



AAMS

Annals of the Academy of Medicine, Singapore

MCI(P) 041/11/2014

VOLUME 44

NUMBER 9

FREE PAPERS

SEPTEMBER 2015



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*"The sound of laughter is like the
vaulted dome of a temple of happiness."*

Milan Kundera (1929 –)
Czechoslovakian writer

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Helping People with Mental Illness Return to Employment: Challenging Existing Beliefs

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Sigmund Freud, the father of psychoanalysis, was asked once what makes people happy. His reply was, “love and work.” Employment does contribute many benefits to our lives. In addition to providing financial independence and security, it contributes to our sense of community, belonging and identity. Unemployment, on the other hand, contributes to isolation, stress and financial vulnerability.¹ These elements are much the same if someone has a mental illness.

However, people with mental illness are at a significant disadvantage when it comes to accessing employment. Stigmatisation and discrimination of people with mental illness is common and this extends to employment.^{2,3} Studies have shown that employed people with mental illness may worry about being discriminated against in the workplace and therefore forego seeking help⁴ despite the toll it takes in absenteeism and presenteeism.⁵ This is an unfortunate situation, especially since employment has been shown to contribute to the recovery of people with mental illness by giving them meaningful activities, a renewed sense of purpose, and increased social inclusion and reintegration.⁶ This is true even in people with a chronic and serious mental illness like schizophrenia.⁷

People with mental illness recognise the benefits of employment; indeed research has shown that a desire for personal growth and avoiding idleness, in addition to financial gain, motivate people with mental illness to seek employment.⁸ While no local data is available to determine what proportion of unemployed people with mental illness would like to return to competitive work, estimates from Western countries vary between 55% and 78%.^{9,10} The level of desire for employment varies greatly from study to study because of unique local contexts, such as the availability of unemployment benefits and social supports.⁹

Additionally, helping people with mental illness to reintegrate into the competitive job market and making available the associated supports necessary to sustain their employment have been shown to reduce stigma in the workplace,^{11,12} which will likely contribute to a reduction in societal stigma. Therefore, finding the impetus to hire

people with employment will likely simultaneously help reduce workplace stigma and increase the material and psychological quality of life of people with mental illness.

Mental Illness and Unemployment in Singapore

The growing attention which mental illness has received has led to several important developments to ascertain the degree to which the country is grappling with mental illness. The Singapore Mental Health Study (SMHS) of 2010¹³ has clearly shown that mental illness is common in the local population. Obsessive compulsive disorder and alcohol abuse afflict 1 in 32 and 1 in 33 Singaporeans, respectively, while 1 in 17 people in Singapore experience depression sometime in their life.¹⁴ Rates of these mental illnesses in those that are employed are similar.⁵ It is imperative for Singapore's health institutions to effectively handle this growing segment of the population since the number of cases detected and the number of people seeking treatment for mental illness will likely increase as a result of increased social and institutional awareness.¹⁵

The rate of unemployment in Singapore is among the lowest in the world, which was 2% in 2014. In comparison, unemployment rates for developed countries range from 4% to 12%.¹⁶ Additionally, Singapore ranks second on labour market efficiency in the World Economic Forum 2014 to 2015 Global Competitiveness Report, suggesting that its use of labour is, relatively speaking, efficient and well above the global average.¹⁶ However, data on employment rates of people with mental illness in Singapore is scarce. The SMHS revealed that the rate of unemployment among those with certain mental illnesses was 11.1% which was significantly higher than the 6.7% rate of unemployment in those without mental illness. The data also show that the rate of mental illness in people who are unemployed is twice as high as compared to those who are employed (5.3% vs 2.3%).⁴

However, the SMHS was a cross-sectional study and hence the association between unemployment and mental illness cannot be causally determined, but 3 possibilities exist, each

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necessitating action: 1) either people with mental illness are not able to find work in the current economic climate of Singapore, in which case they need policies to help the system change to accommodate their needs, or, 2) people who are unemployed may be more prone to mental illness, suggesting that remaining unemployed is contributing to the burden of disease in Singapore. Consequently, there ought to be return-to-work programmes to help these people re-enter the labour force. Finally, 3) the relationship between unemployment and mental illness may be bidirectional, contributing to each other in a cyclical way. In this situation, interventions are needed to break the cycle, help people return to work, reduce the burden of unemployment and reduce the impact of mental illness. Regardless of the association, action is necessary to help people achieve higher standards of living.

Barriers to Employment

The employment of people with mental illness depends on the opinions and actions of several stakeholders in our society. Perceptions of employers have been documented as important barriers to employment. Several studies have looked at the opinion of employers both in Western and Asian countries.^{2,3,17} In a progressive European country, employers have shown reticence to hiring people with mental illness. Discrete choice experiments in which scenarios were presented to Swiss employers along with forced choice instructions revealed a reluctance to hire people with mental illness despite the generous support structures that reduce the financial burden of hiring someone with mental illness on employers in Switzerland.³ Surveys of employers in Hong Kong and Beijing have highlighted employers' reluctance to hire people who have disorders that are perceived to be behaviourally-driven (diseases in which the afflicted may be seen to have some degree of control, depression, and alcoholism) compared to people with disorders that may be out of their control, like bone cancer.¹⁷ This suggests that these employers may discriminate people who are diagnosed with these disorders.

While employers have a central role in deciding whether to hire people with mental illness, coworkers may play a vital role in helping people with mental illness sustain their position in the workplace. However, people may be unreceptive to a coworker's honesty in disclosing the presence of a mental illness.^{11,18} When people with mental illness tell their coworkers, or when their coworkers inadvertently discover that they have a mental illness, the reactions are not necessarily supportive. Often stigma is the response.¹¹ This may make sustaining employment problematic, and may lead to an internalising of stigmatising beliefs.¹⁸ This in turn reduces the individual's self-esteem and self-efficacy, and diminishes his motivation to apply to other

jobs. This may explain why treatment-seeking behaviours are low for employed people with mental illness.^{4,5}

Service providers have supporting roles and may also be instrumental in the development of a person's desire for employment. For example, case managers' perceptions of their clients' readiness to work influenced their pursuit of employment, leading some authors to conclude that "addressing staff negativity with regard to the ability of consumers to work may lead to consumers pursuit of employment".¹⁹ It is therefore imperative that clinicians and service providers avoid imposing their own bias onto their service users and actively include employment in their care plans.²⁰

These various financial preferential and personal aspects impact the probability of an employer's willingness to hire someone with mental illness.² Since all these factors may play a role in Singapore's unique system, locally developed knowledge is crucial.

Potential Solutions

The most effective form of intervention which helps people with mental illness return to employment is evidence-based supported employment, also known as individual placement and support (IPS). This intervention can trace its roots to developments in the 1980s when Wehman and Moon (1988) detailed a "place-train" approach that was intended build on previous models of care but also challenge the entrenched belief that persons with disabilities were unemployable.²¹ By placing people into competitive jobs, service providers accomplished several objectives. The placement, as chosen by the individual, is in a field of the service-user's interest, thereby increasing motivation. The elimination of lengthy pre-employment training also capitalises on initial motivation, reducing the likelihood of attrition due to dissatisfaction with irrelevant activities. By providing the support and training after the placement, service providers could better tailor their support to develop the skills required by the person's job. When service users agreed to disclose that they were receiving assistance from a third party (it is not necessary to always disclose all the information),¹¹ employment specialists could also provide support to employers, thereby increasing understanding and reducing stigma in the workplace.¹⁸ These components also increase employment stability.

The IPS intervention focuses on 8 principles of practice: 1) focus on competitive employment, rather than sheltered employment or social enterprises, 2) focus on individual preferences for job placement, 3) rapid job search without prevocational training, 4) integration with the mental health care team, 5) zero exclusion criterion, 6) benefits counselling, 7) systematic job development with local

community partners, and 8) continued time-unlimited individualised support. By adhering to these principles and achieving a high fidelity, programmes have consistently produced rates of competitive employment between 30% and 55%.²⁰

Since its inception, IPS has been applied to several contexts in several countries²⁰ including Hong Kong and Japan.²²⁻²⁴ These studies provide encouraging evidence for the potential generalisability of these supported employment services in Singapore. In Hong Kong, an IPS programme implemented to serve people with psychotic disorders, major depressive disorder, bipolar disorder or borderline personality disorder reached rates of employment of 61% (n = 65) after 38 months compared to 6% in the group receiving traditional vocational rehabilitation (n = 66).²³ This research has also suggested that the addition of social skills training to IPS may increase the rate of employment to 83%, n = 58.²³ In Japan, a smaller programme looking at a group of people with schizophrenia and mood disorders (n = 19) has reported rates of employment of 44% compared to 11% in traditional services (n = 18).²² These studies have also showed that the length of job tenure is also superior in IPS programmes compared to usual services by a multiple of 1.3 to 3.5, ranging from 7 weeks (of 6 months)²² to 47 weeks (of 39 months).²³

Despite the large body of literature that supports the importance of employment in facilitating recovery, improving quality of life, and reducing financial dependence, to date, no programme of research has sought to thoroughly study the merits of supported-employment programmes, the desire for employment among people with mental illness in Singapore, or the perception and attitudes of key stakeholders like employers and coworkers towards employing and working alongside people with mental illness. Given the body of evidence from other countries, the application of efforts to answer these crucial questions is long overdue.

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A Survey on Singaporean Women's Knowledge, Perception and Practices of Mammogram Screening

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Abstract

Introduction: Singapore is the first Asian country to establish a nationwide breast screening programme, but our breast cancer screening uptake lags behind the Western countries. This survey focused on the subject of screening mammography, to assess the reasons for non-attendance and explore ways to improve our screening uptake. **Materials and Methods:** Females ≥ 21 years old were approached at primary healthcare clinics to participate in this survey, which questioned their knowledge, perception and expectations of breast screening. **Results:** There were 1011 respondents. Of the 740 respondents ≥ 40 years old, 332 respondents (45.5%) went for regular mammogram screening. Women who had lower household incomes [$< \$2000$ (OR 0.49; 95% CI, 0.28 to 0.85); $\$2000$ to $\$3999$ (OR 0.59; 95% CI, 0.36 to 0.97)], did not know anyone with breast cancer (OR 0.62; 95% CI, 0.42 to 0.92), did not perform breast self-examination (OR 0.42; 95% CI, 0.28 to 0.62), had lower knowledge scores (OR 0.34; 95% CI 0.22 to 0.51), did not attend other health screening (OR 0.14; 95% CI, 0.05 to 0.41), and perceived mammography as embarrassing (OR 0.55; 95% CI, 0.31 to 0.96), were less likely to attend mammographic screening. Many did not know that screening is for the asymptomatic (51.2%), or the age to start screening (46.3%). Most respondents preferred to have their mammograms in the polyclinics (62.2%) and their screening reminders to be through short messaging service (SMS) (46.0%). **Conclusion:** Our results show the current influences on Singapore women's screening practices, and also revealed that their understanding of mammogram screening is limited despite a high level of breast cancer awareness.

Ann Acad Med Singapore 2015;44:317-25

Key words: Breast screening, Breast cancer, Asian women

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A Survey on Singaporean Women's Knowledge, Perception and Practices of Mammogram Screening

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Introduction

Singapore has the highest incidence of breast cancer among Asian countries, with an average annual increase of 3.68% from 1968 to 2002.¹ With a current age-standardised incidence of 60.0 per 100,000 person-years in 2005 to 2009, 1 out of 16 women will develop breast cancer by age 75.^{2,3} The BreastScreen Singapore programme was set up in 2002, with the aims of raising public awareness and early detection of breast cancer, and reducing its mortality.⁴ This programme is being carried out at our polyclinics, which provide government-subsidised primary healthcare. Women who are Singapore citizens or permanent residents above 40 years old are eligible for subsidised mammograms, and those above 50 years of age can pay for the mammography

with Medisave, our national health savings scheme.⁵ In 2010, our national health survey revealed that only 39.6% of women aged 50 to 69 years went for mammographic screening in the last 2 years.⁶ In contrast, 73.4% of women between 45 to 74 years old in the United Kingdom went for a mammogram during the year of 2010 to 2011,⁷ and 66.5% of women above 40 years old and 68.8% of women above 50 years old in the United States attended mammographic screening within a period of 2 years (2010 statistics).⁸

We embarked on this survey to assess the level of knowledge and understanding of breast cancer screening among women. In particular, we aimed to elucidate the factors that influence screening attendance, and ways to improve on our screening uptake.

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Materials and Methods

The survey was conducted from September 2011 to March 2012 at 4 polyclinics in eastern Singapore, of which 2 were equipped with mammographic facilities. Female patients and visitors ≥ 21 years old, and who were Singapore citizens or permanent residents, were approached to participate in this survey. We chose the lower age limit of 21 as we also wanted to assess the knowledge of younger women, and preview their screening practises when they become eligible for screening. Respondents were asked to complete a self-administered questionnaire either in English, Mandarin or Malay. An immediate response was requested, and the questionnaires were collected upon completion. For those who were illiterate, the research coordinator would read the questions to them and record their response. All data collected was made anonymous, stored and controlled by the authors. Ethics board approval was obtained prior to the survey.

Basic demographic information like race, age, education level, occupation, household income and type of housing was collected. Respondents were asked whether they had friends or relatives with breast cancer. Those who were ≥ 50 years were also asked if they had received an invitation letter for mammographic screening. A validity test was not performed on the questionnaire.

The first part of the questionnaire contained 9 questions to assess the respondents' knowledge, comprising of questions on the awareness of breast cancer and screening, as well as the understanding of mammographic screening (Table 1). These questions were scored as such: 1 point was awarded for a correct response, and zero for a wrong or 'not sure' response. A correct response was based on BreastScreen Singapore protocol and Ministry of Health (MOH) guidelines on breast cancer screening.⁹

The second part of the questionnaire looked at the respondents' perception of screening mammography and if they regularly performed breast self-examination (BSE). Respondents who were ≥ 40 years old were enquired about their screening practises, and their reasons for and against attending screening mammography. Those < 40 years old were asked regarding their intention to go for screening mammography when they turn 40 years of age, and their reasons for it.

The final part of the questionnaire focused on the needs and preferences of the respondents with regards to information about breast cancer and screening, cost, screening locations and method of receiving reminders to attend screening mammography.

The data was analysed with Chi-square test. Multivariate analysis was performed on the statistically significant variables, using logistic regression analysis, with the

Table 1. Questions on Knowledge and Perception of Mammographic Screening

Knowledge	
1.	Is breast cancer the most common cancer among Singaporean women?
2.	Is there a higher chance of cure if breast cancer is detected early?
3.	What do you consider as breast cancer screening?
4.	Have you heard of BreastScreen Singapore programme?
5.	At which age should women start going for breast screening?
6.	Name 2 places at which mammographic screening is available.*
7.	Can Medisave be used to pay for screening mammograms for women above 50 years old?
8.	If the first mammogram is normal, is there a need for subsequent mammograms?
9.	Radiation from mammograms can cause cancer.
Perception	
1.	Is going for mammogram screening important?
2.	Do you think it is embarrassing to go for a mammogram?
3.	Is going for a mammogram a painful and frightening experience?
4.	Do you think that going for regular mammograms affect breast appearance?
5.	Do you feel that mammogram facilities are not easily available?
6.	Do you think that mammograms are too expensive?

*This question carries 2 points, making the maximum knowledge score 10.

Statistical Package for the Social Sciences (SPSS) version 18.0 (SPSS Inc, Chicago, IL, USA). A *P* value of < 0.05 was taken as statistically significant.

Results

Demographics

The overall response rate was 75.7%, with 1011 respondents participating in the survey. Their median age was 49 years (range, 21 to 83). The racial distribution mirrored that of the national demographics.¹⁰ Table 2 shows the respondents' demographics.

Knowledge

The majority (81.6%) of the respondents knew that breast cancer was the most common female cancer in Singapore, and most (90.7%) were aware that early detection results in high cure rates. Although a large proportion (86.6%) agreed that screening for breast cancer was important and many (85.7%) agreed that screening should be performed regularly, one third (33.4%) had not heard of BreastScreen Singapore. More than half (51.2%) did not know that screening was for asymptomatic women. There were 46.3% of respondents who were not aware of the appropriate age

Table 2. Overall Demographics

Demographics	Respondents (%)
Age	n = 1101
<40 years	271
≥40 years	740
Ethnic Group	n = 1008
Chinese	706 (70.0)
Malay	215 (21.3)
Indian	59 (5.9)
Others	28 (2.8)
Highest education	n = 1005
Diploma/degree holder or higher	404 (40.2)
Secondary education	422 (42.0)
Primary education or less	179 (17.8)
Occupation	n = 1006
Professional/executive	308 (30.6)
Clerical/technical	307 (30.5)
Homemaker	230 (22.9)
Others	161 (16.0)
Gross monthly household income	n = 825
≥\$6000	196 (23.8)
\$4000 – \$5999	178 (21.6)
\$2000 – \$3999	220 (26.7)
<\$2000	231 (28.0)
Housing type	n = 991
Private property	117 (11.8)
4 – 5 room	642 (64.8)
3 room or smaller	232 (23.4)
Know someone with breast cancer	n = 998
Yes	501 (50.2)
No	497 (49.8)
Attend polyclinic with mammogram facilities	n = 998
Yes	484 (48.5)
No	514 (51.5)

to start screening and almost a fifth (19.5%) could not name the location of a screening centre. A large proportion (71.4%) was not aware that Medisave could be used to pay for the screening mammogram.

The mean knowledge score of all the respondents was 6.48 $\pm$ 1.96, and the median score was 7 out of a total of 10. Using the median score of 7, high knowledge was defined as those with a score of ≥ 7 , and low knowledge was those with a score of ≤ 6 . These scores were then analysed against all the demographic variables in Table 2, and the significant variables selected for multivariate analysis. Respondents

with low knowledge scores were younger (age <40 years), had a lower gross monthly family income (<\$2000), and did not know anyone diagnosed with breast cancer (Table 3).

Perception

Negative perceptions of screening mammography were still prevalent, with one third (33.4%) of the respondents perceiving mammograms as painful and frightening, and 15.6% perceiving it as an embarrassing ordeal. Some respondents (5.2%) thought that their breasts' appearance will be altered by regular mammography. There were 6 questions on negative perception, and each was given a score of 1. Using the median score of 1, those with low negative perception had score ≤ 1 , while those with high negative perception had scores ≥ 2 . The perception scores were then analysed against the demographic variables in Table 2, and the knowledge scores, and significant variables taken for multivariate analysis. Respondents who were older, from the lowest education group, knew someone with breast cancer and had low knowledge scores had more negative perceptions (Table 4).

Screening Facilities, Cost and Information Sources

Among the respondents, 43.2% thought that mammogram facilities were not readily available, and this perception did not differ significantly whether they were attending clinics with or without mammogram facilities. More than half of them (54.8%) also felt that mammograms were too costly. The majority (60.8%) of respondents indicated a need to know more about breast cancer screening. Table 5 shows the respondents' preferences of screening centres, mammogram cost, and their breast cancer information sources. There were 46% of respondents who would like the reminders to attend screening to be sent by short message service (SMS).

Practice

Respondents 40 Years and Above

Of all the 740 respondents aged ≥ 40 years, 332 respondents (45.5%) attended regular mammogram screening, and 53.7% performed regular BSE. Most respondents (89.2%) also went for other forms of health screening (Papanicolaou smear, colonoscopy and/or general health screening), and 567 (77.2%) respondents would encourage family and friends to go for mammograms. Univariate analysis of mammogram attendance was performed with all demographic variables, knowledge score as well as each negative perception, and the significant factors subsequently analysed with multivariate analysis. Those who were ≥ 40 years old but did not go for screening, were those who did not have any family members or friends with breast cancer, were less

Table 3. Analysis of Knowledge Scores According to Demographics

Demographics	Knowledge		Univariate	Multivariate Analysis*	
	Low (%)	High (%)	P Value	OR (95% CI)	P Value
Age	n = 998		<0.001		
≥40 years	301 (41.1)	431 (58.9)		1.0	
<40 years	154 (57.9)	112 (42.1)		0.49 (0.34 – 0.72)	<0.001
Education	n = 993		0.002		
Diploma/degree holder or higher	177 (44.3)	223 (55.8)		1.0	
Secondary	173 (41.5)	244 (58.5)		1.04 (0.71 – 1.54)	0.828
Primary education or less	101 (57.4)	75 (42.6)		0.73 (0.42 – 1.28)	0.277
Occupation	n = 994		0.025		
Professional/executive	124 (40.7)	181 (59.3)		1.0	
Clerical/technical staff	135 (44.3)	170 (55.7)		1.11 (0.74 – 1.69)	0.610
Homemaker	108 (47.8)	118 (52.2)		1.02 (0.64 – 1.63)	0.926
Others	87 (55.1)	71 (44.9)		0.79 (0.48 – 1.32)	0.373
Gross household monthly income	n = 815		<0.001		
≥\$6000	70 (35.9)	125 (64.1)		1.0	
\$4000-\$5999	62 (35.4)	113 (64.6)		1.09 (0.69 – 1.73)	0.715
\$2000-\$3999	88 (40.7)	128 (59.3)		0.84 (0.53 – 1.36)	0.486
<\$2000	128 (55.9)	101 (44.1)		0.51 (0.21 – 0.84)	0.008
Housing type	n = 979		<0.001		
Private	47 (40.5)	69 (59.5)		1.0	
4 – 5 room	261 (41.1)	374 (58.9)		1.02 (0.62 – 1.68)	0.938
3 room and smaller	136 (59.6)	92 (40.4)		0.7 (0.38 – 1.26)	0.233
Know someone with breast cancer	n = 998		<0.001		
Yes	185 (36.9)	316 (63.1)		1.0	
No	270 (54.3)	227 (45.7)		0.63 (0.47 – 0.86)	0.003

OR: Odds ratio; CI: Confidence interval; BSE: Breast self-examination

*Multivariate analysis performed with variables of age, education, occupation, gross household monthly income, housing type and having a family member or friend with breast cancer.

likely to perform BSE, had lower knowledge scores and less frequently attended other forms of health screening. Women who perceive mammography as an embarrassing procedure were also less likely to go for screening (Table 6). Of 484 respondents who were ≥50 years, 305 (63%) received an invitation letter from BreastScreen Singapore. However, 149 (48.9%) of those who received the invitation letter did not attend mammographic screening. Of note, among the women who received the letters, the availability of mammographic facilities at their polyclinic is a significant factor in determining screening attendance (Table 6).

Respondents Below 40 Years

A large majority (80.4%) of respondents <40 years old intended to go for screening mammogram when they reach

the eligible age, despite their overall lower knowledge scores compared to those ≥40 years. Further, 86.4% stated that they will encourage family/friends to go for screening. Almost half of these respondents (41.4%) do regular breast self-examination. Demographics, knowledge and negative perceptions were not significant factors in determining their decisions for future breast screening. However, those who intended to go for screening mammography were more likely to encourage friends and family to go for screening (OR 4.43; 95% CI, 1.98 to 9.91). (Data is not shown.)

