Editorial

# Dengue Disease Modelling and Forecasting: Utility and Limitations

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In a joint statement issued earlier this year, the National Environment Agency (NEA) and Ministry of Health (MOH) announced that dengue cases this year would be expected to exceed 30,000—higher than the record of 22,170 experienced in the 2013 dengue epidemic.[1] This forecast was based on retrospective data analyses collected within the past 10 years on Aedes mosquito surveillance, serotype surveillance and weather conditions, as well as statistical modelling based on past incidence of dengue cases. Although the weekly dengue cases showed a rising trend in the first few weeks of 2016, it declined soon after the forecast was announced.[2] Is forecasting therefore accurate or even useful?

Dengue disease forecasting utilises mathematical models, which often integrate multiple parameters, including population susceptibility, duration of infectiousness, transmissibility of the pathogen, geographical, climatic and even pathogen evolutionary factors. Primarily, such efforts are directed at understanding the relative contribution of the various parameters on past disease trends, which are useful to generate hypotheses for further studies. For instance, models have suggested that delaying infection in a population can paradoxically alter the rate of symptomatic infection to cause increased incidence without increases in vector population density.[3] It can also enable us to understand the dynamics of spatio-temporal spread of dengue virus that radiates from urban centres,[4] which would otherwise be impossible to demonstrate through surveillance data alone. Such insights enable policymakers to focus resources on the hub of the problem.[5] Perhaps more importantly, such models have enabled us to calculate the proportion of the population that needs to be vaccinated to achieve herd immunity. This was the basis in which the smallpox eradication programme operated on successfully[6] and is now used to determine the population size that needs to be vaccinated against dengue to prevent outbreaks.[4] Mathematical models have thus contributed much to public health and our understanding of disease epidemiology.

As a forecasting tool, however, the usefulness of mathematical models remains to be demonstrated. History has shown that epidemic outbreak forecasts often fall far short of the mark, as we have witnessed with the recent Ebola outbreak.[7] We propose 2 possible reasons. Firstly, the warning raised by the forecast led to scaled-up disease control efforts. While this is plausible, we are skeptical that this is a major contributory factor to the actual observed disease trend as surge capacity in response to outbreak assumes a pool of readily available trained human resource in disease surveillance and control could be activated at short notice. Secondly, mathematical models necessarily make assumptions on various factors where no data is available. Errors within these assumptions likely limit the predictive ability of models.

Inaccuracies in dengue forecasting have the potential to lead to undue alarm, unnecessary expenditure and resource wastage. A classic example of this was dengue forecasting in the Brazilian 2014 FIFA World Cup. Prior to the event, there was much concern among football fans and public health authorities with regards to the risk of dengue acquisition among travellers to Brazil. The source of this concern was several dengue forecast analyses, which predicted that tourists travelling to match sites would be at high risk of acquiring dengue, with the highest risk predicted in the cities of Fortaleza, Natal, Salvador and Recife.[8-10] Eventually, only 3 cases of dengue affecting tourists were confirmed[11]—all occurring in Belo Horizonte, which interestingly was never regarded as high risk in the forecast. Two other sites, Sao Paulo and Brasilia, also experienced a high incidence of dengue in June 2014, yet were "missed" in the original forecasts.[12] In Singapore, dengue forecasting could, in theory, allow for the timely

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prediction of future outbreaks, giving policymakers sufficient lead-time to implement strategies which could help mitigate dengue transmission, as well as to put in place pre-emptive infrastructural support to allow the country to best cope with a surge in cases. In infectious diseases such as influenza, epidemic forecasting allows governments time to ensure a sufficient stockpile of antivirals and vaccines. The situation is rather different with dengue, which has no vaccine licensed for use in Singapore (Dengvaxia® being approved in only a limited number of countries), or effective antivirals.[13,14] In 2005, Singapore experienced an explosive outbreak with a record number of more than 14,000 dengue cases after many years of low incidence.[15] During that outbreak, dengue admissions overwhelmed the healthcare infrastructure.[16] Since then, every restructured hospital has established dengue protocols for the clinical management of acute dengue. Similarly, the national dengue guideline has continuously undergone update to better inform clinicians on admission criteria based on latest evidence-based practice. These measures have greatly reduced the number of patients requiring hospitalisation for the sole purpose of observation. Furthermore, there are limited number of hospital beds and healthcare workers, with the health system already operating at the limits of capacity constantly. There is thus a limitation to any extra implementation our health agencies can put in place in the face of an impending surge in dengue cases.

