an ageing, shrinking and more vulnerable workforce. Attempts need to be made in implementing TWSH, or we may never fully understand the benefits and constraints of a healthcare system comprising a TWSH service.

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Community End-of-Life Care for Older Non-Cancer Patients: A Pilot Study

Dear Editor,

In Singapore, a majority of patients in established end-of-life (EOL) care programmes are suffering from cancer. But there are patients, typically of advanced age, suffering from a combination of frailty, disability and multiple chronic diseases who will benefit from palliative care. In 2013, 69.3% of deaths in Singapore were unrelated to cancer. A total of 49.7% of all deaths were at age 75 and older. Only 26.8% of deaths occurred in the home.¹ These patients tend to die in pain, not in their place of choice which tends to be the home, but often after frequent visits to the emergency department.² To improve the delivery of EOL care for the homebound, non-cancer elderly patients, the Tsao Foundation Hua Mei EOL Care Pilot Programme was introduced. This study describes the pilot programme.

Discussion

Tsao Foundation is a non-profit organisation incorporated in 1993 to improve the overall experience of ageing in the community. There are several Hua Mei clinical programmes within the Tsao Foundation.

There were 51 patients in the pilot programme. Patient recruitment was non-random. A total of 75% of patients were selected from existing frail and homebound elderly in the Hua Mei Mobile Clinic, and the remaining 25% were hospital referrals. Patients were selected based on a prognosis of more than 50% probability of death within 6 months. This was based on the American Medicare Local Coverage Determination (LCD).³ Patients selected were eligible for nursing home care based on the Resident Assessment Form (RAF) categories 3 or 4, and they were also at high risk of nursing home placement. Once the patient satisfied the LCD for hospice eligibility, the Karnofsky Performance Scale (KPS)⁴ was used to fine-tune the prognosis. This scale showed the strongest association with basic activities of daily living (BADL), instrumental activities of daily living (IADL), and other functional measures. As such, this scale can be used for patients diagnosed with dementia.

Over the 24-month period of the pilot programme from 1 October 2010 to 30 September 2012, patients received team-managed home-based primary care, advanced care planning, caregiver support, and spiritual care. Patients received care from a multidisciplinary team of a family

physician, 2 nurses, a social worker, an assistant social worker and an administrative staff member. All were trained in basic geriatrics and gerontology. Frequency of home visits by different members of the team was based on the patient's clinical stability using KPS. Advance care planning was provided to all patients and it involved their families. To ensure that the experiences of the terminally-ill patient and caregiver were supported, counselling and spiritual care were provided. For patients who lived alone, volunteers within close proximity organised visits to the patient's home. Volunteers provided assistance with BADL and medication use. They complemented the home medical visits and phone consultations.

Grief support was provided to the caregiver and family members prior to and after death. Initial support was provided in the first and second week after the patient's death. Longer periods of grief support were also available. One of the limitations of this study was that the pilot programme was unable to use the Good Death Inventory (GDI) scale⁵ which measures the patient's death from a bereaved family member's perspective. Within a year after a patient's death, social workers would interview the deceased's family members. They were asked to respond with either a "Yes" or "No" to the question of whether the patient had a good death.

The mean age of elders at enrolment was 87 years. The most frequent diagnosis types were dementia (76%) and stroke disease (60%). Table 1 provides information on patients upon enrolment and patients at death.

Over the 24 months, there were 36 deaths; 77% of these actual deaths were in the home and this percentage is higher than the national average of 26.8%. Given the various disease trajectories of the patients, deaths occurred on an average of 172 days after enrolment in the programme. Patients did not appear to have a high level of acute care (AC) utilisation. The rate of AC admission per patient per year of enrolment in the EOL programme was 1.47. Across all AC events, average length of stay was 9 days. This is arguably a low number in AC and implies low healthcare utilisation costs.

Another limitation of this study is that there is no comparative group that can provide information on the

Table 1. Patient Characteristics

Patient Characteristics Upon Enrolment	Mean (Standard Deviation, SD)	Total (n = 51)	%
Age		87 (6.8)	
Gender			
Male		19	37
Female		32	63
BADL			
Independent		1	3
Assisted		10	19
Total dependence		40	78
Number of diagnosis	4.7 (1.9)		
Diagnosis type			
Dementia		42	76
Stroke disease		33	60
Hypertension		27	49
Osteoporosis		22	40
IHD		14	25
Anaemia		19	35
DM		17	31
Hyperlipidemia		10	18
Cataract		14	25
Depression		11	20
Malnutrition		10	18
Cancer		5	9
CRF		10	18
COPD		3	5
Parkinson's disease		8	15
Epilepsy		5	9
CCF		6	11
Hypothyroidism		3	5
OA knees		4	7
Preferred place of death			
Home		46	90
Places other than the home		5	10
Patient Characteristics At Death	Mean (SD)	n = 36	%
Time to death after enrolment	172 (193)		
Actual place of death			
Home		28	77
Hospital		8	23