Reasons for Attendance

Lastly, the respondents were requested to cite reasons for and against their attendance of breast screening. 'Not having any breast problems', lack of time and fear of pain

Table 4. Analysis According to High and Low Negative Perception Scores

Variables	Perception		Univariate	Multivariate Analysis*	
	Low (%)	High (%)	P Value	OR (95% CI)	P Value
Age	n = 998		<0.001		
≥40 years	445 (60.9)	286 (39.1)		2.39 (1.62 – 3.52)	0.001
<40 years	215 (80.5)	52 (19.5)		1.0	
Education	n = 992		<0.001		
Diploma/degreeholder or higher	290 (72.1)	112 (27.9)		1.0	
Secondary	273 (65.6)	143 (34.4)		1.05 (0.76 – 1.46)	0.775
Primary education or less	94 (54.0)	80 (46.0)		1.59 (1.05 – 2.39)	0.028
Know someone with breast cancer	n = 998		0.002		
Yes	308 (61.5)	193 (38.5)		1.52 (1.15 – 2.02)	0.004
No	352 (70.8)	145 (29.2)		1.0	
Knowledge score	n = 998				
High	372 (68.9)	168 (31.1)		1.0	
Low	280 (62.6)	167 (37.4)	0.039	1.54 (1.16 – 2.05)	0.003

OR: Odds ratio; CI: Confidence interval

*Multivariate analysis performed with variables of age, education, having a family member or friend with breast cancer and knowledge score.

Table 5. Respondents' Expectations of Mammographic Breast Screening

	All (%)	≥40 Years Old (%)	<40 Years Old (%)
I prefer to do a mammogram in:*			
Polyclinic	629 (62.2)	497 (67.2)	132 (48.7)
Private clinics	157 (15.5)	100 (13.5)	57 (21.0)
Hospital	231 (22.8)	140 (18.9)	91 (33.6)
Mammo-on-wheels [†]	71 (7.0)	48 (6.5)	23 (8.5)
I will pay:			
\$5 – \$25	368 (37.3)	300 (41.6)	68 (25.7)
\$26 – \$50	408 (41.3)	302 (41.8)	106 (40.0)
\$51 – \$75	126 (12.8)	78 (10.8)	48 (18.1)
\$76 – \$100	50 (5.1)	19 (2.6)	31 (11.7)
\$100 – \$125	35 (3.5)	23 (3.2)	12 (4.5)
I learn about breast cancer screening from:*			
Newspapers	485 (48.0)	361 (48.7)	124 (45.8)
TV programmes	492 (48.7)	358 (48.4)	134 (49.4)
Books/magazines	221 (21.9)	146 (19.7)	75 (27.7)
Internet	175 (17.3)	106 (14.3)	69 (25.5)
Brochures	327 (32.3)	233 (31.5)	94 (34.7)
Family/friends	353 (34.9)	262 (35.4)	91 (33.6)
Public health forums	207 (20.5)	158 (21.4)	49 (18.1)
Doctors	249 (24.6)	206 (27.8)	43 (15.9)
I would like to be reminded of my mammogram screening dates by:*			
Letter	419 (41.4)	329 (44.5)	90 (33.2)
Smart messaging service (SMS)	465 (46.0)	331 (44.7)	134 (49.4)
Email	177 (17.5)	100 (13.5)	77 (28.4)
Phone calls	110 (10.9)	88 (11.9)	22 (8.1)

*Respondents were allowed to choose multiple options when answering these questions.

[†]Mammo-on-wheels are vehicles which are equipped with mammographic facilities, which go into the community to promote breast screening.

Table 6. Multivariate Analysis of Variables Affecting Mammogram Attendance in Respondents ≥ 40 Years Old

Variables	All Respondents		Respondents Who Received Invitation Letters	
	Multivariate*		Multivariate*	
	OR (95% CI)	P Value	OR (95% CI)	P Value
Education				
Diploma/degree holder or higher	1.0		1.0	
Secondary	0.85 (0.52 – 1.39)	0.512	0.59 (0.25 – 1.36)	0.212
Primary education or less	1.1 (0.55 – 2.21)	0.784	0.56 (0.2 – 1.61)	0.285
Occupation				
Professional/executive	1.0		-	-
Clerical/technical staff	1.38 (0.8 – 2.37)	0.249	-	-
Homemaker	1.45 (0.8 – 2.64)	0.219	-	-
Others	1.45 (0.75 – 2.81)	0.266	-	-
Gross household monthly income				
$\geq \$6000$	1.0		1.0	
\$4000 – \$5999	2.04 (1.1 – 3.77)	0.023	1.73 (0.61 – 4.88)	0.304
\$2000 – \$3999	0.87 (0.48 – 1.59)	0.658	1.02 (0.37 – 2.78)	0.974
<\$2000	0.72 (0.37 – 1.37)	0.314	1.18 (0.41 – 0.86)	0.765
Housing				
Private	1.0		1.0	
4 – 5 room	0.65 (0.35 – 1.22)	0.182	0.64 (0.23 – 1.8)	0.394
3 room and smaller	0.61 (0.28 – 1.35)	0.225	0.5 (0.15 – 1.71)	0.268
Know someone with breast cancer				
Yes	1.0		-	-
No	0.62 (0.42 – 0.92)	0.018	-	-
Location				
Polyclinic with facilities [†]	1.0		1.0	
Polyclinic without facilities [†]	0.82 (0.55 – 1.21)	0.314	0.46 (0.25 – 0.856)	0.014
Perform BSE				
Yes	1.0		1.0	
No	0.38 (0.26 – 0.56)	<0.001	0.44 (0.24 – 0.82)	0.009
Knowledge				
High	1.0		1.0	
Low	0.33 (0.22 – 0.5)	0.001	0.41 (0.22 – 0.78)	0.006
Attend other screening				
Yes	1.0		1.0	
No	0.14 (0.05 – 0.42)	<0.001	0.18 (0.05 – 0.70)	0.014
Perception of embarrassment				
Yes	0.57 (0.32 – 0.99)		0.61 (0.28 – 1.33)	
No/not sure	1.0	0.046	1.0	0.213
Think that mammograms change breast appearance				
Yes	0.97 (0.29 – 1.62)		-	-
No/not sure	1.0	0.389	-	-
Perceive mammograms as painful and frightening				
Yes	-	-	0.55 (0.3 – 1.02)	
No/not sure	-	-	1.0	0.056

OR: Odds ratio; CI: Confidence interval; BSE: Breast self-examination

*Multivariate analysis was performed for all respondents ≥ 40 years old, and respondents who received the invitation letter to attend screening mammography respectively, using all the variables which were significant on univariate analysis in each group.[†]Facilities: screening mammography facilities.

Table 7. Reasons For and Against Attending Breast Screening*

	All (%)	≥40 Years Old (%)	<40 Years Old (%)
I go/intend to go for regular mammogram screening because:	(n = 550)	(n = 332)	(n = 218)
I am worried I will get breast cancer	388 (70.5)	216 (65.1)	172 (78.9)
I have a relative/friend with breast cancer	77 (14.0)	51 (15.4)	26 (11.9)
The doctor recommended me to go	124 (22.5)	101 (30.4)	23 (10.6)
My friends/relatives recommended me to go	44 (8.0)	28 (8.4)	16 (11.9)
It is part of my company's health benefits	39 (7.1)	22 (6.6)	17 (7.8)
I have not gone/do not intend to go for a screening mammogram because:	(n = 450)	(n = 397)	(n = 53)
I do not have anything wrong with my breasts	171 (38.0)	152 (38.3)	19 (35.8)
I do not think I will get breast cancer	36 (8.0)	31 (7.8)	5 (9.4)
I have not heard of breast screening before this survey	10 (2.2)	8 (2.0)	2 (3.8)
I have no time	133 (29.6)	124 (31.2)	9 (17.0)
I am afraid of pain	94 (20.9)	88 (22.2)	6 (11.3)
I am afraid of radiation	34 (7.6)	29 (7.3)	5 (9.4)
Mammograms are too expensive	70 (15.6)	64 (16.1)	6 (11.3)
I am afraid of knowing I have breast cancer	56 (12.4)	50 (12.6)	6 (11.3)
I am worried there may be male staff at the clinic	36 (8.0)	33 (8.3)	3 (5.7)
I would go for a screening mammogram if:	(n = 450)	(n = 397)	(n = 53)
I have any breast problem	237 (52.7)	212 (53.4)	25 (47.2)
My doctor encouraged me to go for it	133 (29.6)	119 (30.0)	14 (26.4)
My family/friends encouraged me to go for it	57 (12.7)	51 (12.8)	6 (11.3)
I could take medical leave for it	31 (6.9)	26 (6.5%)	5 (9.4)
It is less expensive	102 (22.7)	91 (22.9)	11 (20.8)
I could claim its cost from Medisave	107 (23.8)	93 (23.4)	14 (26.4)
I can claim from my company	47 (10.4)	38 (9.6)	9 (17.0)

*Respondents were allowed to choose multiple options when answering each question.

were the most commonly cited reasons. Many non-attendees (52.7%) answered that they would go for screening if they found any breast problems. Other important factors that could change their mind towards attending screening were encouragement from their doctors, lower mammogram cost, and ability to claim the mammogram cost from Medisave (Table 7).

Discussion

The study conducted by Sim et al¹¹ in 2009 looked at the level of breast cancer knowledge in Singapore and how it influenced screening practices. This current study focused on the level of understanding and perception of breast cancer screening and the factors affecting screening practices.

Knowledge

Both studies revealed high levels of knowledge with regard to breast cancer and the importance of screening.

As expected, those aged ≥40 years in our study had higher overall knowledge scores since they had reached the “at risk” age for breast cancer. However, when the knowledge questions are analysed separately, the level of awareness and understanding specific to mammographic screening was still poor. Many had not heard of the screening programme and could not name a screening centre. Women who knew someone with breast cancer tended to have higher breast cancer knowledge (Sim et al)¹¹ and understanding of mammographic screening (current study). This is likely to be due to the heightened awareness of breast cancer and the motivation to increase its understanding and prevention. The challenge in public education is to reach out to women from low income families, and who do not have any personal contact with breast cancer, to increase their understanding and motivation to attend screening.

Perception

Negative perceptions of mammography such as fear

of the procedural pain, feelings of embarrassment, and fear of the radiation involved, have been widely reported as barriers to the uptake of breast screening, especially in Asian populations and minority populations in Western countries.¹²⁻¹⁵ Cultural and modesty issues also contribute to the low acceptability of mammographic screening.¹⁶⁻²⁰ Among our respondents, embarrassment and fear of the procedure were still significant deterrents in screening attendance. Despite generally being more knowledgeable about breast screening than the younger women, those above 40 years old had more negative perceptions. Further, knowing someone diagnosed with breast cancer increased knowledge and screening behaviour, but did not improve negative perception. Hence, the authors suggest that future public education efforts be more directed towards allaying public fears and misconceptions of mammographic screening.

Facilities and Cost

Many respondents (43.2%) felt that mammographic facilities were not readily available, yet this did not correlate with whether their polyclinic had screening facilities. This could be more of an awareness problem than actual unavailability of facilities. Interestingly, 22.8% of respondents preferred the screening centre to be a hospital. Unfortunately, this study was not designed to determine the reason. Possible reasons may be the perception that hospitals are better equipped, or that specialists are at hand should there be any problem. Further studies will be needed to elucidate this issue. A significant proportion of respondents (22.7%) cited cost to be one of the deterrents to screening attendance. This may be compounded by the fact that at the time of this study, 71.4% was unaware that Medisave could be used for those ≥ 50 years old. More publicity of this fact could help to improve attendance rate.

Non-attenders

Independent factors that influenced screening attendance were household income, level of knowledge, practice of BSE, knowing someone with breast cancer and attendance of other forms of screening. Attendance of other forms of health screening was the strongest predictor of breast screening, which may be due to these women having more health awareness, or due to the inclusion of mammograms in health screening packages. Previous surveys conducted by A Seow et al²¹ and Leong et al²² in 1994 and 2003 respectively found that Malay women were significantly less likely to attend mammographic than Chinese. Sim et al in 2009¹¹ also found race and education to be significant. However, we did not find race or education to be significant factors in influencing mammogram attendance in our study. As the proportion of non-Chinese in our study population

was small, this study was not able to determine the reasons for our lack for racial differences. We postulate that a rise in our general population's education level over the past 2 decades²³ and recent public education efforts may have resulted in raised awareness across our various ethnic communities and different education levels in Singapore. We await future studies to confirm these. Reasons cited by the respondents in the current study for not attending screening again showed poor understanding and awareness of screening (fear of pain, not having any breast problem, would only go if they found a breast problem), similar to previous studies.^{6,11,24} In the Singapore breast screening project (1994 to 1996), a strong predictor of attendance was encouragement by the spouse or family members,^{21,25} but in our study, more women (29.6%) would go if encouraged by her doctor. The woman is more likely to respond in a positive manner to her regular physician whom she trusts,²⁶⁻²⁸ and primary healthcare physicians should be encouraged to do more opportunistic screening.²⁹

This study was not designed to compare women <40 years with those ≥ 40 years old, but we noted several interesting findings. The younger group had less knowledge of breast screening, but they showed more willingness to attend screening. Younger women obtained breast cancer and screening information from books/magazines and the Internet more frequently, compared to the older women. More women in the younger group also preferred the hospitals as screening centres.

Limitations

We acknowledge several limitations of this survey. First, the survey was carried out in one part (eastern) of Singapore. However, the demographics of our respondents were similar to that of national statistics; hence the findings may be extrapolated to the rest of the country. Although we had chosen to conduct the study in the polyclinics to get a sample population as similar to the community as possible, the respondents were nonetheless in a healthcare setting, with health education material readily available. Their knowledge, perceptions and expectations may still differ from the general community. Certain questions may evoke recall bias. The number of respondents in the younger age group was much smaller than in the group ≥ 40 years old and this may contribute to sampling bias. Another limitation is that our study was unable to distinguish the lack of knowledge regarding screening in general, from lack of knowledge of our national screening programme, as the reason for the low screening uptake.

Conclusion

Breast cancer awareness among women in Singapore

is high but understanding of mammographic screening is limited and misconceptions abound. The emphasis of public education should be the rationale of screening, availability of the facilities and to dispel myths and misconceptions. Primary care physicians should be encouraged to partake in public education and perform more opportunistic screening.

Acknowledgements

The authors would like to acknowledge all the Directors of the involved polyclinics, who had kindly given them permission to conduct their survey, staff of the polyclinics for their assistance, all medical students involved in the conducting of the surveys, especially Ms Teoh Xuhui and Ms Chan Ng Poh Lin Pauline, research coordinators, Dr Tina Xu (statistician) from SCRI and all the respondents who took part in the study for their invaluable time and help.

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Health Screening Behaviour among Singaporeans

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Abstract

Introduction: This study assessed the health screening behaviour of Singaporeans and evaluated factors associated with low uptake of screening tests. **Materials and Methods:** Data from the 2010 National Health Survey, which was conducted on Singapore citizens and permanent residents, was used in this analysis. Multivariate Cox regression was used to evaluate the relationship between sociodemographics and health screening behaviour for selected chronic diseases (hypertension, diabetes and hypercholesterolaemia) and cancers (cervical, breast and colorectal). National recommendations for age at which screening should be initiated and appropriate screening interval were used to define appropriate screening behaviour. **Results:** More respondents have had their last chronic disease screening done within the recommended time period compared to cancer screening. A total of 77.8%, 63.4% and 54.9% of the respondents had their last hypertension, diabetes and hypercholesterolaemia done within the recommended time period, while less than 50% of the respondents had their cervical (45.8%), breast (32.9%) and colorectal (20.2%) cancer screenings done within the recommended time period. Respondents with higher household income or with more years of education were more likely to have undergone screening within the recommended time period. Indians, who are at higher risk of chronic diseases such as diabetes and hypercholesterolaemia, were also more likely to have been screened. A total of 69.9% and 79.5% of persons with previously undiagnosed diabetes and previously undiagnosed hypertension respondents reported having had diabetes and hypertension screening respectively within the recommended time period. **Conclusion:** Sociodemographic factors that could be associated with a lower uptake of screening tests include: 1) those with low household income, 2) low education level, and 3) Malay ethnicity. Health promotion programmes and outreach to these groups can be enhanced to further improve screening uptake.

Ann Acad Med Singapore 2015;44:326-34

Key words: Diabetes screening, Hypercholesterolaemia screening, Hypertension screening

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Introduction

Early detection of disease through health screening, followed by assessment of abnormal screen results and management of chronic conditions, is a key strategy in non-communicable disease control.¹ When used appropriately, screening followed by assessment of results and management of identified health conditions can prevent the development of complications early and significantly increase survival rates, and they are critical to limit escalations in healthcare costs.²

Rapidly urbanising Asian countries are experiencing a rising chronic disease burden. Singapore is no exception and this has led to a national government-led emphasis on health

promotion and disease prevention initiatives. In the past decade, the Health Promotion Board (HPB) has implemented several nationwide health screening programmes to screen for chronic diseases (hypertension, hypercholesterolaemia and diabetes mellitus), selected cancers (breast, cervical and colorectal), as well as age-related functional decline. In 2010, a Screening Test Review Committee (STRC) was set up by the Academy of Medicine, Singapore (AMS) to review the screening framework for population health screening, in order to ensure that screening implemented at the national level are clinically effective, cost-effective and tailored to appropriate risk groups and screening intervals.³ These

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recommendations were thereafter incorporated into the guidelines of national screening programmes and Ministry of Health (MOH) clinical practice guidelines.

While existing screening programmes have been successful in raising public awareness in screening, the participation rates for health screening has varied over time, and cancer screening uptake in particular is low. The last National Health Survey (NHS) conducted in 2010 showed that 39.6% (36.4% in 2004 NHS) of women aged 50 to 69 years had mammography within the last 2 years, and 47.9% (52% in 2004 NHS) of women aged 25 to 69 years had pap smears at least once in the past 3 years.^{4,5} Participation in health screening programmes is largely influenced by sociodemography, personal attitudes and beliefs, and varies across population segments.¹ Studies have shown that individuals of lower socioeconomic status are less likely to engage in preventive health behaviours, are associated with higher prevalence of chronic diseases, and have higher levels of risk factors.⁶⁻⁸

This paper aims to understand the health screening behaviour amongst Singaporeans. We seek to identify population segments with low uptake of recommended screening and factors associated with low uptake for the various screening tests. Understanding the health screening behaviour of Singaporeans will help local health authorities to better plan screening programmes in order to target under-screened population segments.

Materials and Methods

Data used in this analysis come from the NHS 2010 conducted between 17 March 2010 and 13 June 2010. The NHS is a regular 6-yearly nationally representative population-based health survey of Singapore citizens and permanent residents. Its design and rationale have been published in detail elsewhere.⁵ The sample selection was divided into 2 phases. A total of 47,500 household addresses were first randomly selected from the National Database on Dwelling (NDD) maintained by the Singapore Department of Statistics (DOS) based on a 2-stage stratified design. The primary selection units (PSUs) were based on geographical zones and the secondary selection units (SSUs) on residential dwelling units. After incorporating ethnicity information, 17,000 addresses were randomly selected for enumeration. All household members aged 18 to 79 years of age were enumerated from contactable households, and this then formed the sampling frame of eligible participants. Disproportionate stratified sampling (stratified by age, gender and ethnicity) was used to select 7695 participants, of whom 183 were subsequently found to be ineligible. An eventual sample of 4337 individuals was obtained, giving a response rate of 57.7%.

Upon enrolment, a standardised questionnaire on lifestyle practices, demography, health conditions, knowledge, practices and attitudes towards preventive health programmes and risk factors was administered to all participants by trained interviewers. Following this, participants underwent a health screening examination that included blood pressure measurement, an oral glucose tolerance test (except for diabetics on medication), glycated haemoglobin HbA1c levels, fasting lipids, urine protein measurement, assessment on hearing loss and anthropometric measurements.

For diabetic and hypercholesterolaemia examinations, participants had their blood taken by venipuncture after an overnight fast of at least 10 hours. For non-diabetic subjects and diabetic subjects who were not on medication, a glucose load of 75 g in a 296 mL drink was given before a second blood sample was taken after 2 hours. All blood specimens collected for the survey were sent daily to the Biochemistry Laboratory at the Singapore General Hospital (SGH) for analysis. For blood pressure measurements, participants were rested adequately before their readings were taken by trained survey fieldworkers using standard mercury sphygmomanometer. Informed consent was obtained from all eligible participants before the study was administered. The methodology, protocol and procedures were approved by the HPB Medical Dental Board Ethics Committee.

Health Screening Practices

Screening behaviours for 6 health conditions were assessed: diabetes, hypertension, hypercholesterolaemia, breast cancer, cervical cancer and colorectal cancer. Answers to the screening questions were only analysed for individuals within the age groups that are clinically recommended for the respective screenings. For each selected chronic diseases and cancers, individuals were asked when and where they had last been screened, reasons for their last screen or for not participating in health screening for that condition. The recommended screening guidelines for chronic diseases and selected cancers were defined in accordance to the recommendations of the STRC³ as follows: diabetes mellitus – fasting glucose for individuals aged ≥ 40 years every 3 years; hypercholesterolaemia – fasting lipids for individuals aged ≥ 40 years every 3 years; hypertension – blood pressure for individuals aged ≥ 18 years at least once every 2 years; cervical cancer – Pap smear for sexually active females aged 25 to 69 years at least once every 3 years; breast cancer – mammography for females aged 50 to 69 years every 2 years; colorectal cancer – faecal occult blood test (FOBT) done annually or sigmoidoscopy/colonoscopy once every 10 years for individuals aged ≥ 50 years. In the analyses for chronic disease screening, we excluded persons who had already been diagnosed with that chronic disease.

Statistical Analysis

Statistical analyses were carried out using STATA version 11.0. Weighted Cox proportional hazard regression model was used to estimate the prevalence rate ratios (PRR) and 95% confidence intervals (CI) of sociodemographic factors associated with regular health screening behaviour for chronic diseases (hypertension, diabetes and hypercholesterolaemia) and selected cancers (cervical, breast and colorectal). Follow-up was used as the underlying time variable and all multivariate analysis were adjusted for age, gender, education and monthly household income. Statistical significance was determined at $P < 0.05$. Sample weights were calculated at the household enumeration exercise and for survey fieldwork. To adjust for undersampling of Chinese and oversampling of other races and differential response levels, poststratification weights were also computed based on age, gender, ethnic groups, and dwelling type attributes to yield a survey sample similar to the Census 2010 Singapore resident population.

Results

More than 70% of eligible respondents had ever been screened for hypertension (3319 or 94.3%), diabetics (1669 or 79.3%) and hypercholesterolaemia (1129 or 71.1%) at least once in their lifetime (Table 1). Of those aged 18 years and above, 77.8% had their last blood pressure measured at least once within the recommended frequency of 2 years. The proportion of respondents aged 40 years and above who had their last screen for diabetes and hypercholesterolaemia in the past 3 years as recommended were 63.4% and 54.9%, respectively.

In comparison to chronic disease screening, the overall participation for cancer screening within the recommended time period was lower. Slightly more than 70% of eligible female respondents had undergone Pap smear test (70.6%) and mammography (66.0%), while only 36.3% of eligible respondents had undergone FOBT or sigmoidoscopy/ colonoscopy respectively at least once in their lifetime. Less than half of the women (45.8%) aged 25 to 69 years did their last Pap smear within the past 3 years, and only 3 out of 10 women (32.9%) aged 50 to 69 years had undergone mammography within the past 2 years. Of all respondents (males included) aged 50 to 79 years, only 20.2% reported to have done FOBT within the past 1 year or sigmoidoscopy/colonoscopy within the past 10 years for colorectal screening.