Forecasting alone without the capabilities for a swift and robust response can be likened to a body without limbs. The recent Ebola epidemic holds many lessons for how we should prepare for and deal with future outbreaks. This was eloquently articulated in a recent article by Dr Jeremy Farrar, Director of the Wellcome Trust, and Dr Trevor Mundel, President of the Global Health Division at the Bill and Melinda Gates Foundation.[17] Besides having good local health infrastructure in place, there needs to be international coordination to execute effective responses, as well as a transformed approach to research and development of vaccines, drugs or other disease control tools even before an outbreak occurs. Only then can the true potential and utility of forecasting be realised.

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Original Article

# Prevalence of Depression among Older Adults—Results from the Well-being of the Singapore Elderly Study

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## Abstract

**Introduction: Depression is a significant public health issue across all sociodemographic groups and is identified as a common and serious mental health problem particularly among the older adult population. The aims of the current study were to determine the prevalence of depression and subsyndromal depression among older adults in Singapore. Materials and Methods: The Well-being of the Singapore Elderly (WiSE) study was a comprehensive single phase, cross-sectional survey. Stage 1 Geriatric Mental State-Automated Geriatric Examination for Computer Assisted Taxonomy (GMS-AGECAT) depression syndrome was used for this analysis. Association of depression and subsyndromal depression with sociodemographic characteristics, social support as well as comorbidity with chronic physical illnesses and quality of life was assessed. Results: The prevalence of GMS-AGECAT depression and subsyndromal depression was 3.7% and 13.4%, respectively. The odds of depression were significantly higher among those aged 75 to 84 (2.1) as compared to those aged 60 to 74 years and in those who had a history of depression diagnosis by a doctor (4.1). The odds of depression were higher among those of Indian and Malay ethnicities (5.2 and 3.2 times, respectively) as compared to those of Chinese ethnicity. Those with depression and subsyndromal depression were associated with more disability, poorer life satisfaction, and medical comorbidities. Conclusion: Our study suggests that the prevalence of depression seems to have decreased as compared to a decade ago wherein the prevalence of depression was estimated to be 5.5%. This positive trend can be ascribed to concerted efforts across various disciplines and sectors, which need to be continually strengthened, monitored and evaluated.**

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**Key words: Comorbidity, GMS-AGECAT, Social support, Subsyndromal depression**

## Introduction

Depression is a significant public health issue across all sociodemographic groups and is identified as a common and serious mental health problem particularly among the older adult population.[1,2] The World Health Organization (WHO) estimated that the overall prevalence rate of depressive disorders among the elderly in the community ranges from 8% to 20%.[3] Clinically significant depressive symptoms among older adults lead to a number of negative consequences including functional decline, disability, decreased quality of life, comorbid medical conditions[4-6] and an increase in healthcare utilisation associated with increased healthcare costs.[7] In addition, depression is significantly related to a higher suicide rate and higher mortality.[8,9]

Singapore is a multi-ethnic country in Southeast Asia, with a resident population of 3.9 million[10] of which 74.2% are Chinese, 13.3% are Malays, 9.1% are Indians and 3.3% belong to Other ethnic groups. The population of older adults (defined as persons aged 65 years and older) in Singapore has grown significantly over the past few decades. In a study done about 10 years ago, the prevalence rate for syndromal and subsyndromal depression was reported to be 5.5% and 9.6%, respectively among older adults (those aged 60 years and above) in Singapore,[11] while a more recent study reported the estimated prevalence of depressive symptoms among the community-dwelling elderly in Singapore to be 11.4%.[12]

The Well-being of the Singapore Elderly (WiSE) study was initiated in 2011 to provide an updated mental health

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profile of the Singapore elderly, and to inform mental health policy. The aims of the current article were to determine the prevalence of depression and subsyndromal depression among older adults in Singapore according to the Geriatric Mental State-Automated Geriatric Examination for Computer Assisted Taxonomy (GMS-AGECAT) diagnosis.[13] The article also examines the association of sociodemographic characteristics and social support with depression. The extent of disability, comorbidity with chronic physical illnesses and quality of life associated with depression was also assessed.

## Materials and Methods

The WiSE study was a single phase, cross-sectional survey conducted to determine the prevalence of dementia and depression in the Singapore population. A probability sample was randomly selected using a disproportionate stratified sampling design. In order to make inferences of prevalence rates of mental disorders to the entire population of Singapore residents, the survey data were weighted to the 2011 resident population. The study population comprised Singapore residents (including Singapore citizens and permanent residents) aged 60 years and above who were living in Singapore at the time of the survey. Statistical power calculations for binary proportions after adjusting for design effect were estimated to determine the sample sizes for the overall prevalence estimate of dementia, as well as for subgroups by age and ethnicity, with precision of 5%.[14] A target sample size of 2500 was estimated to be adequate to provide sufficient precision to measure the prevalence of dementia.