BADL: Basic activities of daily living; CCF: Congestive cardiac failure; COPD: Chronic obstructive pulmonary disease; CRF: Chronic renal failure; DM: Diabetes mellitus; IHD: Ischaemic heart disease; OA: Osteoarthritis
 Note: Each patient had at least one diagnosis upon programme enrolment

terminally ill who are without community-based care and has access only to acute care. Also, there is no information available on AC utilisation in the last year of life at the national

level. From the 36 deaths, 92% died while leaving family behind while 3 patients died alone without any family. A total of 72% of family members perceived that the patient had a good death, which was interpreted as a peaceful death at home.

Conclusion

This paper has attempted to disseminate knowledge on community-based EOL care for elderly patients with non-malignant chronic disease in Singapore. Access to EOL care can be provided to all and this can be effectively carried out within the community. This will enable more terminally ill elders to die in their place of choice – the home – and reduce AC hospitalisation.

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Spontaneous Repositioning of a Subluxated Posterior Chamber Intraocular Lens

Dear Editor,

Malpositioning of a posterior chamber intraocular lens (PCIOL) is a potential complication following cataract surgery. To our knowledge, only 2 cases of spontaneous repositioning of an anteriorly dislocated PCIOL have been reported in literature.^{1,2} We describe a case of late anterior subluxation of a PCIOL followed by spontaneous repositioning 1 month after presentation.

Case Report

A 60-year-old Chinese male, with no significant medical history, underwent uncomplicated right phacoemulsification surgery with a 5.5 mm capsulorrhexis and implantation of a single piece 4-loop aspheric acrylic PCIOL (Bausch & Lomb Akreos® Adapt AO, +20.0D, Rochester, NY, USA) into the capsular bag in March 2009. There was no zonular dialysis intraoperatively and no significant capsular phimosis postoperatively. Preoperative axial length was 24.09 mm.

Two years later, he presented with a 4-day history of right monocular diplopia. There was no history of trauma. His best corrected visual acuity (BCVA) was 6/9 in the right eye (refraction of -2.00DS/-3.25 DCx136°). An anteriorly subluxated and partially tilted in-the-bag PCIOL with a prolapsed superior haptic overlying the pupillary margin was noted (Fig. 1A). There was no PCIOL-cornea contact and no vitreous in the anterior chamber. The rest of the ocular examination was unremarkable.

He was advised surgical repositioning of the subluxated PCIOL, but he chose to defer surgery. One month later, he reported spontaneous resolution of the diplopia. On examination, the PCIOL had spontaneously repositioned back into the posterior chamber (Fig. 1B). Mild pseudophacodonesis was noted. The BCVA was 6/6 (refraction of +0.25DS/-1.50DCx115°).

Two years later, the PCIOL remained stable in the posterior chamber. No additional measures were taken to prevent dislocation.

Discussion

In the absence of other coexisting ocular pathologies or trauma, we believe that spontaneous anterior dislocation

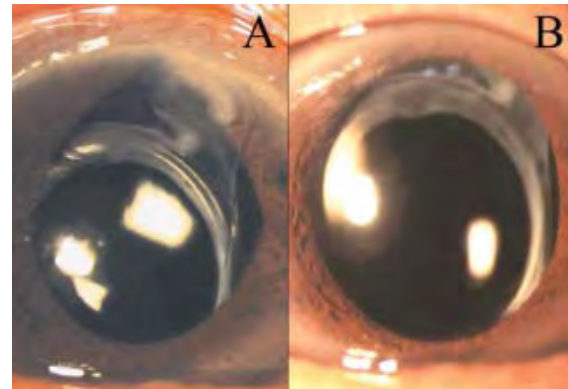


Fig. 1. (A) Anteriorly subluxated in-the-bag posterior chamber intraocular lens with a prolapsed superior haptic seen over the pupillary margin. (B) Spontaneous repositioning of the anteriorly subluxated intraocular lens into the posterior chamber.

of PCIOL in our patient is likely secondary to instability of the capsular bag-IOL complex. Subtle capsular contraction forces with resulting zonular weakness³ may have contributed to the decentration of the single piece acrylic PCIOL.

Management of an anteriorly dislocated PCIOL can be conservative or surgical. Conservative management with observation is a valid option if the dislocation is minimal and if there is no progression on short-term follow-up.⁴ In our patient, physiologic dilatation of the pupil in scotopic conditions associated with the effect of gravity in supine position while resting may have allowed the in-the-bag PCIOL to spontaneously reposition itself.

Conclusion

Spontaneous repositioning of an anteriorly subluxated PCIOL is possible, albeit rarely. It may be worthwhile to consider a conservative approach for minimal anterior dislocation of a PCIOL before proceeding with surgery.

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