Sociodemographic Characteristics Associated with Chronic Disease Screenings

In adjusted analyses, older age groups, Indians, higher educational levels and higher household income (only for hypertension screening) were positively associated with last screening done within the recommended time period for chronic diseases (Table 2). Individuals 60 years and older were more likely to have had their last chronic disease screening done within the recommended guidelines than younger persons (for hypertension, PRR: 1.25, 95% CI, 1.11 to 1.41; for diabetes, PRR: 1.38, 95% CI, 1.20 to 1.58; for hypercholesterolaemia, PRR: 1.24, 95% CI, 1.00 to 1.54). Indians were significantly more likely to have undergone screening for all 3 conditions compared to the Chinese (for hypertension, PRR: 1.08, 95% CI, 1.02

Table 1. Participation in Chronic Disease and Cancer Screenings

	Number of Respondents Eligible for Screening as Recommended*	Those who Had Screened as Recommended	Those who Had Ever Been Screened	Reported to Have Never Been Screened
	Total	n (%)†	n (%)†	n (%)†
Blood pressure	3568	2792 (77.8%)	3319 (94.3%)	249 (5.7%)
Fasting blood glucose	2149	1340 (63.4%)	1669 (79.3%)	480 (20.7%)
Fasting blood lipids	1658	905 (54.9%)	1129 (71.1%)	529 (28.9%)
Pap smear	1993	872 (45.8%)	1379 (70.6%)	590 (28.6%)
Mammography	748	204 (32.9%)	449 (66.0%)	293 (33.7%)
Faecal occult blood test/colonoscopy/ sigmoidoscopy	1464	228 (20.2%)	413 (36.3%)	1020 (61.9%)

*Based on recommended screening guidelines for chronic diseases and selected cancers as defined by STRC recommendation for health screening: hypertension – blood pressure for individuals aged ≥ 18 years at least once every 2 years; diabetes mellitus – fasting glucose for individuals aged ≥ 40 years every 3 years; hypercholesterolaemia – fasting lipids for individuals aged ≥ 40 years every 3 years; cervical cancer – Pap smear for sexually active females aged 25 to 69 years at least once every 3 years; breast cancer – mammography for females aged 50 to 69 years every 2 years; colorectal cancer – faecal occult blood test (FOBT) done annually or sigmoidoscopy/colonoscopy once every 10 years for individuals aged ≥ 50 years. Includes eligible individuals who have responded “don’t know” or “refused to answer” for the screening questions.

†Weighted percentages.

Table 2. Prevalence Rate Ratio (PRR) Estimates for Sociodemographic Characteristics Associated with Chronic Disease Screening Done as Recommended

Sociodemographic Characteristics	Last Blood Pressure Checked as Recommended*			Last Fasting Blood Glucose Checked as Recommended*			Last Fasting Blood Lipids Checked as Recommended*		
	PRR	95% CI	P for Trend	PRR	95% CI	P for Trend	PRR	95% CI	P for Trend
Age (years)									
18 – 39	Ref		-						
40 – 49	1.06	(0.98 – 1.14)		Ref			Ref		
50 – 59	1.16	(1.08 – 1.26)		1.14	(1.01 – 1.29)		1.05	(0.89 – 1.24)	
60 and above	1.25	(1.11 – 1.41)		1.38	(1.20 – 1.58)		1.24	(1.00 – 1.54)	
Gender									
Male	Ref			Ref			Ref		
Female	1.02	(0.97 – 1.08)		1.01	(0.91 – 1.12)		1.02	(0.88 – 1.17)	
Ethnicity									
Chinese	Ref			Ref			Ref		
Malay	1.06	(0.99 – 1.13)		0.91	(0.81 – 1.02)		0.93	(0.81 – 1.08)	
Indian	1.08	(1.02 – 1.13)		1.18	(1.08 – 1.29)		1.16	(1.02 – 1.31)	
Others	0.99	(0.90 – 1.08)		1.02	(0.85 – 1.23)		0.91	(0.71 – 1.17)	
Education			0.001			0.011			0.011
PSLE and below	Ref			Ref			Ref		
Secondary	1.01	(0.88 – 1.16)		1.02	(0.86 – 1.22)		1.03	(0.81 – 1.32)	
O/N ^a level/NTC 3 certificate or equivalent	1.08	(0.96 – 1.22)		1.09	(0.91 – 1.29)		1.15	(0.91 – 1.46)	
A ^a level/NTC 1-2/ Certificate in Office/ Business Skills or its equivalent	1.12	(0.98 – 1.29)		1.17	(0.93 – 1.49)		1.19	(0.86 – 1.64)	
Polytechnic/other diplomas and professional qualification	1.17	(1.03 – 1.34)		1.24	(1.00 – 1.53)		1.24	(0.92 – 1.68)	
University and above	1.20	(1.06 – 1.37)		1.23	(1.02 – 1.49)		1.42	(1.08 – 1.86)	
Household income			0.001			0.070			0.350
Below \$2000 per month	Ref			Ref			Ref		
\$2000 – \$3999 per month	1.10	(0.99 – 1.21)		1.01	(0.87 – 1.17)		1.02	(0.83 – 1.25)	
\$4000 – \$5999 per month	1.09	(0.98 – 1.22)		1.05	(0.88 – 1.26)		1.08	(0.85 – 1.37)	
\$6000 – \$9999 per month	1.10	(0.98 – 1.24)		1.14	(0.95 – 1.36)		0.99	(0.75 – 1.31)	
\$10,000 and above	1.25	(1.12 – 1.39)		1.17	(0.96 – 1.44)		1.19	(0.91 – 1.56)	

PRR: Prevalence rate ratio
Analysis was adjusted for age, gender, ethnicity, education and monthly household income.
*Based on recommended screening guidelines for chronic diseases as defined by STRC recommendation for health screening: diabetes mellitus – fasting glucose for individuals aged ≥40 years every 3 years; hypercholesterolaemia – fasting lipids for individuals aged ≥40 years every 3 years; hypertension – blood pressure for individuals aged ≥18 years at least once every 2 years.

to 1.13; for diabetes, PRR: 1.18, 95% CI, 1.08 to 1.29; for hypercholesterolaemia, PRR: 1.16, 95% CI, 1.02 to 1.31). Significant dose-response relationships were observed between higher educational levels and screening done within recommended time period for hypertension, diabetes and hypercholesterolaemia, with individuals with university education and above having a 20%, 23% and 42% increased uptake of screening respectively, compared to those with PSLE and lower education level. However, a dose-response relationship was as not apparent in household income levels.

Sociodemographic Characteristics Associated with Cancer Screenings

For female cancer screening, younger women and those with higher monthly household income were positively associated with mammography and cervical cancer screening done within recommended guidelines (Table 3). Compared to those between 25 to 39 years old and 50 to 59 years old, those aged 60 and above were less likely to have had Pap smear and mammography done within the recommended time period respectively (for cervical cancer, PRR: 0.44, 95% CI, 0.29 to 0.68; for mammography, PRR: 0.64, 95% CI, 0.43 to 0.95). Household income was positively associated with FOBT/colonoscopy and sigmoidoscopy (P for trend: 0.001) done within the recommended time period. Respondents of Malay ethnicity were less likely to have had cancer screening done within the recommended time period, compared to the Chinese (for Pap smear, PRR: 0.87, 95% CI, 0.77 to 0.99; for mammography, PRR: 0.88, 95% CI, 0.63 to 1.22; for FOBT/colonoscopy/sigmoidoscopy, PRR 0.33, 95% CI, 0.21 to 0.52), compared to the Chinese.

The most commonly cited reason for not participating in screening for chronic diseases and female cancers for respondents who were of the recommended screening age group was “Not necessary as I am healthy” (25.8% to 49.9%), while other commonly cited reason for non-participation in chronic diseases was “Not suggested by doctors” (22.1%; (hypercholesterolaemia) to 40.7% (hypertension). For female cancers, the other commonly cited reasons for Pap smear were “Never heard about Pap smear test” (13.3%) and “Painful test” (10.5%) and “No time due to work commitment” (9.4%) for mammography. Only less than 5% have reported that cost was a factor which had influenced their decisions to not go for chronic diseases and cancer screenings (data not shown in tables).

Health Screening Practices among Respondents with At Least 1 Previously Diagnosed Chronic Disease

Respondents with at least 1 known chronic condition (hypertension, diabetes mellitus or hypercholesterolaemia) prior to the survey were more likely to have been screened

for other chronic diseases within the recommended time period compared to healthy respondents without any of the 3 chronic condition (Table 4). More than 80% of diabetic and hypercholesterolaemia respondents had been screened for the other chronic diseases within the recommended time period. Amongst respondents without known chronic diseases, a higher proportion of them had been screened for hypertension (75.5%) within the recommended time period compared to diabetes (36.7%) and hypercholesterolaemia (34.8%).

Health Screening Practices among Respondents who Had Previously Undiagnosed Chronic Disease Conditions Prior to Survey

A total of 1171 respondents were found to have hypertension (241), diabetes (281) or hypercholesterolaemia (649) which were previously undiagnosed prior to the survey (data not shown in table). Among these respondents with undiagnosed chronic conditions, a large proportion of undiagnosed diabetics (69.9%) and undiagnosed hypertensives (79.5%) had been screened within the recommended time period for the respective conditions. A total of 40.5% and 74.6% of undiagnosed diabetics and hypertensives, respectively had been screened less than a year ago, while almost half of undiagnosed hypercholesterolemia participants (47.1%) had been screened for high cholesterol within the recommended time period.

Discussion

More than 66% of eligible respondents have been screened for chronic diseases and cancers, except for colorectal cancer, at least once in their lives. We found that a significant proportion (>50%) of respondents had their last screen for chronic diseases within recommended intervals, compared to breast, cervical and colorectal cancers (the highest was 45.8% for cervical cancer). Colorectal cancer screening uptake in particular was very poor. This study also highlights several demographic factors associated with low screening uptake for selected chronic diseases and cancers within the recommended time periods: respondents who were Malay, or from households with lower income, or had lower educational levels were more likely not to go for screening within the recommended time period, and were also more likely to have never undergone any screening in their lives. Indians, who are at higher risk of chronic diseases such as diabetes and hypercholesterolaemia, are more likely to have been screened.

Our findings are consistent with local health utilisation studies by Wee et al⁹ and Ng et al,¹⁰ which highlighted poor screening utilisation within the lower income settings and sociodemographics as an indicator for diabetic screening

Table 3. Prevalence Rate Ratio (PRR) Estimates for Sociodemographic Factors Associated with Cancer Screening Done as Recommended

Sociodemographic Characteristics	Last Pap Smear Done as Recommended*			Last Mammography Done as Recommended*			Last FOBT/Colonoscopy/Sigmoidoscopy Done as Recommended*		
	PRR	95% CI	P for Trend	PRR	95% CI	P for Trend	PRR	95% CI	P for Trend
Age (years)									
25 – 39		Ref		-			-		
40 – 49	0.83	(0.72 – 0.96)		-			-		
50 – 59	0.70	(0.57 – 0.86)		Ref			Ref		
60 and above	0.44	(0.29 – 0.68)		0.64	(0.43 – 0.95)		1.38	(0.93 – 2.04)	
Gender									
Male		-		-			Ref		
Female		-		-			0.89	(0.63 – 1.27)	
Ethnicity									
Chinese		Ref		Ref			Ref		
Malay	0.87	(0.77 – 0.99)		0.88	(0.63 – 1.22)		0.33	(0.21 – 0.52)	
Indian	1.03	(0.94 – 1.14)		1.05	(0.80 – 1.38)		0.80	(0.57 – 1.13)	
Others	1.03	(0.89 – 1.19)		1.36	(0.78 – 2.36)		0.72	(0.35 – 1.46)	
Education			0.521			0.167			0.422
PSLE and below		Ref		Ref			Ref		
Secondary	0.93	(0.70 – 1.24)		0.98	(0.59 – 1.64)		1.67	(0.98 – 2.85)	
O/N ^a level/NTC 3 certificate or equivalent	1.10	(0.86 – 1.40)		1.38	(0.89 – 2.13)		1.44	(0.86 – 2.43)	
A ^a level or NTC 1-2 or Certificate in Office/Business Skills or its equivalent	0.98	(0.72 – 1.33)		0.84	(0.37 – 1.90)		1.90	(0.92 – 3.90)	
Polytechnic/other diplomas & professional qualification	0.97	(0.72 – 1.30)		1.37	(0.84 – 2.24)		1.66	(0.76 – 3.62)	
University & above	0.93	(0.70 – 1.25)		1.30	(0.78 – 2.18)		1.49	(0.72 – 3.11)	
Household income			0.073			0.235			0.001
Below \$2000 per month		Ref		Ref			Ref		
\$2000 – \$3999 per month	1.02	(0.84 – 1.23)		0.99	(0.64 – 1.53)		2.35	(1.42 – 3.88)	
\$4000 – \$5999 per month	1.08	(0.87 – 1.33)		1.46	(0.97 – 2.19)		2.21	(1.19 – 4.08)	
\$6000 – \$9999 per month	1.07	(0.85 – 1.35)		1.21	(0.71 – 2.04)		4.00	(2.28 – 6.99)	
\$10,000 and above	1.24	(0.99 – 1.55)		1.30	(0.81 – 2.07)		2.48	(1.19 – 5.18)	

FOBT: Faecal occult blood test; PRR: Prevalence rate ratio

Analysis was adjusted for age, gender (for colorectal cancer), ethnicity, education and monthly household income.

^aBased on recommended screening guidelines for selected cancers as defined by STRC recommendation: cervical cancer – Pap smear for sexually active females aged 25 to 69 years at least once every 3 years; breast cancer – mammography for females aged 50 to 69 years every 2 years; colorectal cancer – faecal occult blood test (FOBT) done annually or sigmoidoscopy/colonoscopy once every 10 years for individuals aged ≥50 years.

Table 4. Screening Behaviour of Respondents without Any Chronic Condition and At Least 1 Diagnosed Chronic Condition

	Previously Diagnosed Hypertensive n = 761	Previously Diagnosed Diabetic n = 427	Previously Diagnosed Hypercholesterolaemia n = 1006	No Previous Diagnosis of the 3 Conditions n = 2977
	%	%	%	%
Have last blood pressure checked as recommended*		98.2	89.1	75.5
Have last fasting blood glucose checked as recommended*	72.9		76.2	36.7
Have last fasting blood lipids checked as recommended*	59.6	83.9		34.8

*Based on recommended screening guidelines for chronic diseases as defined by STRC recommendation for health screening; diabetes mellitus – fasting glucose for individuals aged ≥ 40 years every 3 years; hypercholesterolaemia – fasting lipids for individuals aged ≥ 40 years every 3 years; hypertension – blood pressure for individuals aged ≥ 18 years at least once every 2 years.

uptake, as well as with international studies, which have also reported low uptake of screening amongst ethnic minorities and lower socioeconomic groups.¹¹⁻¹³ Low screening uptake has been attributed to common barriers such as out-of-pocket payments, and cultural and personal beliefs (e.g. underestimation of individual risks to cancers).

While it is worthwhile to consider making screening free to encourage greater uptake within the lower income community,¹⁴⁻¹⁶ poor regular screening attendance amongst lower income strata might not necessarily be due to screening cost. Other factors influencing the decision not to screen could include fear of having to deal with greater healthcare costs should abnormal results arise, especially for cancer screenings, and having a fatalistic attitude towards personal health. We found that the main reasons cited by respondents who had never undergone screening were “No advice by doctors” and “Not necessary as I am healthy” rather than cost of screening, providing indirect support that poor screening attendance may not be due to the cost of screening alone. More targeted health education campaigns and awareness of financial assistance available in the event that treatment is necessary can alleviate this undue fear. It should be remembered that health screenings might also not be the primary priority of members of lower income strata, and time, convenience and anxiety might present physical barriers for screenings.^{17,18} Further studies using qualitative interviews should be considered to provide insights into reasons behind non-participation amongst at-risk groups.

Efforts have been made to reduce financial barriers to screening and make screening affordable and accessible in Singapore. A nationwide screening programme, the Integrated Screening Programme (ISP), was introduced in 2008 to encourage Singapore residents aged 40 to 69 years to go screening for chronic diseases, colorectal and cervical cancer at ISP-registered general practitioner (GP)

clinics. Under the ISP framework, eligible lower income individuals will only need to pay for the consultation fees. To further improve screening outreach to lower income groups, subsidies were extended to the Community Health Assist Scheme (CHAS) to cover screening-related costs, with valid CHAS cardholders receiving subsidies of up to \$18.50 twice a year to offset consultation fees related to screening.¹⁹ For cancer screening, individuals within the recommended age group for mammograms and colonoscopies can use their own or immediate family member’s Medisave to offset screening cost and minimise cash payment. Subsidies for screening mammography are available through the BreastScreen Singapore programme. To enhance accessibility, HPB also collaborates with companies and community groups to bring screening to residents in the workplace and community. For instance, initiatives such as Health Screening on Wheels was launched to make screening more convenient for employees at workplaces, by the deployment of mobile screening buses.²⁰ In 2011, HPB also launched a one-stop screening programme together with a GP network programme at Whampoa Community, which aimed not only to make screening convenient, but to ensure patients with abnormal results receive follow-up treatment and care after screening.²¹ More recently, HPB and Breast Cancer Foundation (BCF) have launched a BCF Encouragement for Active Mammograms (BEAM 15) programme in 2013, which provides free mammograms to eligible women above 50 years old from lower income groups.

HPB has also adopted a multipronged communication and social marketing strategies for screening campaigns to increase awareness. Integrated marketing campaigns were used for national screening programmes such as BreastScreen Singapore. Approaches include media publicity through print media and infomercials, mailers to women, recruitment and educational activities at

community events and road shows, and engagement of health ambassadors to educate the public on the importance of screening.²²

In this study, routine check-up was the main reason cited for screenings done within the recommended time period, which suggested the role of workplace health initiatives and GPs. GPs play a role in influencing people's decision to screen and they can help encourage long-term follow-up patients to go for opportunistic screening. In addition, the presence of a structured and periodic screening schedule in workplace health initiatives and community could also play an important role in bringing more Singaporeans to participate in regular screenings.

To improve screening amongst at-risk groups (people in low socioeconomic strata and the Malay community) within Singapore, health promotion to increase screening uptake may need to be further customised by taking into consideration cultural perspectives and linguistic and socioeconomic diversities.²³ These efforts will need to move beyond health education, and consider economic incentives and the social and built environment, which the HPB has been doing in recent years; the ISP is an example of this broader perspective used in effecting behaviour change. Partnering trusted social institutions such as places of worship and support groups such as Majlis Ugama Islam Singapura (MUIS) may be useful to sustain community outreach and engagement in the Malay community. Similarly, social welfare organisations such as People's Association and the Community Development Councils may be useful when engaging people from lower socioeconomic strata.

It was also observed that individuals with at least 1 known chronic disease were more likely to have been screened for other chronic diseases within the recommended time period, compared to healthy individuals. Possible reasons may be due to better health literacy and more concern about personal health amongst patients with existing health conditions. It is more likely however, that this positive result reflects the efforts of primary care doctors (who see the majority of patients with these conditions), who are ordering appropriate screening tests for other at-risk health conditions in their patients.

For better clinical outcomes, screening has to be coupled with postscreening follow-up and optimal management. The survey found that 69.9% of undiagnosed diabetics were screened within the recommended time period and 41% of these respondents had reported to have done their last diabetic screening less than a year ago. This suggests that diabetes screening might have failed to identify persons with diabetes. There are several possible reasons for this. Large intra-individual variation has been reported for glucose tests. Further, some healthcare providers may have used random glucose testing and capillary testing rather than

the recommended fasting venous glucose tests; random glucose and capillary tests are less accurate^{24, 25} and not recommended in the current Clinical Practice Guidelines for diabetes screening.²⁶ Finally, it is also possible that there may have been a lack of follow-up of patients who had undergone screening and had tested positive. This is especially so for participants of community screening and workplace screening. GP education on appropriate screening tests for diabetes should continue to be provided. To further tighten postscreening follow-up, screening providers in community and workplace health screening events should follow-up closely those individuals with abnormal results. This can be done by providing reminder phone calls to them 1 month after screening in order to nudge them to go for follow-up with GPs, facilitate appointment booking and direct them to appropriate lifestyle interventions. In tandem, a structured referral pathway can be established for individuals with abnormal results to be referred to their GPs for further assessment and management. Screening providers should undertake screening with a call and recall system, by working with HPB and GPs to manage and monitor screening efforts islandwide, under a centralised national screening repository. Not only it will ensure that individuals with abnormal results are better tracked and monitored, eligible individuals due for screening can also be reminded timely by recruitment materials (i.e. invitation letters and education materials) to go for screening.

For this study, individuals without previous diagnosis of chronic diseases were twice as likely to be screened for hypertension than diabetes and hypercholesterolaemia. This may be due to the accessibility and convenience of measuring blood pressure whenever individuals go for a GP visit, compared to the testing of diabetes and hypercholesterolaemia, which involves fasting period and blood sample taken for subsequent analysis. This also reflects the need for increased awareness and understanding of hypercholesterolaemia and diabetes in the public and GPs, which is important to improve early detection.²⁷ GPs should also initiate screening for individuals eligible for screening requirements and where possible, first-degree relatives of patients with these conditions. The strengths of this study include the use of a large representative sample population, with a reasonable response rate. Health examination and blood tests also allowed us to establish the "true" chronic disease status of participants. There are a few limitations in this study. The study did not establish if the tests undergone by participants were for screening, or if participants were symptomatic, and the tests were performed as part of the diagnostic workup. Further, the study did not establish if respondents were going for regular screening; instead, the time from their last screen done to interview was calculated as a proxy for screening within the recommended time period, and it is possible that participants who had been screened

within the recommended time period were nonetheless not being screened regularly and appropriately. Hence, our estimates of screening prevalence might be an overestimate, and the true prevalence is lower. However, the proportion of respondents who reported that the test was being done as part of a diagnostic workup was low (cervical and breast cancer screenings: 5.1 to 5.7%), except for the case of colorectal cancer (37.5%) and hypertension (15%) screenings.

Conclusion

While participation rate in regular screening for chronic diseases is high in the Singapore general population, screening for cancer (especially colorectal cancer) is still relatively low. Further, we identify several groups (low socioeconomic status in terms of household income and educational level and people of Malay ethnicity) where screening within the recommended time period was comparatively low. Health promotion programmes and outreach to these groups should be enhanced. Current efforts to promote appropriate health screening behaviour should be maintained and enhanced. In this regard, GPs play a crucial role, and programmes to support GPs in this important endeavour should be enhanced.