The interviews were conducted by trained lay interviewers at the residence of the older adult. Respondents who were in day care centres, nursing homes and institutions were included while residents who were living outside the country and not contactable due to incomplete or incorrect addresses were excluded from the study. The 10/66 protocol[15] was adopted for this study. All respondents in the study received the full assessment, lasting approximately 2 to 3 hours. For each selected individual, an informant was chosen and both were administered the culturally adapted version of the 10/66 questionnaires. The study was approved by the institutional ethics review boards of participating institutions (National Healthcare Group Domain Specific Review Board [DSRB] and the SingHealth Centralised Institutional Review Board [CIRB]). All respondents provided written informed consent and for respondents who were unable to provide informed consent, written informed consent was taken from their legally acceptable representative/next of kin. The study has been described in greater detail in an earlier article.[16]

### Assessment of Depression

The Geriatric Mental State (GMS) is one of the most frequently used diagnostic instruments for the elderly. The instrument comprises a semi-structured interview and a rating section, covering psychopathology, sensory functions and frailty. Diagnoses are obtained using the Automated Geriatric Examination for Computer Assisted Taxonomy (AGECAT).[13] The GMS-AGECAT, generates 4 syndrome clusters: organicity (dementia); schizophrenia and related paranoia; depression; and anxiety neurosis. A severity level is provided for each syndrome, ranging from 0 (no symptoms) to 5 (very severely affected). Level 3 and greater constitutes a 'case' while levels 1 and 2 represent 'subcases'. These 'stage 1' diagnoses are then organised into a single 'stage 2' diagnosis on the basis of precedence determined by a hierarchically structured algorithm. A previous study by Kua[17] in Singapore reported that the concordance between AGECAT and the psychiatrist's diagnoses for depression achieved kappa values of 0.88.

Similar to the earlier study by Guerra et al[18] we used the stage 1 GMS-AGECAT depression syndrome for this analysis—this is subsequently referred to as 'GMS-AGECAT depression'. The decision was based on the finding that the sensitivity was consistently higher for the stage 1 than for the stage 2 depression diagnosis, against the Montgomery-Åsberg Depression Rating Scale in the pilot studies.[19] This is explained by the tendency of the AGECAT hierarchical system to accord dementia diagnosis precedence over depression in the hierarchical determination; in other words, stage 2 diagnosis uses dementia as an exclusion criteria for selection into the depression group. All 'cases' were classified as depression while 'subcases' were classified as subsyndromal depression.

### Other Assessments

*Overall Health Status, Physical Activity and Quality of Life*

Overall health status was measured by asking the respondents, "How would you rate your overall health in the past 30 days?" using a 5-point scale (4 = very bad, 3 = bad, 2 = moderate, 1 = good, 0 = very good).

Physical activity was assessed by asking respondents, "Taking into account both work and leisure, would you say that you are very physically active (1), fairly physically active (2), not very physically active (3) or not at all physically active (4)?" Satisfaction with life in general was assessed by asking, "How would you describe your satisfaction with life in general at the present time: good, fair or poor?"

*Other Health Conditions*

The presence or absence of health conditions was determined by asking respondents whether a doctor had ever told them that they had any of the following: depression, hypertension, heart trouble (myocardial infarction, cardiac failure and valvular heart disease), stroke, diabetes and transient ischaemic attacks (TIAs); and self-reports of physical impairments (arthritis or rheumatism; eyesight problems; hearing difficulty or deafness; persistent cough; breathlessness, difficulty breathing or asthma; stomach or intestine problems; faints or blackouts; paralysis, weakness or loss of 1 leg or arm; skin disorders such as pressure sores, leg ulcers or severe burns and cancer) were obtained from the respondents.

*Disability*

The World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0)[20] was used to measure limitation and participation restriction. The instrument was developed for use in cross-cultural comparative epidemiological and health services research. The WHODAS 2.0 measures functioning across 6 domains—cognition, mobility, self-care, getting along, life activities and participation in community activities, over the past 30 days. It uses a 5-point scale that ranges from none (0 – no difficulty) to extreme or cannot do (4 – extreme difficulty).

*Sociodemographic Status*

Participants' ages were established from participant and informant reports and official identification documents. Information was also collected on gender, ethnicity, marital status, education and employment.

*Social Support and Loneliness*

A series of questions related to contact with family members, friends and neighbours were used to assess social support. 'Never', 'less than monthly' and 'monthly' contacts with family, friends and neighbours was used as a proxy measure of lack of social support. While those who reported 'daily', '2 to 3 times a week' and 'at least weekly' were assessed as having social support.

Loneliness has often been measured by a single item in various studies. The questions asked include, "Do you feel lonely?"[21] and "Do you suffer from loneliness?"[22] In the current study, loneliness was measured by a single item, "Do you ever feel lonely?" with 3 response alternatives: "Yes, often", "Yes, sometimes", and "No, never". Participants were also asked specifically if they were bothered or depressed by current loneliness.