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Health Screening Behaviour among Singaporeans

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Abstract

Introduction: This study assessed the health screening behaviour of Singaporeans and evaluated factors associated with low uptake of screening tests. **Materials and Methods:** Data from the 2010 National Health Survey, which was conducted on Singapore citizens and permanent residents, was used in this analysis. Multivariate Cox regression was used to evaluate the relationship between sociodemographics and health screening behaviour for selected chronic diseases (hypertension, diabetes and hypercholesterolaemia) and cancers (cervical, breast and colorectal). National recommendations for age at which screening should be initiated and appropriate screening interval were used to define appropriate screening behaviour. **Results:** More respondents have had their last chronic disease screening done within the recommended time period compared to cancer screening. A total of 77.8%, 63.4% and 54.9% of the respondents had their last hypertension, diabetes and hypercholesterolaemia done within the recommended time period respectively, while less than 50% of the respondents had their cervical (45.8%), breast (32.9%) and colorectal (20.2%) cancer screenings done within the recommended time period. Respondents with higher household income or more years of education were more likely to have undergone screening within the recommended time period. Indians, who are at higher risk of chronic diseases such as diabetes and hypercholesterolaemia, were also more likely to have been screened. A total of 69.9% and 79.5% of the respondents with previously undiagnosed diabetes and hypertension had reported to have done diabetes and hypertension screenings respectively, within the recommended time period. **Conclusion:** Sociodemographic factors that could be associated with a lower uptake of screening tests include: 1) low household income, 2) low education level, and 3) Malay ethnicity. Health promotion programmes and outreach to these groups can be enhanced to further improve screening uptake.

Ann Acad Med Singapore 2015;44:326-34

Key words: Diabetes screening, Hypercholesterolaemia screening, Hypertension screening

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Introduction

Early detection of diseases through health screening, followed by assessment of abnormal screen results and management of chronic conditions, is a key strategy in non-communicable disease control.¹ When used appropriately, this strategy can prevent the development of complications early and significantly increase survival rates, and is critical in limiting escalations in healthcare costs.²

Rapidly urbanising Asian countries are experiencing a rising chronic disease burden. Singapore is no exception and this has led to a national government-led emphasis on health promotion and disease prevention initiatives. In the past

decade, the Health Promotion Board (HPB) has implemented several nationwide health screening programmes to screen for chronic diseases (hypertension, hypercholesterolaemia and diabetes mellitus), selected cancers (breast, cervical and colorectal), as well as age-related functional decline. In 2010, a Screening Test Review Committee (STRC) was set up by the Academy of Medicine, Singapore (AMS) to review the screening framework for population health screening, in order to ensure that screening implemented at the national level are clinically effective, cost-effective and tailored to appropriate risk groups and screening intervals.³ These recommendations were thereafter incorporated into the

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guidelines of national screening programmes and Ministry of Health (MOH) clinical practice guidelines.

While existing screening programmes have been successful in raising public awareness in screening, the participation rates for health screening have varied over time, and cancer screening uptake in particular is low. The last National Health Survey (NHS) conducted in 2010 showed that 39.6% (36.4% in 2004 NHS) of women aged 50 to 69 years had mammography within the last 2 years, and 47.9% (52% in 2004 NHS) of women aged 25 to 69 years had pap smears at least once in the past 3 years.^{4,5} Participation in health screening programmes is largely influenced by sociodemography, personal attitudes and beliefs, and varies across population segments.¹ Studies have shown that individuals of lower socioeconomic status are less likely to engage in preventive health behaviours, are associated with higher prevalence of chronic diseases, and have higher levels of risk factors.^{6–8}

This paper aims to understand the health screening behaviour amongst Singaporeans. We seek to identify population segments with low uptake of recommended screening, and factors associated with low uptake. Understanding the health screening behaviour of Singaporeans will help local health authorities to better plan screening programmes in order to target under-screened population segments.

Materials and Methods

Data used in this analysis was derived from the NHS 2010 conducted between 17 March 2010 and 13 June 2010. The NHS is a regular 6-yearly nationally representative population-based health survey of Singapore citizens and permanent residents. Its design and rationale have been published in detail elsewhere.⁵ The sample selection was divided into 2 phases. A total of 47,500 household addresses were first randomly selected from the National Database on Dwelling (NDD) maintained by the Singapore Department of Statistics (DOS) based on a 2-stage stratified design. The primary selection units (PSUs) were based on geographical zones and the secondary selection units (SSUs) on residential dwelling units. After incorporating ethnicity information, 17,000 addresses were randomly selected for enumeration. All household members aged 18 to 79 years of age were enumerated from contactable households, and this then formed the sampling frame of eligible participants. Disproportionate stratified sampling (stratified by age, gender and ethnicity) was used to select 7695 participants, of whom 183 were subsequently found to be ineligible. An eventual sample of 4337 individuals was obtained, giving a response rate of 57.7%.

Upon enrolment, a standardised questionnaire on

lifestyle practices, demography, health conditions, knowledge, practices, and attitudes towards preventive health programmes and risk factors was administered to all participants by trained interviewers. Following this, participants underwent a health screening examination that included blood pressure measurement, an oral glucose tolerance test (except for diabetics on medication), glycated haemoglobin HbA1c levels, fasting lipids, urine protein measurement, assessment on hearing loss and anthropometric measurements.

For diabetic and hypercholesterolaemia examinations, participants had their blood taken by venipuncture after an overnight fast of at least 10 hours. For non-diabetic subjects and diabetic subjects who were not on medication, a glucose load of 75 g in a 296 mL drink was given before a second blood sample was taken after 2 hours. All blood specimens collected for the survey were sent daily to the Biochemistry Laboratory at the Singapore General Hospital (SGH) for analysis. For blood pressure measurements, participants were rested adequately before their readings were taken by trained survey fieldworkers using standard mercury sphygmomanometer. Informed consent was obtained from all eligible participants before the study was administered. The methodology, protocol and procedures were approved by the HPB Medical Dental Board Ethics Committee.

Health Screening Practices

Screening behaviours for 6 health conditions were assessed: diabetes, hypertension, hypercholesterolaemia, breast cancer, cervical cancer and colorectal cancer. Answers to the screening questions were only analysed for individuals within age groups that are clinically recommended for the respective screenings. For each selected chronic diseases and cancers, individuals were asked when and where they had last been screened, reasons for their last screen or for not participating in health screening for that condition. The recommended screening guidelines for chronic diseases and selected cancers were defined in accordance to the recommendations of the STRC³ as follows: diabetes mellitus – fasting glucose for individuals aged ≥ 40 years every 3 years; hypercholesterolaemia – fasting lipids for individuals aged ≥ 40 years every 3 years; hypertension – blood pressure for individuals aged ≥ 18 years at least once every 2 years; cervical cancer – Pap smear for sexually active females aged 25 to 69 years at least once every 3 years; breast cancer – mammography for females aged 50 to 69 years every 2 years; colorectal cancer – faecal occult blood test (FOBT) annually or sigmoidoscopy/colonoscopy once every 10 years for individuals aged ≥ 50 years. In the analyses for chronic disease screening, persons who had already been diagnosed with that chronic disease were excluded.

Statistical Analysis

Statistical analyses were carried out using STATA version 11.0. Weighted Cox proportional hazard regression model was used to estimate the prevalence rate ratios (PRR) and 95% confidence intervals (CI) of sociodemographic factors associated with regular health screening behaviours for chronic diseases (hypertension, diabetes and hypercholesterolaemia) and selected cancers (cervical, breast and colorectal). Follow-up was used as the underlying time variable and all multivariate analyses were adjusted for age, gender, education and monthly household income. Statistical significance was determined at $P < 0.05$. Sample weights were calculated at the household enumeration exercise and for survey fieldwork. To adjust for undersampling of Chinese and oversampling of other races and differential response levels, poststratification weights were also computed based on age, gender, ethnic groups, and dwelling type attributes to yield a survey sample similar to the Census 2010 Singapore resident population.

Results

More than 70% of eligible respondents had ever been screened for hypertension (3319 or 94.3%), diabetics (1669 or 79.3%) and hypercholesterolaemia (1129 or 71.1%) at least once in their lifetime (Table 1). Of those aged 18 years and above, 77.8% had their last blood pressure measured at least once within the recommended frequency of 2 years. The proportion of respondents aged 40 years and above who had their last screen for diabetes and hypercholesterolaemia in the past 3 years as recommended were 63.4% and 54.9%, respectively.

In comparison to chronic disease screening, the overall participation for cancer screening within the recommended time period was lower. A total of 70.6% and 66.0% of eligible female respondents had undergone Pap smear test and mammography at least once in their lifetime respectively, while only 36.3% of eligible respondents had undergone FOBT or sigmoidoscopy/colonoscopy at least once in their lifetime. Less than half of the women (45.8%) aged 25 to 69 years did their last Pap smear within the past 3 years, and only 3 out of 10 women (32.9%) aged 50 to 69 years had undergone mammography within the past 2 years. Of all respondents (males included) aged 50 to 79 years, only 20.2% were reported to have done FOBT within the past 1 year or sigmoidoscopy/colonoscopy within the past 10 years for colorectal screening.

Sociodemographic Characteristics Associated with Chronic Disease Screenings

In adjusted analyses, older age groups, Indians, higher educational levels and higher household income (only for hypertension screening) were positively associated with last screening done within the recommended time period for chronic diseases (Table 2). Individuals 60 years and older were more likely to have had their last chronic disease screening done within the recommended guidelines than younger persons (for hypertension, PRR: 1.25, 95% CI, 1.11 to 1.41; for diabetes, PRR: 1.38, 95% CI, 1.20 to 1.58; for hypercholesterolaemia, PRR: 1.24, 95% CI, 1.00 to 1.54). Indians were significantly more likely to have undergone screening for all 3 conditions compared to the Chinese (for hypertension, PRR: 1.08, 95% CI, 1.02

Table 1. Participation in Chronic Disease and Cancer Screenings

	Number of Respondents Eligible for Screening as Recommended*	Those who Had Screened as Recommended	Those who Had Ever Been Screened	Reported to Have Never Been Screened
	Total	n (%)†	n (%)†	n (%)†
Blood pressure	3568	2792 (77.8%)	3319 (94.3%)	249 (5.7%)
Fasting blood glucose	2149	1340 (63.4%)	1669 (79.3%)	480 (20.7%)
Fasting blood lipids	1658	905 (54.9%)	1129 (71.1%)	529 (28.9%)
Pap smear	1993	872 (45.8%)	1379 (70.6%)	590 (28.6%)
Mammography	748	204 (32.9%)	449 (66.0%)	293 (33.7%)
Faecal occult blood test/colonoscopy/ sigmoidoscopy	1464	228 (20.2%)	413 (36.3%)	1020 (61.9%)

*Based on recommended screening guidelines for chronic diseases and selected cancers as defined by STRC recommendation for health screening: hypertension – blood pressure for individuals aged ≥ 18 years at least once every 2 years; diabetes mellitus – fasting glucose for individuals aged ≥ 40 years every 3 years; hypercholesterolaemia – fasting lipids for individuals aged ≥ 40 years every 3 years; cervical cancer – Pap smear for sexually active females aged 25 to 69 years at least once every 3 years; breast cancer – mammography for females aged 50 to 69 years every 2 years; colorectal cancer – faecal occult blood test (FOBT) done annually or sigmoidoscopy/colonoscopy once every 10 years for individuals aged ≥ 50 years. Includes eligible individuals who have responded “don’t know” or “refused to answer” for the screening questions.

†Weighted percentages.

Table 2. Prevalence Rate Ratio (PRR) Estimates for Sociodemographic Characteristics Associated with Chronic Disease Screening Done as Recommended

Sociodemographic Characteristics	Last Blood Pressure Checked as Recommended*			Last Fasting Blood Glucose Checked as Recommended*			Last Fasting Blood Lipids Checked as Recommended*		
	PRR	95% CI	P for Trend	PRR	95% CI	P for Trend	PRR	95% CI	P for Trend
Age (years)									
18 – 39	Ref		-						
40 – 49	1.06	(0.98 – 1.14)		Ref			Ref		
50 – 59	1.16	(1.08 – 1.26)		1.14	(1.01 – 1.29)		1.05	(0.89 – 1.24)	
60 and above	1.25	(1.11 – 1.41)		1.38	(1.20 – 1.58)		1.24	(1.00 – 1.54)	
Gender									
Male	Ref			Ref			Ref		
Female	1.02	(0.97 – 1.08)		1.01	(0.91 – 1.12)		1.02	(0.88 – 1.17)	
Ethnicity									
Chinese	Ref			Ref			Ref		
Malay	1.06	(0.99 – 1.13)		0.91	(0.81 – 1.02)		0.93	(0.81 – 1.08)	
Indian	1.08	(1.02 – 1.13)		1.18	(1.08 – 1.29)		1.16	(1.02 – 1.31)	
Others	0.99	(0.90 – 1.08)		1.02	(0.85 – 1.23)		0.91	(0.71 – 1.17)	
Education			0.001			0.011			0.011
PSLE and below	Ref			Ref			Ref		
Secondary	1.01	(0.88 – 1.16)		1.02	(0.86 – 1.22)		1.03	(0.81 – 1.32)	
O/N ^a level/NTC 3 certificate or equivalent	1.08	(0.96 – 1.22)		1.09	(0.91 – 1.29)		1.15	(0.91 – 1.46)	
A ^a level/NTC 1-2/ Certificate in Office/ Business Skills or its equivalent	1.12	(0.98 – 1.29)		1.17	(0.93 – 1.49)		1.19	(0.86 – 1.64)	
Polytechnic/other diplomas and professional qualification	1.17	(1.03 – 1.34)		1.24	(1.00 – 1.53)		1.24	(0.92 – 1.68)	
University and above	1.20	(1.06 – 1.37)		1.23	(1.02 – 1.49)		1.42	(1.08 – 1.86)	
Household income			0.001			0.070			0.350
Below \$2000 per month	Ref			Ref			Ref		
\$2000 – \$3999 per month	1.10	(0.99 – 1.21)		1.01	(0.87 – 1.17)		1.02	(0.83 – 1.25)	
\$4000 – \$5999 per month	1.09	(0.98 – 1.22)		1.05	(0.88 – 1.26)		1.08	(0.85 – 1.37)	
\$6000 – \$9999 per month	1.10	(0.98 – 1.24)		1.14	(0.95 – 1.36)		0.99	(0.75 – 1.31)	
\$10,000 and above	1.25	(1.12 – 1.39)		1.17	(0.96 – 1.44)		1.19	(0.91 – 1.56)	

PRR: Prevalence rate ratio
Analyses were adjusted for age, gender, ethnicity, education and monthly household income.
*Based on recommended screening guidelines for chronic diseases as defined by STRC recommendation for health screening: diabetes mellitus – fasting glucose for individuals aged ≥40 years every 3 years; hypercholesterolaemia – fasting lipids for individuals aged ≥40 years every 3 years; hypertension – blood pressure for individuals aged ≥18 years at least once every 2 years.

to 1.13; for diabetes, PRR: 1.18, 95% CI, 1.08 to 1.29; for hypercholesterolaemia, PRR: 1.16, 95% CI, 1.02 to 1.31). Significant dose-response relationships were observed between higher educational levels and screening done within recommended time period for hypertension, diabetes and hypercholesterolaemia, with individuals with university education and above having a 20%, 23% and 42% increased uptake in screening respectively, compared to those with PSLE and lower education level. However, a dose-response relationship was not as apparent in household income levels.

Sociodemographic Characteristics Associated with Cancer Screenings

For female cancer screening, younger women and those with higher monthly household income were positively associated with mammography and cervical cancer screening done within recommended guidelines (Table 3). Compared to those between 25 to 39 years old and 50 to 59 years old, those aged 60 and above were less likely to have had Pap smear and mammography done within the recommended time period (for cervical cancer, PRR: 0.44, 95% CI, 0.29 to 0.68; for mammography, PRR: 0.64, 95% CI, 0.43 to 0.95). Household income was positively associated with FOBT/colonoscopy and sigmoidoscopy (P for trend: 0.001) done within the recommended time period. Respondents of Malay ethnicity were less likely to have had cancer screening done within the recommended time period, compared to Chinese (for Pap smear, PRR: 0.87, 95% CI, 0.77 to 0.99; for mammography, PRR: 0.88, 95% CI, 0.63 to 1.22; for FOBT/colonoscopy/sigmoidoscopy, PRR 0.33, 95% CI, 0.21 to 0.52).

The most commonly cited reason for not participating in screening for chronic diseases and female cancers for respondents who were of the recommended screening age group was “Not necessary as I am healthy” (25.8% to 49.9%), while another commonly cited reason for non-participation in chronic diseases was “Not suggested by doctors” (22.1% for hypercholesterolaemia to 40.7% for hypertension). For female cancers, the other commonly cited reasons for Pap smear were “Never heard about Pap smear test” (13.3%) and “Painful test” (10.5%) and “No time due to work commitment” (9.4%) for mammography. Only less than 5% have reported that cost was a factor which influenced their decisions to not go for chronic diseases and cancer screenings (data not shown in tables).

Health Screening Practices among Respondents with At Least 1 Previously Diagnosed Chronic Disease

Respondents with at least 1 known chronic condition (hypertension, diabetes mellitus or hypercholesterolaemia) prior to the survey were more likely to have been screened

for other chronic diseases within the recommended time period compared to healthy respondents without any of the 3 chronic conditions (Table 4). More than 80% of diabetic and hypercholesterolaemia respondents had been screened for the other chronic diseases within the recommended time period. Amongst respondents without known chronic diseases, a higher proportion of them had been screened for hypertension (75.5%) within the recommended time period compared to diabetes (36.7%) and hypercholesterolaemia (34.8%).

Health Screening Practices among Respondents who Had Previously Undiagnosed Chronic Disease Conditions Prior to Survey

A total of 1171 respondents were found to have hypertension (241), diabetes (281) or hypercholesterolaemia (649) and were previously undiagnosed prior to the survey (data not shown in table). Among these respondents with undiagnosed chronic conditions, a large proportion of undiagnosed diabetics (69.9%) and undiagnosed hypertensives (79.5%) had been screened within the recommended time period for the respective conditions. A total of 40.5% and 74.6% of undiagnosed diabetics and hypertensives respectively, had been screened less than a year ago, while almost half of undiagnosed hypercholesterolemia participants (47.1%) had been screened for high cholesterol within the recommended time period.

Discussion

More than 66% of eligible respondents have been screened for chronic diseases and cancers, except for colorectal cancer, at least once in their lives. We found that a significant proportion (>50%) of respondents had their last screen for chronic diseases within recommended intervals, compared to breast, cervical and colorectal cancers (the highest was 45.8% for cervical cancer). Colorectal cancer screening uptake in particular was very poor. This study also highlights several demographic factors associated with low screening uptake for selected chronic diseases and cancers within recommended time periods: respondents who were Malay, or from households with lower income, or had lower educational levels were more likely not to go for screening within the recommended time period, and were also more likely to have never undergone any screening in their lives. Indians, who are at higher risk of chronic diseases such as diabetes and hypercholesterolaemia, are more likely to have been screened.

Our findings are consistent with local health utilisation studies by Wee et al⁹ and Ng et al,¹⁰ which highlighted poor screening utilisation within the lower income settings, and sociodemographics as an indicator for diabetic screening

Table 3. Prevalence Rate Ratio (PRR) Estimates for Sociodemographic Factors Associated with Cancer Screening Done as Recommended

Sociodemographic Characteristics	Last Pap Smear Done as Recommended*			Last Mammography Done as Recommended*			Last FOBT/Colonoscopy/Sigmoidoscopy Done as Recommended*		
	PRR	95% CI	P for Trend	PRR	95% CI	P for Trend	PRR	95% CI	P for Trend
Age (years)									
25 – 39	Ref			-			-		
40 – 49	0.83	(0.72 – 0.96)		-			-		
50 – 59	0.70	(0.57 – 0.86)		Ref			Ref		
60 and above	0.44	(0.29 – 0.68)		0.64	(0.43 – 0.95)		1.38	(0.93 – 2.04)	
Gender									
Male	-			-			Ref		
Female	-			-			0.89	(0.63 – 1.27)	
Ethnicity									
Chinese	Ref			Ref			Ref		
Malay	0.87	(0.77 – 0.99)		0.88	(0.63 – 1.22)		0.33	(0.21 – 0.52)	
Indian	1.03	(0.94 – 1.14)		1.05	(0.80 – 1.38)		0.80	(0.57 – 1.13)	
Others	1.03	(0.89 – 1.19)		1.36	(0.78 – 2.36)		0.72	(0.35 – 1.46)	
Education			0.521			0.167			0.422
PSLE and below	Ref			Ref			Ref		
Secondary	0.93	(0.70 – 1.24)		0.98	(0.59 – 1.64)		1.67	(0.98 – 2.85)	
O/N ^a level/NTC 3 certificate or equivalent	1.10	(0.86 – 1.40)		1.38	(0.89 – 2.13)		1.44	(0.86 – 2.43)	
A ^a level or NTC 1-2 or Certificate in Office/Business Skills or its equivalent	0.98	(0.72 – 1.33)		0.84	(0.37 – 1.90)		1.90	(0.92 – 3.90)	
Polytechnic/other diplomas & professional qualification	0.97	(0.72 – 1.30)		1.37	(0.84 – 2.24)		1.66	(0.76 – 3.62)	
University & above	0.93	(0.70 – 1.25)		1.30	(0.78 – 2.18)		1.49	(0.72 – 3.11)	
Household income			0.073			0.235			0.001
Below \$2000 per month	Ref			Ref			Ref		
\$2000 – \$3999 per month	1.02	(0.84 – 1.23)		0.99	(0.64 – 1.53)		2.35	(1.42 – 3.88)	
\$4000 – \$5999 per month	1.08	(0.87 – 1.33)		1.46	(0.97 – 2.19)		2.21	(1.19 – 4.08)	
\$6000 – \$9999 per month	1.07	(0.85 – 1.35)		1.21	(0.71 – 2.04)		4.00	(2.28 – 6.99)	
\$10,000 and above	1.24	(0.99 – 1.55)		1.30	(0.81 – 2.07)		2.48	(1.19 – 5.18)	

FOBT: Faecal occult blood test; PRR: Prevalence rate ratio

Analyses were adjusted for age, gender (for colorectal cancer), ethnicity, education and monthly household income.

^aBased on recommended screening guidelines for selected cancers as defined by STRC recommendation: cervical cancer – Pap smear for sexually active females aged 25 to 69 years at least once every 3 years; breast cancer – mammography for females aged 50 to 69 years every 2 years; colorectal cancer – faecal occult blood test (FOBT) done annually or sigmoidoscopy/colonoscopy once every 10 years for individuals aged ≥50 years.

Table 4. Screening Behaviour of Respondents without or At Least 1 Diagnosed Chronic Condition

	Previously Diagnosed Hypertensive n = 761	Previously Diagnosed Diabetic n = 427	Previously Diagnosed Hypercholesterolaemia n = 1006	No Previous Diagnosis of the 3 Conditions n = 2977
	%	%	%	%
Have last blood pressure checked as recommended*		98.2	89.1	75.5
Have last fasting blood glucose checked as recommended*	72.9		76.2	36.7
Have last fasting blood lipids checked as recommended*	59.6	83.9		34.8

*Based on recommended screening guidelines for chronic diseases as defined by STRC recommendation for health screening; diabetes mellitus – fasting glucose for individuals aged ≥ 40 years every 3 years; hypercholesterolaemia – fasting lipids for individuals aged ≥ 40 years every 3 years; hypertension – blood pressure for individuals aged ≥ 18 years at least once every 2 years.

uptake, as well as with international studies, which have also reported low uptake of screening amongst ethnic minorities and lower socioeconomic groups.^{11–13} Low screening uptake has been attributed to common barriers such as out-of-pocket payments, and cultural and personal beliefs (e.g. underestimation of individual risks to cancers).