*Statistical Analysis*

Statistical analyses were carried out using the SAS System version 9.3. All data analyses were performed using weighted data. A series of multivariate regression models were used to examine sociodemographic correlates of depression, associations between depression and other health outcomes with adjustment for sociodemographic variables such as age, gender, ethnicity, marital status, education and employment status. To account for the effects of complex sample design due to stratification and weighting, standard errors and significance tests were estimated using the Taylor series linearisation method. Multivariate significance was evaluated using the Wald test based on design-corrected coefficient variance-covariance matrices. Statistical significance was set at the conventional level of $P < 0.05$, using two-sided tests.

**Results**

The sociodemographic characteristics of the respondents are shown in Table 1. A total of 2565 respondents were included in the present study. The sample comprised 55.9% female and 44.1% male respondents. Majority of the sample was aged between 60 to 74 years (75%), of Chinese ethnicity (83.3%), and currently married (64%). The prevalence of GMS-AGECAT depression and subsyndromal depression was 3.7% and 13.4%, respectively. Table 1 also shows the prevalence of depression by sociodemographic characteristics of the sample. The odds of GMS-AGECAT depression were significantly higher among those aged 75 to 84 years and those who had a history of depression diagnosis by a doctor, while the odds of both depression and subsyndromal depression were higher among those of Indian and Malay ethnicity. Having no formal education and being divorced/separated was also significantly associated with higher odds of having subsyndromal depression (Table 2).

Table 3 shows the prevalence and odds ratio of other health conditions with depression. After adjusting for covariates in multiple logistic regression analyses, we found GMS-AGECAT depression was significantly associated with heart problem, diabetes, TIA, arthritis or rheumatism, persistent cough, asthma, stomach or intestine problems and paralysis. Subsyndromal depression was associated with stroke, diabetes, TIA, arthritis or rheumatism, eye problems, persistent cough, asthma, stomach or intestine problems, faints or blackouts, paralysis, and skin disorders.

The relationship between depression and disability, quality of life as well as social support is shown in Table 4. The mean disability status (as measured by WHODAS 2.0) was significantly higher among those with depression and subsyndromal depression. Those with depression and

Table 1. Sociodemographic Characteristics of the Sample and Prevalence of Depression

| Demographic Characteristic | Category | n | Unweighted % | Weighted % | SE | GMS-AGECAT Depression | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Cases | | | Subcases | | | Non-Cases | | |
| | | | | | | n | % | SE | n | % | SE | n | % | SE |
| Age group (years) | 60 – 74 | 1494 | 58.2 | 75.0 | 0 | 96 | 59.8 | 5.7 | 226 | 72.5 | 2.7 | 1172 | 76.1 | 0.5 |
| | 75 – 84 | 669 | 26.1 | 19.5 | 0 | 52 | 32.0 | 5.5 | 122 | 21.1 | 2.5 | 495 | 18.6 | 0.5 |
| | 85+ | 402 | 15.7 | 5.5 | 0 | 29 | 8.2 | 2.2 | 77 | 6.5 | 1 | 296 | 5.3 | 0.2 |
| Gender | Men | 1117 | 43.5 | 44.1 | 1.4 | 52 | 32.8 | 5.9 | 149 | 36.7 | 3.6 | 916 | 45.8 | 1.6 |
| | Women | 1448 | 56.5 | 55.9 | 1.4 | 125 | 67.2 | 5.9 | 276 | 63.3 | 3.6 | 1047 | 54.2 | 1.6 |
| Ethnicity | Chinese | 1012 | 39.5 | 83.3 | 0 | 34 | 62.0 | 4.9 | 129 | 78.2 | 1.8 | 849 | 85.1 | 0.3 |
| | Malay | 745 | 29.0 | 9.3 | 0 | 58 | 19.0 | 3.1 | 137 | 11.6 | 1.2 | 550 | 8.5 | 0.2 |
| | Indian | 772 | 30.1 | 6.0 | 0 | 83 | 16.8 | 2.5 | 152 | 8.5 | 0.8 | 537 | 5.1 | 0.1 |
| | Others | 36 | 1.4 | 1.4 | 0 | 2 | 2.2 | 1.5 | 7 | 1.8 | 0.6 | 27 | 1.4 | 0.1 |
| Marital status | Never married | 136 | 5.3 | 8.0 | 0.8 | 7 | 4.2 | 2.8 | 25 | 8.6 | 2.3 | 104 | 8.0 | 0.9 |
| | Married/cohabiting | 1484 | 57.9 | 64.0 | 1.3 | 84 | 63.4 | 5.6 | 209 | 53.1 | 3.7 | 1191 | 65.8 | 1.5 |
| | Widowed | 836 | 32.6 | 22.5 | 1 | 72 | 25.7 | 4.7 | 172 | 29 | 3.1 | 592 | 21.3 | 1.2 |
| | Divorced/separated | 107 | 4.2 | 5.5 | 0.7 | 14 | 6.7 | 2.9 | 19 | 9.2 | 2.4 | 74 | 4.9 | 0.7 |
| Education | None | 511 | 20.0 | 16.5 | 1 | 54 | 28.6 | 5.2 | 110 | 24.3 | 3.1 | 347 | 14.6 | 1 |
| | Some, but did not complete primary | 620 | 24.3 | 23.9 | 1.2 | 37 | 19.9 | 4.8 | 122 | 26.5 | 3.3 | 461 | 23.7 | 1.3 |
| | Completed primary | 640 | 25.1 | 24.8 | 1.2 | 41 | 24.8 | 5.5 | 94 | 21.7 | 3.1 | 505 | 25.3 | 1.4 |
| | Completed secondary | 517 | 20.3 | 22.4 | 1.2 | 28 | 14.1 | 4 | 73 | 19.9 | 3.1 | 416 | 23.1 | 1.3 |
| | Completed tertiary | 262 | 10.3 | 12.4 | 1 | 16 | 12.6 | 4.7 | 24 | 7.6 | 2.1 | 222 | 13.2 | 1.1 |
| Employment | Paid work (part time and full time) | 688 | 27.2 | 33.9 | 1.3 | 27 | 21.0 | 5.4 | 94 | 30.2 | 3.6 | 567 | 35.0 | 1.5 |
| | Unemployed (looking for work) | 32 | 1.3 | 1.5 | 0.4 | 4 | 1.3 | 0.7 | 5 | 1.8 | 1.1 | 23 | 1.5 | 0.4 |
| | Homemaker | 808 | 31.9 | 26.3 | 1.2 | 70 | 36.4 | 5.9 | 166 | 31.4 | 3.4 | 572 | 25.0 | 1.3 |
| | Retired | 1006 | 39.7 | 38.3 | 1.3 | 73 | 41.3 | 6.1 | 156 | 36.5 | 3.6 | 777 | 38.5 | 1.5 |
| Doctor-diagnosed depression | No | | | | | 167 | 94.4 | 2.9 | 417 | 98.5 | 0.8 | 1931 | 98.3 | 0.4 |
| | Yes | | | | | 10 | 5.6 | 2.9 | 8 | 1.5 | 0.8 | 32 | 1.7 | 0.4 |