While it is worthwhile to consider making screening free to encourage greater uptake within the lower income community,^{14–16} poor regular screening attendance amongst lower income strata may not necessarily be due to screening cost. Other factors influencing the decision not to screen may include fear of having to deal with greater healthcare costs should abnormal results arise, especially for cancer screenings, and having a fatalistic attitude towards personal health. We found that the main reasons cited by respondents who had never undergone screening were “No advice by doctors” and “Not necessary as I am healthy” rather than cost of screening, providing indirect support that poor screening attendance may not be due to the cost of screening alone. More targeted health education campaigns and awareness of financial assistance available in the event that treatment is necessary may alleviate the undue fear. It should be remembered that health screenings may also not be the primary priority of members of lower income strata, and time, convenience and anxiety may present physical barriers for screenings.^{17,18} Further studies using qualitative interviews should be considered to provide insights into specific reasons behind non-participation amongst at-risk groups.

Efforts have been made to reduce financial barriers to screening and make screening affordable and accessible in Singapore. A nationwide screening programme, the Integrated Screening Programme (ISP), was introduced in 2008 to encourage Singapore residents aged 40 to 69 years to undergo screening for chronic diseases, colorectal and cervical cancers at ISP-registered general practitioner (GP)

clinics. Under the ISP framework, eligible lower income individuals will only need to pay for the consultation fees. To further improve screening outreach to lower income groups, subsidies are extended to the Community Health Assist Scheme (CHAS) to cover screening-related costs, with valid CHAS cardholders receiving subsidies of up to \$18.50 twice a year to offset consultation fees related to screening.¹⁹ For cancer screening, individuals within the recommended age group for mammograms and colonoscopies can use their own or immediate family member’s Medisave to offset screening cost and minimise cash payment. Subsidies for mammography are also available through the BreastScreen Singapore programme. To enhance accessibility, HPB also collaborates with companies and community groups to bring screening to residents in the community or at their workplace. For instance, initiatives such as Health Screening on Wheels was launched to make screening more convenient for employees at workplaces, by the deployment of mobile screening buses.²⁰ In 2011, HPB also launched a one-stop screening programme together with a GP network programme at Whampoa Community, which aimed not only to make screening convenient, but to ensure patients with abnormal results receive follow-up treatment and care after screening.²¹ More recently, HPB and Breast Cancer Foundation (BCF) have launched a BCF Encouragement for Active Mammograms (BEAM 15) programme in 2013, which provides free mammograms to eligible women above 50 years old from lower income groups.

HPB has also adopted multipronged communication and social marketing strategies for screening campaigns to increase awareness. Integrated marketing campaigns were used for national screening programmes such as BreastScreen Singapore. Approaches include media publicity through print media and infomercials, mailers to women, recruitment and educational activities at

community events and road shows, and engagement of health ambassadors to educate the public on the importance of screening.²²

In this study, routine check-up was the main reason cited for screenings done within the recommended time period, which suggested the importance of workplace health initiatives and GPs. GPs play a role in influencing people's decision to screen and they can help encourage long-term follow-up patients to go for opportunistic screening. In addition, the presence of a structured and periodic screening schedule in workplace health initiatives and community could also play an important role in bringing more Singaporeans to participate in regular screenings.

To improve screening amongst at-risk groups (people in low socioeconomic strata and the Malay community) within Singapore, health promotion to increase screening uptake may need to be further customised by taking into consideration cultural perspectives and linguistic and socioeconomic diversities.²³ These efforts will need to move beyond health education, and consider economic incentives and the social and built environment, which the HPB has been doing in recent years; the ISP is an example of this broader perspective used in effecting behavioural change. Partnering trusted social institutions such as places of worship and support groups such as Majlis Ugama Islam Singapura (MUIS) may be useful to sustain community outreach and engagement in the Malay community. Similarly, social welfare organisations such as People's Association and the Community Development Councils may be useful when engaging people from lower socioeconomic strata.

It was also observed that individuals with at least 1 known chronic disease were more likely to have screened for other chronic diseases within the recommended time period, compared to healthy individuals. Possible reasons may be due to better health literacy and more concern about personal health amongst patients with pre-existing health conditions. It is more likely however, that this positive result reflects the efforts of primary care doctors (who see the majority of patients with these conditions), ordering appropriate screening tests for other at-risk health conditions for their patients.

For better clinical outcomes, screening has to be coupled with postscreening follow-up and optimal management. The survey found that 69.9% of undiagnosed diabetics were screened within the recommended time period and 41% of these respondents had reported to have done their last diabetic screening less than a year ago. This suggests that diabetes screening might have failed to identify persons with diabetes. There are several possible reasons for this. Large intra-individual variation has been reported for glucose tests. Further, some healthcare providers may have used random glucose testing and capillary testing rather than

the recommended fasting venous glucose tests; random glucose and capillary tests are less accurate^{24, 25} and not recommended in the current Clinical Practice Guidelines for diabetes screening.²⁶ Finally, it is also possible that there may have been a lack of follow-up of patients who had undergone screening and were tested positive. This is especially so for participants of community screening and workplace screening. GP education on appropriate screening tests for diabetes should continue to be provided. To further tighten postscreening follow-up, screening providers in community and workplace health screening events should follow-up closely with individuals who have abnormal results. This can be done by providing reminder phone calls to them 1 month after screening to nudge them to go for follow-ups with GPs, facilitate appointment booking and direct them to appropriate lifestyle interventions. In tandem, a structured referral pathway can be established for individuals with abnormal results to be referred to their GPs for further assessment and management. Screening providers should undertake screening with a call and recall system, by working with HPB and GPs to manage and monitor screening efforts islandwide, under a centralised national screening repository. Not only will this ensure that individuals with abnormal results are better tracked and monitored, eligible individuals due for screening can also be timely reminded by recruitment materials (i.e. invitation letters and education materials) to go for screening.

In this study, individuals without previous diagnosis of chronic disease were twice as likely to be screened for hypertension than diabetes and hypercholesterolaemia. This may be due to the accessibility and convenience of measuring blood pressure whenever individuals go for a GP visit, compared to the testing of diabetes and hypercholesterolaemia, which involves fasting period and blood samples taken for subsequent analyses. This also reflects the need for increased awareness and understanding of hypercholesterolaemia and diabetes in the public and GPs, which is important to improve early detection.²⁷ GPs should also initiate screening for individuals eligible for screening requirements and where possible, first-degree relatives of patients with these conditions.

The strengths of this study include the use of a large representative sample population, with a reasonable response rate. Health examination and blood tests also allowed us to establish the "true" chronic disease status of participants. There are a few limitations in this study. The study did not establish if the tests undergone by participants were for screening, or if participants were symptomatic, and the tests were performed as part of the diagnostic workup. Further, the study did not establish if respondents were going for regular screening; instead, the time from their last screen done to the NHS interview was calculated as a proxy for screening

within the recommended time period. It is possible that participants who had been screened within the recommended time period were nonetheless not being screened regularly and appropriately. Hence, our estimates of screening prevalence might be an overestimate, and the true prevalence is lower. However, the proportion of respondents who reported that the test was being done as part of a diagnostic workup was low (cervical and breast cancer screenings: 5.1 to 5.7%), except for the case of colorectal cancer (37.5%) and hypertension (15%) screenings.

Conclusion

While participation rate in regular screening for chronic diseases is high in the Singapore general population, screening for cancer (especially colorectal cancer) is still relatively low. Further, we identified several groups (low socioeconomic status in terms of household income and educational level, and people of Malay ethnicity) where screening within the recommended time period was comparatively low. Health promotion programmes and outreach to these groups should be enhanced. Current efforts to promote appropriate health screening behaviour should be maintained and enhanced. In this regard, GPs play a crucial role, and programmes to support GPs in this important endeavour should be enhanced.

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Clinical Decision Rules for Paediatric Minor Head Injury: Are CT Scans a Necessary Evil?

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Abstract

Introduction: High performing clinical decision rules (CDRs) have been derived to predict which head-injured child requires a computed tomography (CT) of the brain. We set out to evaluate the performance of these rules in the Singapore population. **Materials and Methods:** This is a prospective observational cohort study of children aged less than 16 who presented to the emergency department (ED) from April 2014 to June 2014 with a history of head injury. Predictor variables used in the Canadian Assessment of Tomography for Childhood Head Injury (CATCH), Children's Head Injury Algorithm for the Prediction of Important Clinical Events (CHALICE) and Pediatric Emergency Care Applied Research Network (PECARN) CDRs were collected. Decisions on CT imaging and disposition were made at the physician's discretion. The performance of the CDRs were assessed and compared to current practices. **Results:** A total of 1179 children were included in this study. Twelve (1%) CT scans were ordered; 6 (0.5%) of them had positive findings. The application of the CDRs would have resulted in a significant increase in the number of children being subjected to CT (as follows): CATCH 237 (20.1%), CHALICE 282 (23.9%), PECARN high- and intermediate-risk 456 (38.7%), PECARN high-risk only 45 (3.8%). The CDRs demonstrated sensitivities of: CATCH 100% (54.1 to 100), CHALICE 83.3% (35.9 to 99.6), PECARN 100% (54.1 to 100), and specificities of: CATCH 80.3% (77.9 to 82.5), CHALICE 76.4% (73.8 to 78.8), PECARN high- and intermediate-risk 61.6% (58.8 to 64.4) and PECARN high-risk only 96.7% (95.5 to 97.6). **Conclusion:** The CDRs demonstrated high accuracy in detecting children with positive CT findings but direct application in areas with low rates of significant traumatic brain injury (TBI) is likely to increase unnecessary CT scans ordered. Clinical observation in most cases may be a better alternative.

Ann Acad Med Singapore 2015;44:335-41

Key words: Brain injuries, Children, Prediction rules, Traumatic brain injury

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Introduction

Head injury is a common complaint in the paediatric emergency department (ED), accounting for approximately 500,000 paediatric ED visits a year in the United States.¹ While most head-injured children do not require treatment and may be discharged after a period of observation, an estimated 4% to 7% have intracranial injuries and only 0.5% require neurosurgical intervention.^{2,3} Intracranial injuries can result in long-term morbidity and mortality.^{4,5}

Clinical assessment in young children frequently poses a challenge to the emergency physician, due to their variable and non-specific complaints postinjury,⁶ especially in the

preverbal age group.⁷ The fastest definitive diagnostic tool for intracranial lesions is the computed tomography (CT) scan. It allows for intracranial injuries to be promptly diagnosed, and guides further intervention. However, the radiation from CT has been shown to increase the risk of future radiation-induced malignancies.⁸⁻¹¹ This leads to the current difficulty the ED physician faces when deciding whether or not, and when to order a CT scan of the brain.

To standardise and guide the usage of CT, independent clinical decision rules (CDRs) have been developed to guide physicians on which child should receive a CT in the presence of traumatic head injury. Of the numerous CDRs

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developed, the Canadian Assessment of Tomography for Childhood Head Injury (CATCH),¹² Children's Head Injury Algorithm for the Prediction of Important Clinical Events (CHALICE)¹³ and Pediatric Emergency Care Applied Research Network (PECARN)¹⁴ CDRs are considered to be of high quality as they were powered by large research networks.

These rules have been reported to have good performance in other populations.^{15–17} Notably, a paper has also compared the 3 CDRs and their performances with that of physician practice.¹⁷ Given the low rate of positive CTs however, others have advocated a period of monitoring to allow for imaging to be performed with greater discretion.¹⁸

We were interested to find out if these rules (CATCH, CHALICE and PECARN) could be applied to the Singapore population, given our current healthcare practices and CT rates. We hypothesise that its direct application would lead to a significant increase in CT scans ordered.

Materials and Methods

Study Design

This study is part of an ongoing prospective observational cohort study among head-injured children in our population. We prospectively collected data from patients who presented to the paediatric ED at KK Women's and Children's Hospital (KKH) with a history of head injury from April 2014 to July 2014. KKH sees approximately 175,000 visits at the ED each year. Patients were included if they: 1) aged less than 16; 2) had a presenting complaint of head injury; and 3) presented to the ED within 72 hours after injury. The exclusion criteria included: 1) children aged 16 and above; 2) presentation to ED more than 72 hours after injury; 3) bleeding disorders or usage of anticoagulants; 4) brain tumours; 5) ventricular shunts; and 6) previous neuroimaging. There was no intervention in this study. Decisions on neuroimaging and subsequent disposition of the patients were made at the discretion of the physician. This study was approved by the local Institutional Review Board.

Data Collection

A standardised electronic template was filled for every head-injured child. Data were collected including patient demographics, predictor variables, and outcome measures. Predictor variables as published in the above CDRs included (from history): headache, vomiting, loss of consciousness, amnesia, seizure, mechanism of injury; and (from physical examination) Glasgow Coma Scale (GCS) score, abnormal mental status, neurological deficit, skull fracture and scalp haematoma. Physicians working in the ED underwent a

training session in regard to completion of the form and they recorded the presence or absence of the predictor variables after assessing the patient.

Outcome Measures

The primary outcome was defined as the presence of positive findings on CT. These included epidural haemorrhage, subdural haemorrhage, subarachnoid haemorrhage, intraparenchymal haematoma, cerebral oedema, depressed fracture, and contusion. A follow-up call was given to patients discharged from the ED after 72 hours, to assess for any evolution of symptoms or attendance at another hospital. We also surveyed the current rate of CT usage and the projected CT rate if each of the CDRs were applied.

Data Analysis

The CDRs were retrospectively applied to the study cohort and were considered to be positive for recommending a CT scan when at least 1 of the predictor variables was present. Performance of the CDRs was assessed using descriptive statistics to generate sensitivity, specificity, positive predictive and negative predictive values. Ninety-five percent confidence intervals (CI) were provided for each measure of accuracy described using STATA v12 (Stata Corp, College Station, Tx, USA).

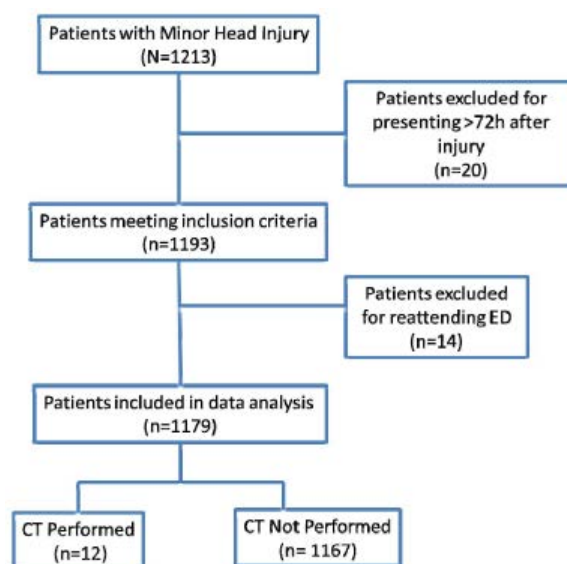


Fig. 1. Study flow diagram.
CT: Computed tomography; ED: Emergency department

Results

Patient Characteristics

A total of 1213 patients presented to the ED with minor head injury. Twenty were excluded because they presented more than 72 hours after the injury, and 14 patients who reattended at the ED were also excluded (Fig. 1). In the latter group, only signs and symptoms from their first attendance were included in the study. There were no events among these 14 patients who reattended. In total, 1179 patients were included in the study and analysed. The largest majority presented within 24 hours of injury, whereas 154 (13.1%) presented 24 to 72 hours after injury, and 21 (1.8%) had an unknown time/date of injury. Of the patients analysed, 12 underwent CT, with 6 patients having positive findings on CT. In the 12 patients who had CTs performed, 7 had signs of altered mental status, 5 had signs of basal skull fracture and 4 had loss of consciousness for more than 5 seconds. Finally, 1 had monocular diplopia. The positive CT findings in the 6 patients are described as follows: 1 left temporal bone fracture extending to the mastoid process, 1 mildly depressed occipital skull vault fracture, 1 cerebral contusion, 1 pneumocephalus with haemoantrum, 2 intracranial haemorrhages, and 1 with midline shift. Of the 12 patients, only 1 patient underwent neurosurgical intervention in the form of a craniotomy and monitoring for intracranial pressure.

Patient characteristics were assessed and compared with the original derivation cohorts in the CDRs (Tables 1 and 2). The distribution of gender and GCS value are generally comparable to that of the derivation cohorts. However, the mean age (4.4) of our study cohort was lower. Of interest, we had a large number of children ($n = 387$) aged less than 2 years among those who presented to our ED with head injury, comprising 32.8% of the included patients.

Significant differences also exist in the mechanism of injury (MOI) across all age groups where falls contributed to a large majority (81.3%) in the study cohort as compared to 44.9% in CATCH and 51.0% in PECARN. CHALICE had a fall rate of 0.6%, but this could be attributed to their stronger criterion for fall, requiring a fall more than 3 metres in height. For children aged below 2, the MOI are as follows: 362 falls (93.5%), 1 road traffic accident (RTA) (0.3%), 1 non-accidental injury (NAI) (0.3%), and 23 others (5.9%). Of note, we had a low event rate in our population, with a positive CT rate of only 0.5%.

Performance of Clinical Decision Rules

The performance of the CDRs in detecting positive CT findings was compared and evaluated using descriptive statistics (Table 3). CATCH and PECARN demonstrated excellent sensitivity (100%) (54.1 to 100), accurately

Table 1. Comparison of Patient Characteristics in Our Study Cohort versus Derivation Cohorts in Clinical Decision Rules

Characteristics	Study Cohort (n = 1179)	CATCH (n = 3866)	CHALICE (n = 22,772)	PECARN (n = 42,412)
Mean age	4.4	10*	5.7	7.1
Number of patients <2 years	387 (32.8)	277 (7.2)	6229 (27.4)	10,718 (25.3)
Gender				
Male	880 (74.6)	2505 (64.8)	14,767 (64.8)	NR
Female	299 (25.4)	1361 (35.2)	7941 (34.9)	
GCS				
13	1 (0.1)	95 (2.5)	73 (0.3)	0
14	17 (1.4)	282 (7.3)	229 (1.0)	1341 (3.2)
15	1158 (98.2)	3489 (90.2)	21,996 (96.7)	41,071 (96.8)
Mechanism of injury				
Fall	959 (81.3)	1737 (44.9)	129 (0.6)*	21,629 (51.0)
Road traffic accident	21 (1.8)	687 (17.8)	204 (0.9)	8064 (19.0)
Struck by object/projectile	14 (1.2)	447 (11.6)	456 (2.0)	3124 (7.4)
CT performed	12 (1.0)	2043 (52.8)	766 (3.4)	14,969 (35.3)
CT positive [§]	6 (0.5)	159 (4.1)	281 (1.2)	780 (1.8)
Neurosurgical intervention [†]	1 (0.1)	24 (0.6)	157 (0.7)	60 (0.1)

CATCH: Canadian Assessment of Tomography for Childhood Head Injury; CHALICE: Children's Head Injury Algorithm for the Prediction of Important Clinical Events; PECARN: Pediatric Emergency Care Applied Research Network; CT: Computed tomography; GCS: Glasgow Coma Scale; NR: Not reported

*Median age.

†Fall >3 m.

‡Includes neurosurgery and intubation for monitoring of intracranial pressure.

§Any abnormality on CT scan.

Table 2. Signs and Symptoms of Patients in Study Cohort versus Derivation Cohorts in CDRs

Characteristics	Study Cohort (n = 1179)	CATCH (n = 3866)	CHALICE (n = 22,772)	PECARN (n = 42,412)
Loss of consciousness	27 (2.3)	1267 (32.8)	1185 (5.2)	6286 (14.8)
Vomiting	208 (17.6)	1582 [†] (40.9)	2498 (11.0)	5557 (13.1)
Stiffening/jerking of limbs	7 (0.6)	152 [‡] (3.9)	96 [‡] (0.4)	NR
Altered mental status*	12 (1.0)	419 [§] (10.8)	NR	5487 (12.9)
Headache	160 (13.6)	623 (16.1)	4783 (21.0)	12,675 (29.9)
Scalp haematoma	297 (25.2)	1256 (32.5)	52 [¶] (0.2)	16,715 (39.4)

CATCH: Canadian Assessment of Tomography for Childhood Head Injury; CHALICE: Children's Head Injury Algorithm for the Prediction of Important Clinical Events; PECARN: Pediatric Emergency Care Applied Research Network; CDR: Clinical decision rules; NR: Not reported

*Altered mental status includes irritability, agitation, somnolence, repetitive questioning and slow response to verbal communication.

[†]≥2 episodes of vomiting.

[‡]Seizure after head injury in patients without history of epilepsy.

[§]Irritability.

^{||}Worsening headache.

[¶]Bruise/swelling or laceration >5 cm in children aged <1 year.

detecting all the 6 patients with positive CT findings. CHALICE had slightly lower sensitivity (83.3%) (35.9 to 99.6), failing to detect 1 of the patients with positive CT findings. This patient presented with a history of persistent irritability and agitation. CATCH and CHALICE demonstrated similar specificity (80.3% [77.9 to 82.5] and 76.4% [73.8 to 78.8] respectively), modestly being able to identify patients with negative CT findings. PECARN showed a relatively lower specificity (61.6%) (58.8 to 64.4) for its high- and intermediate-risk criteria. By using only the high-risk criteria, PECARN had a very high specificity

of 96.7% (95.5 to 97.6). All three CDRs demonstrated low PPV (<3%), indicating an extremely low likelihood of a positive initial diagnosis based on CT findings. Of note, using only the high-risk criteria for PECARN yielded a PPV of 13.3% (5.1 to 26.8). All 3 CDRs demonstrated high NPV (>99.9%).

Projected CT Rate

Of the 1179 patients in the study cohort, 12 underwent CT scan. Six out of the 12 had positive CT findings. This

Table 3. Performance of Clinical Decision Rules for Prediction of Injury in Study Cohort

CDR	CT Findings		Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
	Positive	Negative*				
CATCH						
Positive	6	231	100	80.3	2.5	100
Negative	0	942	(54.1 – 100) [†]	(77.9 – 82.5) [†]	(0.9 – 5.4) [†]	(99.6 – 100) [†]
CHALICE						
Positive	5	277	83.3	76.4	1.8	99.9
Negative	1	896	(35.9 – 99.6) [†]	(73.8 – 78.8) [†]	(0.6 – 4.1) [†]	(99.4 – 100) [†]
PECARN high- and intermediate-risk						
Positive	6	450	100	61.6	1.3	100
Negative	0	723	(54.1 – 100) [†]	(58.8 – 64.4) [†]	(0.5 – 2.8) [†]	(99.5 – 100) [†]
PECARN high-risk only						
Positive	6	39	100	96.7	13.3	100
Negative	0	1134	(54.1 – 100) [†]	(95.5 – 97.6) [†]	(5.1 – 26.8) [†]	(99.7 – 100) [†]

CATCH: Canadian Assessment of Tomography for Childhood Head Injury; CHALICE: Children's Head Injury Algorithm for the Prediction of Important Clinical Events; PECARN: Pediatric Emergency Care Applied Research Network; CDR: Clinical decision rules; CT: Computed tomography; NPV: Negative predictive value; PPV: Positive predictive value

*Assumption of negativity based on resolution of symptoms and absence of clinical deterioration.