GMS-AGECAT: Geriatric Mental State-Automated Geriatric Examination for Computer Assisted Taxonomy

Table 2. Sociodemographic Correlates of Depression and Subsyndromal Depression

| Demographic Characteristic | Category | Depression | | | | Subsyndromal Depression | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | OR* | 95% CI | | *P* Value | OR* | 95% CI | | *P* Value |
| Age group (years) | 60 – 74 | Ref. | | | | | | | |
| | 75 – 84 | 2.1 | 1.1 | 3.9 | 0.018 | 1.0 | 0.7 | 1.5 | 0.942 |
| | 85+ | 1.7 | 0.7 | 3.8 | 0.208 | 1.0 | 0.6 | 1.7 | 0.978 |
| Gender | Men | Ref. | | | | Ref. | | | |
| | Women | 1.7 | 0.8 | 3.7 | 0.190 | 1.2 | 0.8 | 2.0 | 0.378 |
| Ethnicity | Chinese | Ref. | | | | Ref. | | | |
| | Indian | 5.2 | 3.1 | 8.7 | <.0001 | 2.1 | 1.6 | 2.8 | <.0001 |
| | Malay | 3.2 | 1.9 | 5.4 | <.0001 | 1.4 | 1.1 | 2.0 | 0.020 |
| | Others | 2.4 | 0.5 | 12.7 | 0.301 | 1.8 | 0.7 | 4.5 | 0.227 |
| Marital status | Married | Ref. | | | | Ref. | | | |
| | Divorced/separated | 1.8 | 0.6 | 5.2 | 0.309 | 2.1 | 1.0 | 4.3 | 0.044 |
| | Never married | 0.6 | 0.1 | 3.0 | 0.577 | 1.3 | 0.6 | 2.6 | 0.489 |
| | Widowed | 0.6 | 0.3 | 1.2 | 0.121 | 1.2 | 0.8 | 1.9 | 0.318 |
| Education | Completed tertiary | Ref. | | | | Ref. | | | |
| | None | 1.6 | 0.5 | 4.7 | 0.403 | 2.5 | 1.2 | 5.4 | 0.018 |
| | Some, but did not complete primary | 0.8 | 0.3 | 2.3 | 0.711 | 1.8 | 0.9 | 3.7 | 0.096 |
| | Completed primary | 1.0 | 0.3 | 2.7 | 0.954 | 1.4 | 0.7 | 2.9 | 0.348 |
| | Completed secondary | 0.6 | 0.2 | 1.7 | 0.321 | 1.3 | 0.6 | 2.7 | 0.477 |
| Employment | Paid work (part time and full time) | Ref. | | | | Ref. | | | |
| | Homemaker | 1.3 | 0.5 | 3.4 | 0.532 | 1.1 | 0.6 | 1.8 | 0.823 |
| | Retired | 1.5 | 0.7 | 3.0 | 0.309 | 1.0 | 0.7 | 1.6 | 0.862 |
| | Unemployed (looking for work) | 1.4 | 0.4 | 5.3 | 0.607 | 1.3 | 0.3 | 6.0 | 0.731 |
| Doctor-diagnosed depression | No | Ref. | | | | Ref. | | | |
| | Yes | 4.1 | 1.1 | 14.9 | 0.030 | 1.2 | 0.3 | 4.2 | 0.826 |