[†]95% CIs are in the brackets.

gives rise to a CT ordering rate of 1% and CT positivity rate of 0.5% in the study cohort.

If the CDRs were to be applied, there would be a significant increase in the number of CT being ordered (Table 4). Using CATCH, 237 (20.1%) patients met the criteria for a CT. However, if only the high-risk variables were used, the number would be reduced to 67 (5.7%). CHALICE demonstrated similar CT recommendation rates with 282 (23.9%) patients meeting the criteria. PECARN stratified the patients into high-, intermediate- and low-risk. For the intermediate-risk category, PECARN recommended either CT or observation. If only the high-risk group was sent for CT, 45 patients would be subjected to CT (3.8%) and 411 patients (34.9%) would require observation. However, if both the high-risk and intermediate-risk patients were sent for CT, this would give rise to a CT rate of 38.7% (or 456 patients).

Discussion

There is a very low prevalence of significant traumatic brain injury (TBI) in our population. Most of the head-injured children brought to the ED had sustained minor injuries from falls. This was especially true for children aged less than 2 years, with falls making up 96% of the MOI. There was a much lower injury rate from RTA at 1.8%. We also note that our baseline CT rate is much lower than those of other centers (as high as 52.8% in the case of CATCH),¹² and postulate that this could be due to 2 reasons: 1) very low prevalence of moderate – severe head injuries, 2) the viable alternative of observation with the intent of performing the

CT at a later time if new symptoms or signs evolve. In this study, 195 (16.5%) patients were admitted for observation. This strategy of “watchful waiting” could have played a part in reducing the CT rate.

A period of observation may allow the physician to make a more informed decision on neuroimaging in a majority of the head-injured children. Studies have shown that a delayed presentation of severe head injury is very uncommon in children who present with only mild symptoms from minor head injury.^{19,20} There is also growing evidence demonstrating that observation before CT is safe in a large majority of patients, especially among those who present with mild symptoms.^{21,22} The optimal duration of observation after head injury is however yet to be well-defined and more study in this area could be potentially clarifying.

The CDRs generally performed with high sensitivity and negative predictive value, with PECARN and CATCH detecting all cases. These parameters of performance are especially important because of the implications of misdiagnosis. On the other hand, the results of this study confirmed our hypothesis that direct application of these rules would raise our CT rates significantly. Although the application of the CDRs would have correctly identified the small number of cases with abnormal CT findings, the majority of CT scans would have been unnecessary with resultant radiation exposure and increased healthcare costs. This concern is particularly valid for populations with a very low prevalence of significant TBI. In particular, PECARN performed fairly well in our population, if CT was performed only for the high-risk group and those with intermediate-risk were mostly observed.

A more recent publication in the Annals of Emergency Medicine in 2014¹⁷ compared the performance of the 3 CDRs as well as that of physician estimates. Easter et al’s study had a cohort of a similar size, yet a much higher event rate even when simply comparing positive findings on CT. This could possibly be due to variation in injury mechanisms, with Easter’s paper reporting much higher frequencies of severe mechanism of injury. As mentioned earlier, our physician CT rates are much more conservative compared to that of the CDRs, whereas in Easter’s paper, physician practice had a CT rate very similar to those of the CDRs, and this could be possibly attributed to the much lower frequency of positive events that physicians in our local population are used to. Another possible reason for the difference in results between Easter’s and our study is that Easter’s study limited the enrolment of children who had apparently trivial injury. In our experience with the local head-injured population, ground level falls have also resulted in intracranial bleeds, hence we were not able to exclude ground level falls. We did, however, exclude children with facial injuries from minor mechanisms.

Table 4. Projected CT Rate if Clinical Decision Rules Applied in Study Cohort

Clinical Decision Rule	CT Rate n (%)
CATCH	
High-risk only	67 (5.7)
High- and medium-risk	237 (20.1)
CHALICE	282 (23.9)
PECARN	
High-risk only	
<2 years	20 (1.7)
≥2 years	25 (2.1)
High- and intermediate-risk	
<2 years	166 (14.1)
≥2 years	290 (24.6)

CATCH: Canadian Assessment of Tomography for Childhood Head Injury; CHALICE: Children's Head Injury Algorithm for the Prediction of Important Clinical Events; PECARN: Pediatric Emergency Care Applied Research Network; CDR: Clinical decision rules; CT: Computed tomography

We also chose to include children whose head injuries occurred up to 72 hours prior to presentation. Both PECARN and CATCH restricted their population to those who presented within 24 hours of presentation, whereas CHALICE did not. We were concerned that placing a strict 24 hour criteria may result in missed cases. In our study, 1 patient who presented with an injury of unknown duration was still sent for CT based on the physician's call. This patient presented with persistent confusion and agitation, and his CT was found to be positive with a subdural bleed. This case suggests that the time interval between injury and presentation is less important than the patient's presenting status.

In some populations, CT scans are unnecessarily done for other reasons. A recent study on a Switzerland population has found that defensive medicine is a major contributor to physicians ordering CT scans, even if not recommended to do so by CDRs.²³ Reasons cited included: "fear of missing an intracranial lesion", "fear of being sued", and "pressure from the patient or relatives". In such a situation, observation may potentially be a safe and cost-saving strategy, reducing unnecessary CT scans in majority of the children with MHI without compromising patient care. Further studies are recommended to evaluate the appropriate duration of clinical observation and the safety profile of this strategy in large-scale cohort populations.

The authors recognise the following limitations of this study. Firstly, in this single-centre study, the number of patients in our study cohort is relatively small in comparison to the CDRs derivation cohorts. This is an early analysis of a prospective cohort study in which we are accruing data on head-injured patients in our population. The small number of events in our population accounted for the wide 95% CIs for the sensitivity values. Also, we recognise that the positive and negative predictive values are dependent on prevalence, for which the event of moderate to severe brain injury is very low in our population. We recognise that given the different healthcare practices and settings, our study results may not be generalisable to all populations, especially to areas with a higher prevalence of severe TBI. Lastly, follow-up was done at 72 hours postdischarge and there may be a small possibility of unreported events that occurred after this period.

Conclusion

The CDRs demonstrated high accuracy in detecting children with positive CT findings but its direct application would likely lead to a significant increase in unnecessary CT scans in our population. Clinical observation in most cases is a viable alternative.

Acknowledgement

The ongoing prospective head injury surveillance is supported by the Paediatrics Academic Clinical Program (Paeds ACP) Young Researcher Pilot Grant. The authors would like to thank Ms Dianna Sri for her contribution towards the data collection.

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Hyperfamiliarity in Dementia and Mild Cognitive Impairment

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Abstract

Introduction: Hyperfamiliarity, a phenomenon in which feelings of familiarity are evoked by novel stimuli, is well described in epilepsy and the lesioned brain. Abnormality of familiarity in Alzheimer's disease (AD) and mild cognitive impairment (MCI) have also been described in the literature, but more from a neuropsychological approach perspective. Currently, there is a lack of study on the real-life experience of familiarity abnormality in dementia and MCI. Our aim was to compare the occurrence of hyperfamiliarity among dementia and MCI. **Materials & Methods:** We recruited 73 participants, 29 with AD, 10 with vascular dementia, 7 with MCI and 27 healthy controls, and administered a questionnaire to assess hyperfamiliarity frequency. **Results:** Hyperfamiliarity was observed in real-life in cognitive impairment, but was unrelated to its severity or underlying aetiology. **Conclusion:** This study highlights the similar rate of occurrence of hyperfamiliarity in the daily life of individuals with cognitive impairment. Future research should examine neuropsychological correlations and mechanisms that contribute to such observations.

Ann Acad Med Singapore 2015;44:342-9

Key words: Alzheimer's disease, Delusional misidentification syndrome, Vascular dementia

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Introduction

Hyperfamiliarity, a phenomenon in which novel stimuli evoke feelings of familiarity, has been described in dementia, temporal lobe epilepsy (TLE) and the lesioned brain.¹⁻⁴ There is currently no universal term for the phenomenon of hyperfamiliarity. Labels have been used to describe spurious feelings of familiarity, including 'false memory', 'false recall', 'recognition without identification' and indeed, 'hyperfamiliarity'.^{3,5-7} Predominant theories on the cognitive processes behind hyperfamiliarity are highly similar. These theories postulate that hyperfamiliarity occurs when there is recognition without recollection—that is, though a stimulus is perceived to be familiar (i.e. it is recognised), there is no retrieval for contextual information regarding the stimulus (i.e. there is no recollection). However, the theories differ regarding which parts of the brain are responsible.^{2,4,8-10}

While the specific causes of hyperfamiliarity are still ambiguous, existing research has identified general trends regarding its aetiology and its relationship with

cognitive function. In dementia, research has largely associated deficits in the frontal and temporal lobes with hyperfamiliarity.^{2,7,11-14} Additionally, research suggests that the severity of hyperfamiliarity is not linked with cognitive decline. For example, studies found that in recognition tests that involved word lists, the likelihood of falsely recognising words increased with the presence of Alzheimer's disease (AD) but was not related to the severity of AD.^{1,3} In TLE and the lesioned brain, hyperfamiliarity has been described as having both a right and left hemispheric focus, as well as an association with impairments in the temporal areas.^{8,15-17} These broad and occasionally ambiguous trends highlight the need for further research on hyperfamiliarity.

To date, studies on familiarity deficits in dementia and mild cognitive impairment (MCI) have been mainly based on a neuropsychological approach. It remains uncertain whether the deficits are reflected or manifested in patients' daily life. Our study aimed to fill this knowledge gap by conducting an investigation on the occurrence of hyperfamiliarity

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experienced in daily life by individuals with dementia or MCI. We included both dementia and MCI in order to study the effect and relationship of different stages or severity of cognitive impairment towards the real-life phenomenon of hyperfamiliarity. We hypothesised that hyperfamiliarity is common in both dementia and MCI, and its presence is not related to the status or severity of cognitive impairment.

Materials and Methods

Patients who presented to the neurology outpatient clinic of a large tertiary hospital in Singapore with a clinical diagnosis of AD, MCI or vascular dementia (VD) were approached and recruited into the study. Diagnosis of AD was in accordance with the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV),¹⁸ while diagnosis of VD fulfilled the NINDS-AIREN criteria¹⁹ and diagnosis of MCI fulfilled the Peterson criteria.²⁰ A total of 73 participants were recruited for the study, and written consent was obtained either from the participants themselves or from their informants. Recruited participants included 29 with AD, 10 with VD, 7 with MCI (6 amnesic MCI multiple domain, 1 non-amnesic MCI single domain) and 27 healthy control participants.

Informants were approached to rate the severity of hyperfamiliarity of the patients. To participate in the study, informants were required to have spent at least 9 hours per week with the participant for the past 12 months and be familiar with the participant's habits. Healthy controls (age- and gender-matched) were defined as participants with no personal history of cognitive impairment or subjective cognitive complaints; they were mostly spouses of patients with their children serving as informant for the questionnaire. Patients with delusional misidentification syndrome (DMS) were excluded from participation. This study was approved by the SingHealth Institutional Review Board.

A questionnaire assessing participants' demographics and hyperfamiliarity-related symptoms was administered verbally to the informants. The demographics included age, gender, dementia diagnosis and Mini Mental State Examination (MMSE) score. Background of the informants such as relationship with patients was not included in the questionnaire. Hyperfamiliarity was measured on 3 domains: people (e.g. passers-by on the street), places (e.g. shopping malls) and objects (e.g. cars on the road). For each domain, informants were required to give a subjective score ranging from '0' to '5' based on the frequency of hyperfamiliarity being expressed within the past month. The scale measures how many times, on average, the participant experiences an occurrence of hyperfamiliarity per 10 opportunities. A rating of '0' indicates no occurrence of hyperfamiliarity, a rating of '1' indicates 1 to 2 occurrences, a rating of '2' indicates

3 to 4 occurrences and so on, with the highest rating of '5' indicating 9 to 10 occurrences of hyperfamiliarity out of 10 opportunities. The frequency scores for all 3 domains were added to obtain the participant's total hyperfamiliarity frequency score. The instruction given to informants was as below: Please give 1 rating for the period of within the past month of your care recipient's symptoms for below: 1) Patient claims to recognise or be familiar with people on the street he/she has not met before, 2) Patient claims to recognise or be familiar with new places even though he/she has not been there before, 3) Patient claims to recognise or be familiar with objects he/she encounters (for example, cars on the street, trees by the road) even though he/she has not previously encountered them before. The questionnaire is attached in Appendix 1.

Statistical Method

The hyperfamiliarity scores were binned into 2 categories; first category with only score of 0 and the other category with scores of 1 to 5. A Chi-square test was first applied to compare hyperfamiliarity scores among the 4 groups (AD, VD, MCI, and healthy controls). It was then applied to compare hyperfamiliarity scores among the 3 disease groups only. Spearman's rank correlation coefficient was used to measure the correlation of the hyperfamiliarity domain scores of people, places, objects and total score with MMSE score. Finally, multiple linear regression was used to determine whether MMSE score is a predictor for hyperfamiliarity total score, adjusting for covariates of age and gender. MMSE was used as a predictor in this study in order to examine the relationship of cognitive status, as reflected by MMSE score, with severity of hyperfamiliarity.

Results

Table 1 summarises the demographics of the 3 disease groups and the healthy control group.

In the comparison between all 4 groups, statistically significant differences were found in the hyperfamiliarity domains of people and objects, as well as in total score ($P < 0.05$), but not in the hyperfamiliarity domain of places ($P = 0.249$). For the hyperfamiliarity domain of people, the MCI group had a lower rate of score 0 (i.e. no occurrence of hyperfamiliarity) than did the control group. For the hyperfamiliarity domain of objects, the VD and MCI groups had lower rates of score 0 than did the control group. For total score of hyperfamiliarity, the AD, VD and MCI groups had lower rates of score 0 than did the control group. However, no statistically significant differences were found in any of the 3 hyperfamiliarity domains when comparing only among the AD, VD and MCI groups. These results are summarised in Table 2 and Figure 1. We adopted this 2

Table 1. Demographics of the Various Groups

Demographic	AD	VD	MCI	Controls
	(n = 29) n (%)	(n = 10) n (%)	(n = 7) n (%)	(n = 27) n (%)
Male gender	13 (44.8)	5 (50.0)	5 (71.4)	11 (40.7)
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Age	79.3 (5.9)	73.7 (9.4)	75.7 (9.4)	74.5 (12.0)
MMSE score	16.5 (4.7)	15.0 (4.5)	21.0 (4.7)	NA

AD: Alzheimer's disease; MCI: Mild cognitive impairment; MMSE: Mini Mental State Examination; NA: Not applicable; SD: Standard deviation; VD: Vascular dementia

Table 2. Distribution of Hyperfamiliarity Score of 0 (i.e. No Occurrence of Hyperfamiliarity) in the Various Groups

Hyperfamiliarity Domains	AD	VD	MCI	Controls	4-Group Comparisons	3-Disease-Group Comparisons
	(n = 29) n (%)	(n = 10) n (%)	(n = 7) n (%)	(n = 27) n (%)	P Value*	P Value†
People	27 (93.1)	10 (100.0)	5 (71.4)	27 (100.0)	0.024‡	0.103
Places	24 (82.8)	9 (90.0)	6 (85.7)	27 (100.0)	0.249	0.940
Objects	29 (100.0)	8 (80.0)	6 (85.7)	27 (100.0)	0.014‡	0.058
Total score	25 (86.2)	7 (70.0)	3 (42.9)	27 (100.0)	0.001‡	0.048

AD: Alzheimer's disease; MCI: Mild cognitive impairment; VD: Vascular dementia

*Chi-square test comparing all 4 groups.

†Chi-square test comparing the 3 disease groups AD, VD and MCI.

‡P values represent statistical significance at $P < 0.05$.

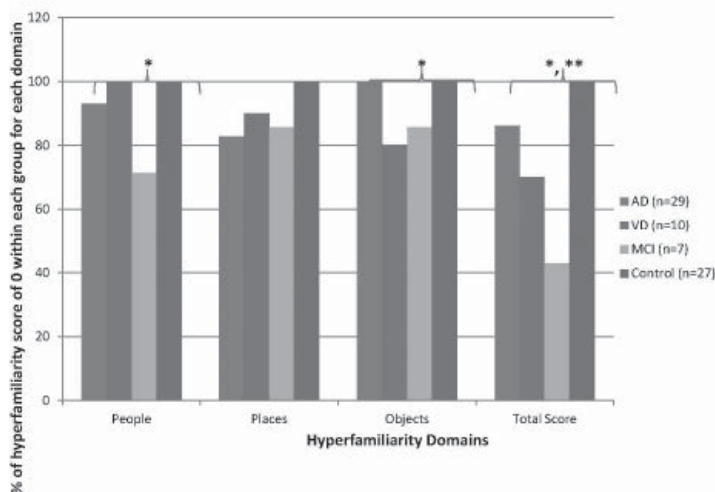


Fig. 1. Distribution of hyperfamiliarity score of 0 (i.e. no occurrence of hyperfamiliarity) in the various groups.

separate Chi-square tests approach for 2 main reasons; firstly, control group showed no occurrence of hyperfamiliarity as opposed to the 3 disease groups; secondly, to avoid multiple testing (example, single Chi-square followed by multiple pairs posthoc testing).

There was no significant correlation between any of the 3 domain scores or the total score of hyperfamiliarity and MMSE score (people: $P = 0.809$, places: $P = 0.489$; objects: $P = 0.115$, total: $P = 0.154$).

Multiple linear regression showed that MMSE was not a significant predictor for hyperfamiliarity total score (regression coefficient, β (95% CI): 0.05 (-0.03, 0.14), $P = 0.202$) even after adjustment for age and gender.

Discussion

The results suggest that hyperfamiliarity occurred in a similar rate in dementia-related cognitive impairment. Consistent with previous research, hyperfamiliarity was associated with cognitive impairment, but there was no relation between cognitive status—as indicated by MMSE

scores—and frequency of hyperfamiliarity.^{1,3} To date, evidence in the literature of familiarity deficits in MCI has been controversial.²¹ However, the MCI group in our study showed a significant trend in abnormal familiarity, which was comparable to those found in the dementia groups. These findings from a real-life perspective are in keeping with and supportive of the neuropsychological-based or approach studies that have indicated abnormal familiarity during memory recollection in MCI.²² The statistical insignificance found in place domain was probably due to small sample size; less travelling in cognitively impaired patients might also have contributed to the lower rate of hyperfamiliarity in this domain.

DMS is an important form of abnormal familiarity that has been well described in dementia. It comprises a group of syndromes that are characterised by delusions of misidentification toward people, places or objects. Examples of DMS include Capgras syndrome, the belief that a loved one has been replaced by an impostor, and Fregoli syndrome, the belief that several people are in fact 1 person in disguise.²³ Face-selective self-misidentification secondary to a right occipitotemporal hypometabolism has also been reported.²⁴ In dementia, DMS is most commonly associated with dementia with Lewy bodies (DLB) and AD.^{25,26} For instance, facial-specific DMS and hyperfamiliarity even towards animacy has been reported in AD.²⁷ It has been hypothesised that hyperfamiliarity is related to DMS in that they both involve the same pathophysiological mechanisms, with hyperfamiliarity being a lesser representation of DMS.^{28,29} In our study, patients with DMS were excluded from analysis in order to investigate hyperfamiliarity independently and examine whether it shares any clinical resemblance with DMS.

Interestingly, there was no significant difference in incidence of hyperfamiliarity between the various dementia/MCI diagnoses. Since DMS has a strong association with AD and DLB, and not with VD and MCI, our finding of uniformity in hyperfamiliarity incidence between the 3 diagnosis groups suggests that hyperfamiliarity and DMS probably do not involve the exact same pathophysiological mechanisms. Of course, it would be too simplistic to draw such a conclusion based on these results. It is possible that hyperfamiliarity could be due to a number of causes and that multiple types of hyperfamiliarities exist, of which some share similar pathologies with DMS. For instance, Schacter et al¹⁴ described patient BG, whose hyperfamiliarity was eliminated when the patient was presented with categorised stimuli and was tested with stimuli from non-studied categories. Schacter et al¹⁴ argued that BG's hyperfamiliarity might be due to an over-reliance on memory for broad characteristics with impaired memory for specific items. Additionally, Vuilleumier et al¹⁷ described patient JR,

whose hyperfamiliarity appeared to be context-specific. For example, JR's hyperfamiliarity decreased while on public transport, but increased when she was on her university's campus. These findings again suggest that hyperfamiliarity involves multiple cognitive processes and thus can arise from deficits at any of the processing stages. The idea that hyperfamiliarity has multiple causes—or even that multiple types of hyperfamiliarities exist—could explain why hyperfamiliarity was not found to be specific to any particular dementia/MCI diagnosis in this study, even though DMS appears to be largely specific to AD and DLB.²⁶

Previous studies demonstrated evidence supporting a dual-process mechanism in the memory recognition process.³⁰ From our study, we can probably conclude that the familiarity process in memory recognition is more resistant to impairment during the dementing process. Participants experience similar rates of hyperfamiliarity in their daily life, regardless of aetiology or severity of cognitive impairment. Meanwhile, factual memory recollection appeared to be more prone to degradation in the dementing process. It involves, but is not limited to, an effective and accurate information retrieval and matching process that is also required to be context-specific. This likely indicates the more widespread involvement of neuronal structures in this process. Thus, even a subtle injury may induce hyperfamiliarity secondary to an overriding familiarity process. This probably explains the common occurrence of hyperfamiliarity during daily life in all cognitive impairment participants while there was no significant difference in occurrence among the 3 diagnosis groups, as any injury along the pathway of factual memory recollection will produce a highly similar clinical outcome in terms of memory recognition experience.

We also noted the MCI group had the worst performance among the 3 groups in terms of rate of total numbers of patients scoring 0 in the questionnaire, followed by the VD group. In this study, we did not look into the neuroimaging finding of the MCI patients that could possibly have concomitant subcortical ischaemia similar to the VD group. We are still not sure whether executive dysfunction, a common finding in subcortical ischaemia, could positively affect hyperfamiliarity. Future studies should examine and correlate subcortical lesions with clinical hyperfamiliarity. However, we do need to be cautious and take note that only a very small sample size is present in the MCI group.

This study has a few limitations. First, it was limited by its small sample size and its retrospective nature coupled by relatively low occurrence of reported hyperfamiliarity among the groups. Second, diagnosis of AD was based on DSM-IV criteria, thus details regarding concomitant vascular burden in the AD group were not examined. This could confound the findings due to potential overlapping mechanisms of memory recollection deficits between the

AD and VD groups. Third, full neuropsychological data for the participants is lacking and therefore not examined; hence, poor self-monitoring or executive dysfunction was not adjusted for the results. Lastly, we didn't examine the demographic differences of informant between the groups, this might influence the way how they rate hyperfamiliarity. The multiple regression analysis would be more complete if further adjusted by informant's background differences. Nevertheless, the informants were usually the primary caregivers who know the patients the best thus this bias should be minimal.