CI: Confidence interval; OR: Odds ratio
*Odds ratio was derived from multinomial logistic regression analysis.

subsyndromal depression were less likely to endorse that their satisfaction with life was 'fair or good'.

## Discussion

The study found that the prevalence of GMS-AGECAT depression and subsyndromal depression were 3.7% and 13.4%, respectively in the multi-ethnic, older adult population of Singapore. Guerra et al[18] reported GMS-AGECAT depression between 30% and 35.9%, across 3 countries in Latin America among those aged 65 years and above. Prevalence of depression as reported by Medical Research Council Cognitive Function and Ageing Study (MRC CFAS) (United Kingdom [UK]) among those aged 65 years and above using GMS-AGECAT was 8.7% (95% CI, 7.3 to 10.2) (age and sex standardised).[23] Prevalence rates reported in studies vary considerably, partly depending on assessment scales and criteria, with symptom scales finding higher rates, than studies based on diagnostic criteria such as the Diagnostic and Statistical Manual of Mental Disorders (DSM) or GMS-AGECAT criteria.[24]

The prevalence of depression among older adults in Singapore seems to be lower than that reported by studies using similar methodology from Latin America and the UK. The low prevalence rate in the current study could be due to cultural differences. Past studies have shown that culture influences the experience and expression of distress symptoms.[25] Liao et al[26] who similarly observed a low prevalence of major depressive disorder (MDD) among the Taiwanese adult population attributed this tendency for under reporting symptoms to 'cultural stoicism'.[27] The concept of 'cultural stoicism' hypothesises that a culturally determined 'response bias' may lead to a lower estimate of the prevalence of emotional problems. However, given the high concordance rate reported by Kua,[17] this explanation

Table 3. Prevalence and Odds Ratio of Other Health Conditions in Depression

| Health Conditions | GMS-AGECAT Depression | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Non-Cases | | Subcases | | | | | | Cases | | | | | |
| | n | % | n | % | OR* | Lower | Upper | *P* Value | n | % | OR* | Lower | Upper | *P* Value |
| High blood pressure | 1156 | 58.6 | 281 | 66.1 | 1.4 | 0.9 | 1.9 | 0.095 | 114 | 53.8 | 0.7 | 0.4 | 1.2 | 0.194 |
| Heart trouble | 275 | 11.3 | 93 | 14.3 | 1.3 | 0.8 | 2.1 | 0.218 | 54 | 25.0 | 2.4 | 1.2 | 4.5 | 0.009 |
| Stroke | 127 | 6.4 | 52 | 13.4 | 2.2 | 1.2 | 3.7 | 0.006 | 20 | 13.3 | 2.2 | 0.9 | 5.1 | 0.071 |
| Diabetes | 571 | 23.5 | 155 | 33.5 | 1.6 | 1.1 | 2.2 | 0.016 | 72 | 40.5 | 1.9 | 1.1 | 3.4 | 0.019 |
| TIAs | 35 | 1.3 | 23 | 3.7 | 3.1 | 1.3 | 7.3 | 0.012 | 13 | 9.1 | 8.5 | 2.6 | 28.2 | <0.001 |
| Arthritis or rheumatism | 507 | 29.9 | 175 | 42.7 | 1.7 | 1.2 | 2.4 | 0.002 | 86 | 48.0 | 2.2 | 1.3 | 3.7 | 0.003 |
| Eyesight problems | 813 | 45.4 | 209 | 60.1 | 1.9 | 1.4 | 2.7 | <0.001 | 92 | 54.0 | 1.6 | 1.0 | 2.7 | 0.077 |
| Hearing difficulty | 398 | 18.3 | 100 | 19.8 | 1.1 | 0.7 | 1.7 | 0.56 | 43 | 23.3 | 1.2 | 0.6 | 2.5 | 0.553 |
| Persistent cough | 74 | 3.2 | 35 | 8.5 | 2.7 | 1.4 | 5.4 | 0.005 | 17 | 8.2 | 2.6 | 1.0 | 6.6 | 0.043 |
| Asthma | 171 | 6.1 | 57 | 12.6 | 2.1 | 1.3 | 3.5 | 0.003 | 33 | 21.3 | 3.3 | 1.6 | 6.7 | 0.001 |
| Stomach or intestine problems | 166 | 10.3 | 64 | 18.8 | 2.2 | 1.4 | 3.5 | 0.001 | 28 | 18.3 | 2.2 | 1.0 | 4.6 | 0.045 |
| Faints or blackouts | 75 | 4.8 | 41 | 11.2 | 2.4 | 1.4 | 4.3 | 0.003 | 13 | 11.1 | 2.5 | 0.9 | 7.1 | 0.089 |
| Paralysis | 207 | 7.0 | 107 | 19.8 | 3.2 | 2.0 | 5 | <0.001 | 44 | 19.9 | 2.7 | 1.4 | 5.3 | 0.004 |
| Skin disorders | 107 | 4.9 | 47 | 13.1 | 2.8 | 1.6 | 4.9 | 0.001 | 22 | 8.1 | 1.6 | 0.8 | 3.4 | 0.208 |
| Cancer | 45 | 2.5 | 11 | 3.3 | 1.5 | 0.6 | 3.9 | 0.41 | 8 | 7.7 | 2.8 | 0.9 | 9.5 | 0.09 |