Conclusion

Hyperfamiliarity is likely a generic or non-specific phenomenon in terms of aetiology or cognitive status correlation when applied in the dementing process. Current conceptualisation of hyperfamiliarity poses challenges in defining the aims and outcome measurement of study that relates to it. Future research should examine the full neuropsychological data of larger samples to further delineate the interactions or contributions of the various cognitive domains to hyperfamiliarity; and probably a more focus approach such as only studying AD in order to better conceptualise hyperfamiliarity so that the gap of understanding of real-life experience and neuropsychological finding of hyperfamiliarity could be further narrowed. Future study should also investigate the occurrence of hyperfamiliarity in other types of dementing illness such as Parkinsonian dementia or frontotemporal dementia.

Acknowledgement

The authors would like to thank Jon Kilner, MS, MA (Pittsburgh, Pennsylvania, USA), for his assistance in medical editing.

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Appendix 1**Questionnaire of Hyperfamiliarity in Dementia and Mild Cognitive Impairment Study****Hyperfamiliarity in Dementia and Mild Cognitive Impairment Study****DEMOGRAPHICS**

Patient's diagnosis: _____

(To be filled in by doctor): Stage _____ MMSE _____ / _____ (Date)

Number of years since onset of symptoms: _____

How many hours a week do you spend with care recipient? _____ hours

QUESTIONNAIRE

A. Has the patient been diagnosed with delusional misidentification syndrome (DMS)?

If **YES**, which type? Please circle one.

- a. Capgras Syndrome
- b. Fergoli Syndrome
- c. Intermetamorphosis
- d. Subjective Doubles
- e. Mirrored self-misidentification
- f. Reduplicative paramnesia
- g. Cotard Syndrome
- h. Other: _____

If **NO**, proceed below.

B. Please rate the frequency of the following situations on a scale of 0 to 5 according to the following criteria:

0 – does not occur at all	1 – occurs 1, 2 times out of 10	2 – occurs 3, 4 times out of 10
3 – occurs 5, 6 times out of 10	4 – occurs 7, 8 times out of 10	5 – occurs 9, 10 times out of 10

Please give one rating for the period before onset of your care recipient's symptoms and one rating for the present period (within the past month).

	Before onset of dementia/ MCI symptoms	Presently (Within past month)
1. Patient claims to recognize or be familiar with <u>people</u> on the street he/she has not met before. Please indicate who the false sense of familiarity is normally directed at (e.g. people on the street, healthcare workers): _____		
2. Patient claims to recognise or be familiar with new <u>places</u> even though he/she has not been there before. Please indicate where the false sense of familiarity is normally directed at (e.g. shopping malls, friends/ relatives' homes): _____		
3. Patient claims to recognise or be familiar with <u>objects</u> he/she encounters (e.g. cars on the street, trees by the road) even though he/she has not previously encountered them before. Please indicate what the false sense of familiarity is normally directed at (e.g. cars on the street, products on sale when shopping): _____		

Hyperfamiliarity in Dementia and Mild Cognitive Impairment

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Abstract

Introduction: Hyperfamiliarity, a phenomenon in which feelings of familiarity are evoked by novel stimuli, is well described in epilepsy and the lesioned brain. Abnormality of familiarity in Alzheimer's disease (AD) and mild cognitive impairment (MCI) have also been described in the literature, but more from a neuropsychological approach perspective. Currently, there is a lack of study on the real-life experience of familiarity abnormality in dementia and MCI. Our aim was to compare the occurrence of hyperfamiliarity among dementia and MCI. **Materials and Methods:** We recruited 73 participants, 29 with AD, 10 with vascular dementia, 7 with MCI and 27 healthy controls, and administered a questionnaire to assess hyperfamiliarity frequency. **Results:** Hyperfamiliarity was observed in real-life in cognitive impairment, but was unrelated to its severity or underlying aetiology. **Conclusion:** This study highlights the similar rate of occurrence of hyperfamiliarity in the daily life of individuals with cognitive impairment. Future research should examine neuropsychological correlations and mechanisms that contribute to such observations.

Ann Acad Med Singapore 2015;44:342-9

Key words: Alzheimer's disease, Delusional misidentification syndrome, Vascular dementia

Introduction

Hyperfamiliarity, a phenomenon in which novel stimuli evoke feelings of familiarity, has been described in dementia, temporal lobe epilepsy (TLE) and the lesioned brain.¹⁻⁴ There is currently no universal term for the phenomenon of hyperfamiliarity. Labels have been used to describe spurious feelings of familiarity, including 'false memory', 'false recall', 'recognition without identification' and indeed, 'hyperfamiliarity'.^{3,5-7} Predominant theories on the cognitive processes behind hyperfamiliarity are highly similar. These theories postulate that hyperfamiliarity occurs when there is recognition without recollection—that is, though a stimulus is perceived to be familiar (i.e. it is recognised), there is no retrieval for contextual information regarding the stimulus (i.e. there is no recollection). However, the theories differ regarding which parts of the brain are responsible.^{2,4,8-10}

While the specific causes of hyperfamiliarity are still ambiguous, existing research has identified general trends regarding its aetiology and its relationship with

cognitive function. In dementia, research has largely associated deficits in the frontal and temporal lobes with hyperfamiliarity.^{2,7,11-14} Additionally, research suggests that the severity of hyperfamiliarity is not linked with cognitive decline. For example, studies found that in recognition tests that involved word lists, the likelihood of falsely recognising words increased with the presence of Alzheimer's disease (AD) but was not related to the severity of AD.^{1,3} In TLE and the lesioned brain, hyperfamiliarity has been described as having both a right and left hemispheric focus, as well as an association with impairments in the temporal areas.^{8,15-17} These broad and occasionally ambiguous trends highlight the need for further research on hyperfamiliarity.

To date, studies on familiarity deficits in dementia and mild cognitive impairment (MCI) have been mainly based on a neuropsychological approach. It remains uncertain whether the deficits are reflected or manifested in patients' daily life. Our study aimed to fill this knowledge gap by conducting an investigation on the occurrence of hyperfamiliarity

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experienced in daily life by individuals with dementia or MCI. We included both dementia and MCI in order to study the effect and relationship of different stages or severity of cognitive impairment towards the real-life phenomenon of hyperfamiliarity. We hypothesised that hyperfamiliarity is common in both dementia and MCI, and its presence is not related to the status or severity of cognitive impairment.

Materials and Methods

Patients who presented to the neurology outpatient clinic of a large tertiary hospital in Singapore with a clinical diagnosis of AD, MCI or vascular dementia (VD) were approached and recruited into the study. Diagnosis of AD was in accordance with the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV),¹⁸ while diagnosis of VD fulfilled the NINDS-AIREN criteria¹⁹ and diagnosis of MCI fulfilled the Peterson criteria.²⁰ A total of 73 participants were recruited for the study, and written consent was obtained either from the participants themselves or from their informants. Recruited participants included 29 with AD, 10 with VD, 7 with MCI (6 amnesic MCI multiple domain, 1 non-amnesic MCI single domain) and 27 healthy control participants.

Informants were approached to rate the severity of hyperfamiliarity of the patients. To participate in the study, informants were required to have spent at least 9 hours per week with the participant for the past 12 months and be familiar with the participant's habits. Healthy controls (age- and gender-matched) were defined as participants with no personal history of cognitive impairment or subjective cognitive complaints; they were mostly spouses of patients with their children serving as informant for the questionnaire. Patients with delusional misidentification syndrome (DMS) were excluded from participation. This study was approved by the SingHealth Institutional Review Board.

A questionnaire assessing participants' demographics and hyperfamiliarity-related symptoms was administered verbally to the informants. The demographics included age, gender, dementia diagnosis and Mini Mental State Examination (MMSE) score. Background of the informants such as relationship with patients was not included in the questionnaire. Hyperfamiliarity was measured on 3 domains: people (e.g. passers-by on the street), places (e.g. shopping malls) and objects (e.g. cars on the road). For each domain, informants were required to give a subjective score ranging from '0' to '5' based on the frequency of hyperfamiliarity being expressed within the past month. The scale measures how many times, on average, the participant experiences an occurrence of hyperfamiliarity per 10 opportunities. A rating of '0' indicates no occurrence of hyperfamiliarity, a rating of '1' indicates 1 to 2 occurrences, a rating of '2' indicates

3 to 4 occurrences and so on, with the highest rating of '5' indicating 9 to 10 occurrences of hyperfamiliarity out of 10 opportunities. The frequency scores for all 3 domains were added to obtain the participant's total hyperfamiliarity frequency score. The instruction given to informants was as below: Please give 1 rating for the period of within the past month of your care recipient's symptoms for below: 1) Patient claims to recognise or be familiar with people on the street he/she has not met before, 2) Patient claims to recognise or be familiar with new places even though he/she has not been there before, 3) Patient claims to recognise or be familiar with objects he/she encounters (for example, cars on the street, trees by the road) even though he/she has not previously encountered them before. The questionnaire is attached in Appendix 1.

Statistical Method

The hyperfamiliarity scores were binned into 2 categories; first category with only score of 0 and the other category with scores of 1 to 5. A Chi-square test was first applied to compare hyperfamiliarity scores among the 4 groups (AD, VD, MCI, and healthy controls). It was then applied to compare hyperfamiliarity scores among the 3 disease groups only. Spearman's rank correlation coefficient was used to measure the correlation of the hyperfamiliarity domain scores of people, places, objects and total score with MMSE score. Finally, multiple linear regression was used to determine whether MMSE score is a predictor for hyperfamiliarity total score, adjusting for covariates of age and gender. MMSE was used as a predictor in this study in order to examine the relationship of cognitive status, as reflected by MMSE score, with severity of hyperfamiliarity.

Results

Table 1 summarises the demographics of the 3 disease groups and the healthy control group.

In the comparison between all 4 groups, statistically significant differences were found in the hyperfamiliarity domains of people and objects, as well as in total score ($P < 0.05$), but not in the hyperfamiliarity domain of places ($P = 0.249$). For the hyperfamiliarity domain of people, the MCI group had a lower rate of score 0 (i.e. no occurrence of hyperfamiliarity) than did the control group. For the hyperfamiliarity domain of objects, the VD and MCI groups had lower rates of score 0 than did the control group. For total score of hyperfamiliarity, the AD, VD and MCI groups had lower rates of score 0 than did the control group. However, no statistically significant differences were found in any of the 3 hyperfamiliarity domains when comparing only among the AD, VD and MCI groups. These results are summarised in Table 2 and Figure 1. We adopted this 2

Table 1. Demographics of the Various Groups

Demographic	AD	VD	MCI	Controls
	(n = 29) n (%)	(n = 10) n (%)	(n = 7) n (%)	(n = 27) n (%)
Male gender	13 (44.8)	5 (50.0)	5 (71.4)	11 (40.7)
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Age	79.3 (5.9)	73.7 (9.4)	75.7 (9.4)	74.5 (12.0)
MMSE score	16.5 (4.7)	15.0 (4.5)	21.0 (4.7)	NA

AD: Alzheimer's disease; MCI: Mild cognitive impairment; MMSE: Mini Mental State Examination; NA: Not applicable; SD: Standard deviation; VD: Vascular dementia

Table 2. Distribution of Hyperfamiliarity Score of 0 (i.e. No Occurrence of Hyperfamiliarity) in the Various Groups

Hyperfamiliarity Domains	AD	VD	MCI	Controls	4-Group Comparisons	3-Disease-Group Comparisons
	(n = 29) n (%)	(n = 10) n (%)	(n = 7) n (%)	(n = 27) n (%)	P Value*	P Value†
People	27 (93.1)	10 (100.0)	5 (71.4)	27 (100.0)	0.024‡	0.103
Places	24 (82.8)	9 (90.0)	6 (85.7)	27 (100.0)	0.249	0.940
Objects	29 (100.0)	8 (80.0)	6 (85.7)	27 (100.0)	0.014‡	0.058
Total score	25 (86.2)	7 (70.0)	3 (42.9)	27 (100.0)	0.001‡	0.048

AD: Alzheimer's disease; MCI: Mild cognitive impairment; VD: Vascular dementia

*Chi-square test comparing all 4 groups.

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‡P values represent statistical significance at $P < 0.05$.

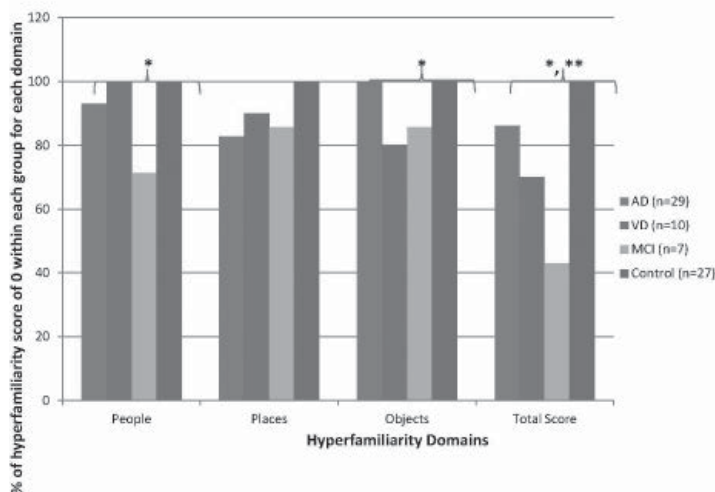


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There was no significant correlation between any of the 3 domain scores or the total score of hyperfamiliarity and MMSE score (people: $P = 0.809$, places: $P = 0.489$; objects: $P = 0.115$, total: $P = 0.154$).

Multiple linear regression showed that MMSE was not a significant predictor for hyperfamiliarity total score (regression coefficient, β (95% CI): 0.05 (-0.03, 0.14), $P = 0.202$) even after adjustment for age and gender.

Discussion

The results suggest that hyperfamiliarity occurred in a similar rate in dementia-related cognitive impairment. Consistent with previous research, hyperfamiliarity was associated with cognitive impairment, but there was no relation between cognitive status—as indicated by MMSE

scores—and frequency of hyperfamiliarity.^{1,3} To date, evidence in the literature of familiarity deficits in MCI has been controversial.²¹ However, the MCI group in our study showed a significant trend in abnormal familiarity, which was comparable to those found in the dementia groups. These findings from a real-life perspective are in keeping with and supportive of the neuropsychological-based or approach studies that have indicated abnormal familiarity during memory recollection in MCI.²² The statistical insignificance found in place domain was probably due to small sample size; less travelling in cognitively impaired patients might also have contributed to the lower rate of hyperfamiliarity in this domain.

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whose hyperfamiliarity appeared to be context-specific. For example, JR's hyperfamiliarity decreased while on public transport, but increased when she was on her university's campus. These findings again suggest that hyperfamiliarity involves multiple cognitive processes and thus can arise from deficits at any of the processing stages. The idea that hyperfamiliarity has multiple causes—or even that multiple types of hyperfamiliarities exist—could explain why hyperfamiliarity was not found to be specific to any particular dementia/MCI diagnosis in this study, even though DMS appears to be largely specific to AD and DLB.²⁶

Previous studies demonstrated evidence supporting a dual-process mechanism in the memory recognition process.³⁰ From our study, we can probably conclude that the familiarity process in memory recognition is more resistant to impairment during the dementing process. Participants experience similar rates of hyperfamiliarity in their daily life, regardless of aetiology or severity of cognitive impairment. Meanwhile, factual memory recollection appeared to be more prone to degradation in the dementing process. It involves, but is not limited to, an effective and accurate information retrieval and matching process that is also required to be context-specific. This likely indicates the more widespread involvement of neuronal structures in this process. Thus, even a subtle injury may induce hyperfamiliarity secondary to an overriding familiarity process. This probably explains the common occurrence of hyperfamiliarity during daily life in all cognitive impairment participants while there was no significant difference in occurrence among the 3 diagnosis groups, as any injury along the pathway of factual memory recollection will produce a highly similar clinical outcome in terms of memory recognition experience.

We also noted the MCI group had the worst performance among the 3 groups in terms of rate of total numbers of patients scoring 0 in the questionnaire, followed by the VD group. In this study, we did not look into the neuroimaging finding of the MCI patients that could possibly have concomitant subcortical ischaemia similar to the VD group. We are still not sure whether executive dysfunction, a common finding in subcortical ischaemia, could positively affect hyperfamiliarity. Future studies should examine and correlate subcortical lesions with clinical hyperfamiliarity. However, we do need to be cautious and take note that only a very small sample size is present in the MCI group.

This study has a few limitations. First, it was limited by its small sample size and its retrospective nature coupled by relatively low occurrence of reported hyperfamiliarity among the groups. Second, diagnosis of AD was based on DSM-IV criteria, thus details regarding concomitant vascular burden in the AD group were not examined. This could confound the findings due to potential overlapping mechanisms of memory recollection deficits between the

AD and VD groups. Third, full neuropsychological data for the participants is lacking and therefore not examined; hence, poor self-monitoring or executive dysfunction was not adjusted for the results. Lastly, we didn't examine the demographic differences of informant between the groups, this might influence the way how they rate hyperfamiliarity. The multiple regression analysis would be more complete if further adjusted by informant's background differences. Nevertheless, the informants were usually the primary caregivers who know the patients the best thus this bias should be minimal.

Conclusion

Hyperfamiliarity is likely a generic or non-specific phenomenon in terms of aetiology or cognitive status correlation when applied in the dementing process. Current conceptualisation of hyperfamiliarity poses challenges in defining the aims and outcome measurement of study that relates to it. Future research should examine the full neuropsychological data of larger samples to further delineate the interactions or contributions of the various cognitive domains to hyperfamiliarity; and probably a more focus approach such as only studying AD in order to better conceptualise hyperfamiliarity so that the gap of understanding of real-life experience and neuropsychological finding of hyperfamiliarity could be further narrowed. Future study should also investigate the occurrence of hyperfamiliarity in other types of dementing illness such as Parkinsonian dementia or frontotemporal dementia.

Acknowledgement

The authors would like to thank Jon Kilner, MS, MA (Pittsburgh, Pennsylvania, USA), for his assistance in medical editing.

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Appendix 1**Questionnaire of Hyperfamiliarity in Dementia and Mild Cognitive Impairment Study****Hyperfamiliarity in Dementia and Mild Cognitive Impairment Study****DEMOGRAPHICS**

Patient's diagnosis: _____

(To be filled in by doctor): Stage _____ MMSE _____ / _____ (Date)

Number of years since onset of symptoms: _____

How many hours a week do you spend with care recipient? _____ hours

QUESTIONNAIRE

A. Has the patient been diagnosed with delusional misidentification syndrome (DMS)?

If **YES**, which type? Please circle one.

- a. Capgras Syndrome
- b. Fergoli Syndrome
- c. Intermetamorphosis
- d. Subjective Doubles
- e. Mirrored self-misidentification
- f. Reduplicative paramnesia
- g. Cotard Syndrome
- h. Other: _____

If **NO**, proceed below.

B. Please rate the frequency of the following situations on a scale of 0 to 5 according to the following criteria:

0 – does not occur at all	1 – occurs 1, 2 times out of 10	2 – occurs 3, 4 times out of 10
3 – occurs 5, 6 times out of 10	4 – occurs 7, 8 times out of 10	5 – occurs 9, 10 times out of 10

Please give one rating for the period before onset of your care recipient's symptoms and one rating for the present period (within the past month).

	Before onset of dementia/ MCI symptoms	Presently (Within past month)
1. Patient claims to recognize or be familiar with <u>people</u> on the street he/she has not met before. Please indicate who the false sense of familiarity is normally directed at (e.g. people on the street, healthcare workers): _____		
2. Patient claims to recognise or be familiar with new <u>places</u> even though he/she has not been there before. Please indicate where the false sense of familiarity is normally directed at (e.g. shopping malls, friends/ relatives' homes): _____		
3. Patient claims to recognise or be familiar with <u>objects</u> he/she encounters (e.g. cars on the street, trees by the road) even though he/she has not previously encountered them before. Please indicate what the false sense of familiarity is normally directed at (e.g. cars on the street, products on sale when shopping): _____		

Localising Median Neuropathies: The Role of Different Investigations

A 50-year-old male with diabetic nephropathy and renal failure on maintenance haemodialysis through a left arterio-venous fistula was referred to the Neuroscience Clinic with pain, numbness and tingling over the lateral 3 fingers of the left hand of a few days duration. The pain increased when the fistula was used for haemodialysis. On clinical examination, the patient was unable to oppose the thumb and flex the thumb, Digit I and Digit II. He also had weakness of wrist flexion and forearm pronation, suggesting a proximal median neuropathy.

Electrodiagnostic studies (Table 1) indicated a mixed axonal and demyelinating sensori-motor polyneuropathy. Additionally, the median nerve study on the right was compatible with a median neuropathy at the wrist. Studies on the left, however, were consistent with a severe median neuropathy with absent sensory nerve action potential and markedly decreased compound muscle action potential. Distal latency to the flexor pollicis longus on proximal stimulation was prolonged indicating a left-sided proximal median neuropathy.

Which investigations can assist in localising the site of the left median nerve lesion? Which investigation is most useful?

- Needle electrode examination
- High resolution sonography
- Magnetic resonance imaging (MRI)
- Angiogram
- Serial nerve conduction studies

Discussion

The patient had a brachial artery haematoma compressing the proximal median nerve. High resolution sonography of the arm showed a lesion compressing the median nerve 13 cm proximal to the medial epicondyle (Figs. 1A and 1B). The nerve was moderately swollen with loss of fascicular architecture. Doppler ultrasound revealed a haematoma (1.26 cm x 0.75 cm x 1.3 cm) medial and superficial to the brachial artery which was compressing and displacing the median nerve. A loss in continuity of the mural architecture was also noted on sonographic studies suggesting a puncture of the brachial artery. The haematoma was drained and the patient underwent physiotherapy with complete recovery.

The identification of concomitant entrapment or compressive neuropathy in the presence of severe peripheral neuropathy can be challenging. Demonstration of a dual

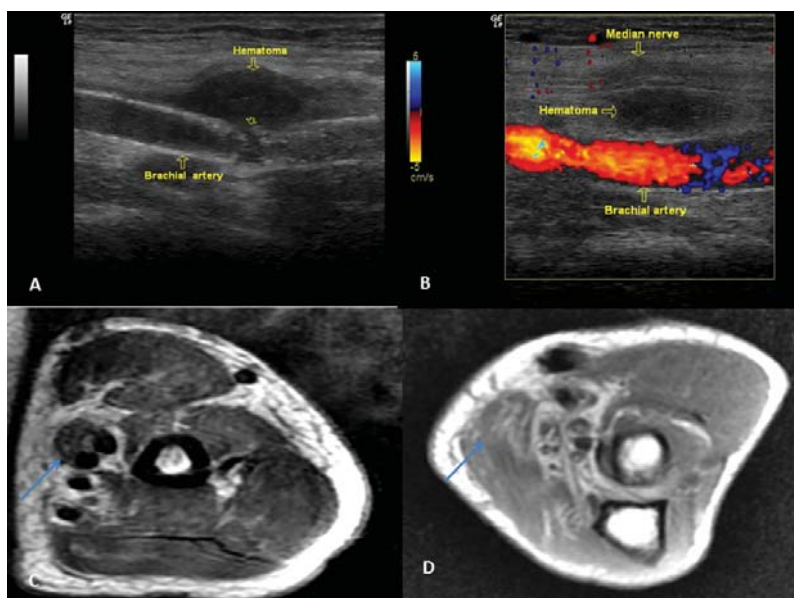


Fig. 1. Ultrasound in A and B show a haematoma medial and superficial to the brachial artery compressing the nerve as well as delineating the puncture of the median artery. In C, T1-weighted fat suppressed MRI shows a hypointense focal lesion in the median neurovascular bundle, which is approximately 13 cm proximal to the medial epicondyle of the humerus. In D, high signal intensity is seen in the pronator teres and flexor carpi radialis due to fatty infiltration and edema secondary to denervation.