GMS-AGECAT: Geriatric Mental State-Automated Geriatric Examination for Computer Assisted Taxonomy; OR: Odds ratio; TIAs: Transient ischaemic attack

*Odds ratio was derived from multiple logistic regression analyses after adjusting for age, gender, ethnicity, education, marital status and employment status.

Table 4. Relationship between Depression and Functioning, Quality of Life and Social Support Factors

| Variables | | GMS-AGECAT Depression | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Non-Cases | | | Subcases | | | | | | | Cases | | | | | | |
| | | n | Mean | SE | n | Mean | SE | B* | 95% CI | | *P* Value | n | Mean | SE | B* | 95% CI | | *P* Value |
| WHODAS 2.0 total scores | | 1962 | 8.7 | 0.4 | 425 | 18.7 | 1.6 | 8.8 | 5.7 | 11.8 | <0.001 | 177 | 31.3 | 3.4 | 19.5 | 12.6 | 26.4 | <0.001 |
| | | n | % | SE | n | % | SE | OR† | 95% CI | | *P* Value | n | % | SE | OR† | 95% CI | | *P* Value |
| Overall health status | Moderate to very bad | 29 | 1.5 | 0.4 | 21 | 3.8 | 1.4 | Ref. | | | | 20 | 19.9 | 5.4 | Ref. | | | |
| | Good and very good | 1927 | 98.5 | 0.4 | 404 | 96.2 | 1.4 | 0.4 | 0.2 | 1.1 | 0.065 | 155 | 80.1 | 5.4 | 0.1 | 0.02 | 0.1 | <0.001 |
| Satisfaction with life | Poor | 588 | 35.3 | 1.6 | 215 | 59.6 | 3.8 | Ref. | | | | 109 | 64.6 | 6.0 | Ref. | | | |
| | Fair & good | 1804 | 99.4 | 0.2 | 377 | 95.6 | 1.7 | 0.1 | 0.04 | 0.4 | <0.001 | 145 | 85.1 | 4.4 | 0.03 | 0.01 | 0.08 | <0.001 |

CI: Confidence interval; GMS-AGECAT: Geriatric Mental State-Automated Geriatric Examination for Computer Assisted Taxonomy; OR: Odds ratio

*Beta coefficient was derived from multiple linear regression analysis after adjusting for age, gender, ethnicity, education, marital status and employment status.

†Odds ratio was derived from multiple logistic regression analyses after adjusting for age, gender, ethnicity, education, marital status and employment status.

Table 4. Relationship between Depression and Functioning, Quality of Life and Social Support Factors (Con't)