Answer: B

pathology would necessitate the use of non-conventional electrodiagnostic studies or the need for imaging studies.

Electrodiagnostic studies in our patient were compatible with a severe diabetic peripheral neuropathy (Table 1). Additionally there was evidence of a carpal tunnel syndrome of the right. Confirmation of the clinical suspicion of a proximal median neuropathy on the left prompted us to examine the latency to the flexor pollicis longus which was prolonged when compared to the right. Needle electrode examination (NEE) can be useful in identifying the severity of nerve injury, and in differentiating a proximal from a distal median neuropathy. Needle findings can also help to ascertain the age of the injury (acute, subacute, or chronic) based on the extent of abnormal rest activity and the presence or absence of motor unit remodelling. In our case, NEE showed evidence of active denervation involving the left flexor pollicis longus, the flexor carpi radialis and the pronator teres consistent with an axonal loss lesion proximal to the elbow. Further localisation of median nerve pathology in the axilla to elbow segment is, however, limited due to absence of any muscular branches. Demonstration of a focal pathology in this segment would necessitate the use of imaging studies.

MRI scan of the left arm was able to localise the haematoma adjacent to the neurovascular bundle in the mid-arm, with associated signal changes within the median innervated muscles suggesting denervation edema. Further characterisation of the median nerve pathology (Figs. 1C and 1D), however, was not possible. High resolution sonography was able to demonstrate the nerve compression and the associated mural injury to the brachial artery.

Our case highlights the usefulness of peripheral nerve ultrasound in localising a proximal compressive median nerve pathology; especially so in the presence of concomitant diabetic peripheral neuropathy where nerve conduction studies were grossly abnormal. When a mononeuropathy is discovered ultrasound is well suited to look for entrapment or compressive pathologies. Peripheral nerve ultrasound is a painless, non-invasive useful adjunct to electrodiagnostic studies. It has several advantages: 1) it can be targeted directly to the area of concern, and 2) it can assess pulsatile flow and vascularity in real time. In cases where the underlying pathology is suspected to be vascular in nature, it may even be a superior modality compared to MRI scan by better delineating the vessels, looking for pseudoaneurysm and identifying an area of mural injury or “puncture”. However, ultrasound has its own set of limitations such as being operator dependent and not being able to depict muscle atrophy and edema to the extent of what MR images would do.¹

Table 1. Nerve Conduction Studies

	Right	Left
Median Nerve		
Sensory peak latency (ms)	5.3	Absent
Sensory amplitude (micV)	2.0	-
Sensory conduction velocity (m/s)	29.1	-
Motor distal latency (wrist) (ms) – Abductor pollicis brevis (APB)	5.4	7.3
Motor amplitude (wrist)(mV)	5.3	0.2
Motor latency (elbow) (ms)	11.15	16.95
Motor amplitude (elbow) (mV)	5.6	0.3
Motor conduction velocity (elbow-wrist) (m/s)	41.0	26.7
Motor distal latency (elbow) (ms) – Flexor pollicis longus (FPL)	4.2	6.45
Motor amplitude (elbow)(mV)	5.1	0.1
F wave latency (ms)	34.85	Absent
2L-INT (ms)	1.35	Median absent
Ulnar Nerve		
Sensory peak latency (ms)	Absent	Absent
Sensory amplitude (micV)	-	-
Sensory conduction velocity (m/s)	-	-
Motor distal at wrist (ms)	3.4	3.55
Motor amplitude at wrist (mV)	5.9	2.4
Motor latency (below elbow) (ms)	8.55	9.05
Motor amplitude (below elbow) (mv)	5.2	1.9
Motor conduction velocity (below elbow-wrist)(m/s)	37.9	37.8
Motor latency (above elbow) (ms)	9.6	12.4
Motor amplitude (above elbow) (m/s)	4.9	1.8
Motor conduction velocity (across elbow) (m/s)	49.5	39.4
Radial Nerve		
Sensory peak latency (ms)	2.25	2.05
Sensory amplitude (micV)	16.6	23.0
Sensory conduction velocity (m/s)	45.6	38.8
Med Antebrachial Cutaneous Nerve		
Peak latency (ms)	1.95	2.55
Amplitude (micV)	7.6	5.0
Conduction velocity (m/s)	50.3	43.6
Lateral Antebrachial Cutaneous Nerve		
Peak latency (ms)	2.6	Fistula
Amplitude (micV)	6.3	Fistula
Conduction velocity (m/s)	40.5	Fistula
Sural Nerve		
Peak latency (ms)	Absent	Amputated
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Localising Median Neuropathies: The Role of Different Investigations

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- E. Serial nerve conduction studies

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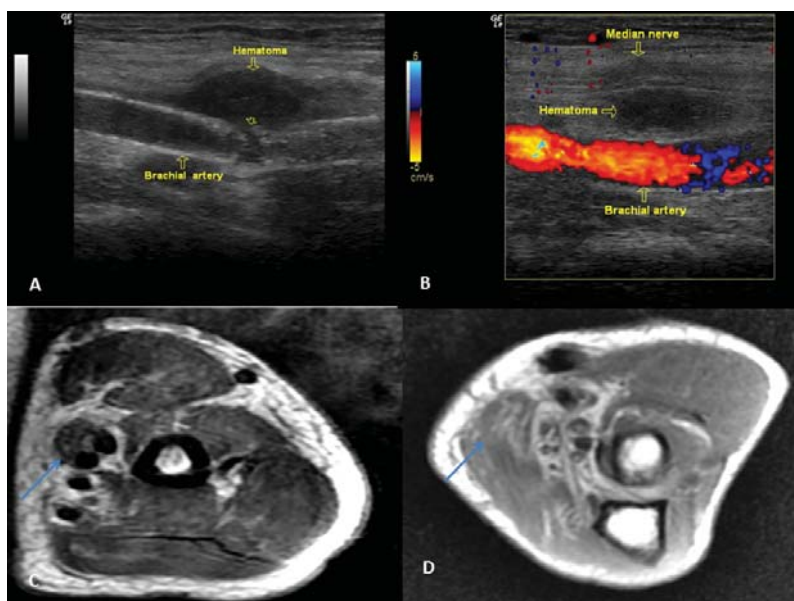


Fig. 1. Ultrasound in A and B show a haematoma medial and superficial to the brachial artery compressing the nerve as well as delineating the puncture of the median artery. In C, T1-weighted fat suppressed MRI shows a hypointense focal lesion in the median neurovascular bundle, which is approximately 13 cm proximal to the medial epicondyle of the humerus. In D, high signal intensity is seen in the pronator teres and flexor carpi radialis due to fatty infiltration and edema secondary to denervation.

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22nd Gordon Arthur Ransome Oration: Is Medicine Still an Art?*

James Best, ¹MD (Melb.), FRACP, FRCPath

Distinguished guests and colleagues in medicine, I am deeply honoured to have been invited to deliver this 22nd oration in honour of Sir Gordon Arthur Ransome, and also humbled when I peruse the list of outstanding previous orators.

I took up my position here as Dean of the Lee Kong Chian School of Medicine exactly a year ago, in time to welcome just the second cohort of medical students to Singapore's newest medical school. Soon after I arrived, I was addressing a group of high school students interested in studying medicine. I emphasised that medicine is both an art and a science. After my address, one of the students came up to me and asked, "What do you mean that medicine is both an art and a science?"

I was sure he was not questioning whether medicine is a science, but I am not sure my answer convinced him—perhaps because this proposition was self-evident at the time when I learnt the practice of medicine and so I have not thought very carefully about it in the current era. So choosing this topic has given me the opportunity to consider this proposition anew and to share with you this evening my thoughts about whether medicine is still an art.

Now I mentioned that I have been living in Singapore for only one year but I am not a stranger to Singapore. In fact my first visit here, and to Kuala Lumpur on the same trip—the first time I left Australia—was in 1963, the same year as this Congress was first held. My grandfather brought me here to meet his Singaporean friends. Singapore made a deep impression on me and I have been here many times since. So it is a particular pleasure to speak at the Singapore-Malaysia Congress of Medicine over 50 years after my first visit to both the island and the peninsula.

Medicine Has Evolved Since the Era of Hippocrates and Voltaire

Medicine has long been described as an art. "Life is short, the art long, opportunity fleeting, experience treacherous,

judgment difficult" wrote Hippocrates. Voltaire was being frivolous when he wrote "Medicine is the art of amusing the patient while nature cures the disease" and more serious when he wrote "Nothing is more estimable than a physician who, having studied nature from his youth, knows the properties of the human body, the diseases which assail it, the remedies which will benefit it, exercises his art with caution, and pays equal attention to the rich and the poor".

But we are over 2000 years on from the time of Hippocrates and more than 200 years on from the time of Voltaire. Has the scientific era changed medicine irrevocably from an art to a science? Has that other common medical aphorism—"cure sometimes, relieve often, comfort always"—been overtaken by advances in diagnostic and therapeutic medicine?

Certainly engineering and technology have brought great advances to medicine over the past 40 to 50 years. I choose this interval as the likely lifetime in medical practice and coincident with my own. Over the past 40 to 50 years, dramatic developments in imaging techniques have allowed us to see inside the body, particularly the brain, with both structural and functional analysis. Surgery has advanced, with laparoscopic techniques and robotic surgery. The prevention and treatment of cardiovascular disease has changed dramatically, with angioplasty and refinement of coronary artery bypass surgery. In vitro fertilisation has brought the joys, and the tribulations, of parenthood to many families. In my own field of diabetes, we now have miniaturised insulin infusion pumps and continuous glucose monitoring devices, enabling a more physiological match between insulin and glucose levels.

Advances in therapeutics have been equally impressive. Study of the genetic and molecular basis of cellular function in health and disease has led to many new therapies. Inhibitors of the enzyme HMG-CoA reductase in the cholesterol synthesis pathway—statins—have revolutionised the prevention and treatment of coronary heart disease. We have entered the era of designer drugs, targeted at cellular signaling pathways and based on

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*Delivered on 31 July 2015 at the 49th Singapore-Malaysia Congress of Medicine 2015

knowledge of molecular structures. For example, the tyrosine kinase inhibitor, imatinib is dramatically effective in several cancers, including chronic myeloid leukaemia and gastrointestinal stromal tumour. Biological therapies have been developed, such as antibodies designed to block the function of the inflammatory molecule TNF α , which have proven very effective in the treatment of rheumatoid arthritis and useful in other inflammatory diseases such as ulcerative colitis and psoriasis. Another antibody therapy, solanezumab, binds to β amyloid proteins and was reported only last week to slow progression of dementia. Stem cell therapies are starting to show real promise in the treatment of macular degeneration and Parkinson's disease.

Laboratory research has also led to an understanding of how some existing therapies work. Only recently have we known that metformin, firstline therapy in the treatment of type 2 diabetes for over 50 years, activates the enzyme AMP-kinase, which is also activated by exercise. The holy grail of research in this area is to develop a therapy which is the pharmaceutical equivalent of physical exercise. We have also learned that insulin stimulates uptake of glucose by muscle tissue through activating transfer of a specific glucose transporter protein—a sugar shuttle—from an inactive intracellular site to insert itself in the cell membrane.

At the same time, particularly in the use of pharmacological treatments, medicine has moved from relying too much on treacherous experience and difficult judgment to the use of systematised evidence based on well conducted and unbiased clinical trials. One of the great pioneers in this area of medicine, David Sackett, died on May 13 this year and has left a huge legacy based on judicious application of knowledge. For what use is new knowledge if it is not used appropriately? It can be considered an art to apply the scientific basis of medicine wisely and effectively.

The Era of Precision Medicine

Now—62 years after Watson and Crick reported the structure of DNA and 12 years after the first human genome was sequenced—we stand on the threshold of an era named precision medicine. In this proposed model of medical care, diagnosis, prognosis and treatment will be based on genome analysis—genomics, protein analysis—proteomics and metabolite analysis—metabolomics, from each individual. This mega-data or big data will be collated to predict response and so to individualise therapy.

Of course this approach relies on high level computing, which is also changing the nature of medical practice. Although it is argued that medicine has been much slower to utilise computing technology than other industries such as the commercial and engineering fields, the advent of the electronic medical record and digitisation of imaging and

laboratory results mean that the computer screen is or will soon be our constant companion during the consultation. As we all know, our patients can and do access medical information on the internet, as well as from family, friends and neighbours, who also get information from the internet. And our patients can also seek treatment through the internet. Computerised cognitive behavioural therapy is available online for help with anxiety, stress, depression, phobias and obsessive compulsive disorders. Systematic analysis of studies in this area has demonstrated the utility of this approach.

So what are the consequences of the explosion of technology and scientific discovery for the practice of medicine and the role of the doctor? Science and technology of medicine is at its most advanced in the US, of course, and so perhaps we should look there for the answer to what lies ahead. Dr Abraham Verghese, physician-author and Professor for the Theory and Practice of Medicine at Stanford University Medical School says, “I joke, but only half joke, that if you show up in an American hospital missing a finger, no one will believe you until they get a CAT scan, MRI and orthopedic consult”. So using one's judgment and common sense is still part of the art of medicine, in both diagnosis and treatment. Much of medicine continues to involve complexity and uncertainty, so there remains a place for clinical reasoning despite the ubiquity of clinical guidelines and decision support systems.

What Constitutes the Art of Medicine and Is It Still Required?

But what other elements of medical practice remain relevant and constitute the art of medicine? They are contained in the many strands that make up the bond between doctor and patient. The basis of the doctor-patient relationship is trust—and trust is engendered in ways that include active listening, empathy, compassion and physical contact.

That is not easy. As Kafka wrote in his short book, ‘A Country Doctor’: “To write prescriptions is easy; to come to an understanding with people is hard.” That is the essence of clinical medicine: to come to an understanding with people and with that understanding to accompany them on their medical journey. No matter how sophisticated diagnosis and therapy becomes, patients will still appreciate someone they trust accompanying them on that journey. What comfort can a computer provide? Even if it does have artificial intelligence and even if it can simulate the human touch, it will still be just that—artificial and simulated.

Even with the scientific advances over the past 40 to 50 years, I would contend that this kind of relationship with our patients is just as important as it ever was. With more

chronic disease and in Singapore an ageing population, complex illnesses such as diabetes require a strong bond between doctor and patient to achieve good outcomes. We are far from curative treatments for kidney, liver, lung or heart failure, despite the advances in stem cell research. Neurodegenerative diseases and musculoskeletal disorders are major burdens with only modest advances in most areas. Mental illness remains a major cause of morbidity and progress in the therapeutic management of major psychiatric disorders over the past 40 to 50 years has been incremental but not dramatic.

In cancer treatment there have been significant advances in some areas, but cancers of lung, pancreas, breast, ovary and prostate are still major causes of mortality and the promise of precise therapies based on the genetic and molecular analysis of individual cancers remains just a promise.

I do, of course, share the excitement at the discoveries that have enhanced our knowledge of the pathophysiological basis of human disease and I can envision the amazing progress likely to occur over the next 50 years in the treatment, and hopefully in the prevention, of many of the diseases I have mentioned. But I do not foresee medicine becoming totally mechanised and even if there are effective treatments for all illnesses, they will still need to be managed by caring clinicians with empathy and compassion. Just as insulin was expected to be a cure for diabetes 94 years ago, I expect that many of the so-called cures that will be discovered in the future, will in fact, be imperfect and complex therapies.

Management of Patients with Terminal Illness in the Era of Precision Medicine

One concern about the advent of precision medicine is that we could, as a profession, focus almost entirely on technical treatment of the disease process and lose our view of the whole person, our patient. This danger of applying scientifically sound therapies in circumstances which are futile already occurs frequently in the management of patients with cancer.

In his book *‘Being Mortal’*, Harvard Medical School surgeon Atul Gawande writes “The simple view is that medicine exists to fight death and disease, and that is, of course, its most basic task. But the enemy has superior forces. Eventually, it wins. And in a war that you cannot win, you don’t want a general who fights to the point of total annihilation.” Treatment that is burdensome—both in terms of major side effects and cost—and essentially futile in that it may prolong life by only a few months is already prevalent in the so-called battle against cancer.

In the precision medicine age, we will undoubtedly see major advances in cancer therapy with dramatic and

worthwhile outcomes. At the same time, there will be many other therapies that have only incremental benefit, extending life by a few months at great cost to all concerned. Helping our patients and their families to choose wisely in this situation will require great art.

Sir Murray Brennan, a New Zealand born and educated surgical oncologist, who was Chairman of the Department of Surgery at Memorial Sloan Kettering Cancer Center in New York for over 20 years, spoke at a symposium I attended earlier this year on ‘Affordable Cancer Care.’ He spoke about the extensive practice of futile and burdensome surgery in cancer care because doctors lose sight of what is good for their patients.

And he contrasted the ways that doctors can care for their patients when the decision is made that aggressive treatment of the disease is no longer warranted. An all too common approach is to say, “There is nothing more I can do for you” and to pass the patient on for palliative care management. His recommended approach is to say, “I do not think there is any further benefit to be gained from more surgery. But I will continue to care for you and make sure you receive the best possible treatment.” I believe that is the kind of doctor you and I would like to have caring for us.

So let us make sure that use of the new treatments that will become available as the precision medicine wave rolls in, is matched by a renewed focus on patient-centred care, balancing the science with the art of medicine. Let us afford our patients a good death when the time comes, with all the care that modern medicine can provide, but avoiding futile and invasive treatments that rob them of dignity and precious last moments with their loved ones.

The Rewards from Medicine as a Caring Profession and its Teaching

While doctors who are skilled in the art of medicine provide great benefit to their patients, we should not forget the rewards we receive as clinicians from practising the art of medicine. Robert M Solomon, medical graduate of University of Singapore and bishop of the Methodist Church in Singapore believes that “the quality of the doctor-patient relationship...is guided by the best of human virtues such as altruism, compassion and the desire to alleviate human suffering.” Isn’t that what has drawn us to medicine as a career—the opportunity to share in the lives of others and to lighten their burden in times of trouble? Doesn’t that give meaning to our lives—or at least to our working lives? As the American poet and essayist Ralph Waldo Emerson said: “To know even one life has breathed easier because you have lived. This is to have succeeded.”

So if it is important for doctors to practise the art of medicine well into the future, how should we be equipping

our medical students to learn the art? Again Dr Verghese from Stanford: “What we need in medical schools is not to teach empathy, as much as to preserve it—the process of learning huge volumes of information about disease, of learning a specialised language, can ironically make one lose sight of the patient one came to serve; empathy can be replaced by cynicism.”

Of course we do attempt now to select students in part on the basis of their empathic skills, but that is a very inexact science. At least we demonstrate that we think it is important. Encouraging our students to learn from their patients and from other health professionals is part of the modern curriculum for instilling a sense of empathy and compassion. We can also teach about professionalism and ethical responsibility. The development of professional identity is aided in many medical schools by white coat ceremonies and recitation of the Hippocratic Oath on entry to medical school. Over 100 years ago William Osler urged us to treat medical students as our junior colleagues, surely an important way for them to develop that sense of belonging to our profession.

Innovative programmes in the humanities and medicine use art, literature and poetry to explain the human condition and to help our students come to an understanding of human nature and the effect of illness on the individual. In fact, it is not just students who can benefit from a study of the humanities. William Osler read non-medical classics from 10 to 11 every evening—and just as we keep ourselves up to date with medical literature, we can refresh our commitment to the art of medicine in this way.

With all of these efforts to develop our students as caring professionals, it is the role model that doctors provide to our students that probably has the most impact. Learning by example, just as children tend to emulate their parents’ behaviour, is called the hidden curriculum. That means we all have a responsibility to demonstrate the art of medicine when we are being observed and to practise it even when we are not being observed. Because genuine empathy and compassion are not qualities that can be turned on and off like a tap.

What Can We Learn and Emulate from Gordon Arthur Ransome?

In his collection of aphorisms called ‘*Aequanimitas*’, William Osler wrote “the stories of the lives of the masters of medicine do much to stimulate our ambition and rouse our sympathies.” So what can we learn from that master of medicine and first master of the Academy, Gordon Arthur Ransome, that will stimulate our ambition to practise the art of medicine?

I draw on his entry in Munk’s Roll of the lives of members

of the College of Physicians, which in turn, derives from the writings of his students and colleagues, some of whom have spoken of him at earlier orations in his honour. He is described as kind and softly spoken. He was always ready to answer any cry for help from patients, staff or colleagues. When he was with a patient, he was transported into a world where only the patient mattered—and his patients knew that. He believed that a doctor is placed in a special position to gain the patient’s trust and that a doctor needs to be a student of human nature. He was a master of clinical diagnosis and an enthusiastic and effective teacher, fondly remembered by his students.

I want to emphasise here that Gordon Arthur Ransome loved teaching, as did William Osler. In fact Osler said: “I desire no other epitaph—no hurry about it, I may say—than the statement that I taught medical students in the wards, as I regard this as by far the most useful and important work I have been called upon to do.” I am sure Ransome knew this Oslerian saying and he himself was notorious for becoming so engaged in teaching his medical students that they complained he would often keep them through their lunch period. He believed that students should study history and philosophy—and I am sure he would have approved of the introduction of the study of the humanities into the modern medical curriculum.

As Dean of a medical school, I cannot pass up the opportunity to recommend teaching as another way to maintain our currency in the art and science of medicine, as well as to give back to the profession which has nurtured us.

I mentioned earlier the practice of reciting the Hippocratic Oath at entry to medical school or after graduation. It is usually a modern version such as that endorsed by the World Medical Association. Another interpretation that I particularly like was written in 1964 by the Dean of Tufts University medical school, Dr Louis Lasagna. The first promise in this version is: “I will respect the hard-won scientific gains of those physicians in whose steps I walk, and gladly share such knowledge as is mine with those who are to follow.” And there is another promise that is relevant to my topic this evening: “I will remember that there is art to medicine as well as science, and that warmth, sympathy and understanding may outweigh the surgeon’s knife or the chemist’s drug.”

Clearly, Gordon Arthur Ransome epitomised the art of medicine and we can learn much from his example of selflessness and devotion to his patients. Of course, the world and its ways have changed since he practised medicine here in Singapore. The gender balance of the medical profession has changed and the importance of family and other commitments outside of medicine are acknowledged more readily. We are also challenged by changes that can distance us from our patients, like the computer terminal, the

mask and gloves that are now part of the medical uniform in many settings. But it is the ethos, the spirit of his legacy that we want to emulate and pass on in turn to the future members of the medical profession.

Gordon Arthur Ransome valued medical history and medical books and was a devotee of the works of William Osler. So it is fitting to conclude the oration in his honour

with another aphorism from ‘Aequanimitas’: “The practice of medicine is an art, not a trade; a calling, not a business; a calling in which your heart will be exercised equally with your head.”

Thank you for this singular honour of addressing you this evening.