| Variables | | GMS-AGECAT Depression | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Non-Cases | | | Subcases | | | | | | Cases | | | | | | |
| | | n | % | SE | n | % | SE | OR† | 95% CI | | *P* Value | n | % | SE | OR† | 95% CI | | *P* Value |
| Physically active | Not very physically active or not at all physically active | 573 | 21.3 | 1.2 | 201 | 34.8 | 3.5 | Ref. | | | | 97 | 58.4 | 6.0 | Ref. | | | |
| | Very physically active & fairly physically active | 1390 | 78.7 | 1.2 | 224 | 65.2 | 3.5 | 0.5 | 0.4 | 0.7 | 0.0004 | 80 | 41.6 | 6.0 | 0.2 | 0.1 | 0.4 | <0.001 |
| Loneliness | | | | | | | | | | | | | | | | | | |
| Feeling lonely | No | 1781 | 92.8 | 0.8 | 287 | 69.1 | 3.4 | Ref. | | | | 93 | 48.5 | 6.1 | Ref. | | | |
| | Yes | 182 | 7.2 | 0.8 | 138 | 30.9 | 3.4 | 5.5 | 3.6 | 8.2 | <0.001 | 84 | 51.5 | 6.1 | 13.4 | 7.1 | 25.2 | <0.001 |
| Depressed by current loneliness | No | 1959 | 99.7 | 0.2 | 392 | 91.0 | 2.2 | Ref. | | | | 136 | 74.5 | 5.6 | Ref. | | | |
| | Yes | 4 | 0.3 | 0.2 | 33 | 9.0 | 2.2 | 36.5 | 9.3 | 143.9 | <0.001 | 41 | 25.5 | 5.6 | 161.3 | 35.9 | 724.5 | <0.001 |
| Social support factors | | | | | | | | | | | | | | | | | | |
| Speak to children or other relatives | Never; at least monthly or less often | 311 | 17.7 | 1.2 | 70 | 22.7 | 3.3 | Ref. | | | | 28 | 12.5 | 4.1 | 1.5 | 0.5 | 4.1 | 0.443 |
| | Daily, 2 to 3 times a week or at least weekly | 1647 | 82.3 | 1.2 | 355 | 77.3 | 3.3 | 0.7 | 0.4 | 1.3 | 0.283 | 149 | 87.5 | 4.1 | 1.5 | 0.5 | 4.1 | 0.443 |
| Chat or do something with one of your friends | Never; at least monthly or less often | 917 | 44.5 | 1.6 | 239 | 51.1 | 3.8 | Ref. | | | | 102 | 62.4 | 5.8 | Ref. | | | |
| | Daily, 2 to 3 times a week or at least weekly | 1044 | 55.5 | 1.6 | 186 | 48.9 | 3.8 | 0.8 | 0.6 | 1.1 | 0.192 | 75 | 37.6 | 5.8 | 0.5 | 0.3 | 0.8 | 0.01 |
| Satisfied with the help and support from close friends | Dissatisfied | 235 | 11.6 | 1.0 | 74 | 20.5 | 3.6 | Ref. | | | | 36 | 36.3 | 7.4 | Ref. | | | |
| | Satisfied | 1178 | 88.4 | 1.0 | 204 | 79.5 | 3.6 | 0.5 | 0.3 | 0.9 | 0.013 | 82 | 63.7 | 7.4 | 0.2 | 0.1 | 0.5 | 0.001 |
| Often see any of neighbours to have a chat or do something with | Never; at least monthly or less often | 857 | 45.7 | 1.6 | 212 | 52.7 | 3.8 | Ref. | | | | 89 | 59.5 | 5.9 | Ref. | | | |
| | Daily; 2 to 3 times a week or at least weekly | 1077 | 54.3 | 1.6 | 209 | 47.3 | 3.8 | 0.8 | 0.5 | 1.1 | 0.116 | 87 | 40.5 | 5.9 | 0.5 | 0.3 | 0.9 | 0.014 |
| Has ever felt suicidal or wished to be dead | No | 1814 | 99.3 | 0.3 | 359 | 87.7 | 2.7 | Ref. | | | | 112 | 66.6 | 6.0 | Ref. | | | |
| | Yes | 11 | 0.7 | 0.3 | 35 | 12.3 | 2.7 | 20.2 | 7.6 | 53.7 | <0.001 | 57 | 33.4 | 6.0 | 88 | 31.1 | 249 | <0.001 |

CI: Confidence interval; GMS-AGECAT: Geriatric Mental State-Automated Geriatric Examination for Computer Assisted Taxonomy; OR: Odds ratio

*Beta coefficient was derived from multiple linear regression analysis after adjusting for age, gender, ethnicity, education, marital status and employment status.

†Odds ratio was derived from multiple logistic regression analyses after adjusting for age, gender, ethnicity, education, marital status and employment status.

may not explain our findings and it is possible that prevalence is lower in this population of older Asian adults as compared to that reported from other studies.

The prevalence also seems to have decreased as compared to results from the study conducted a decade ago in the same population that reported prevalence of depression to be 5.5%.[11] Using Chuan et al's prevalence estimates of depression (5.5%) and subsyndromal depression (9.6%), we found that the projected age standardised prevalence of depression and subsyndromal depression in the 2011 population was 8.3% and 14.7%, respectively. The earlier study used probability sampling from a national sampling frame of dwellings and reported a response rate of 72.4% with 1092 older adults participating in the study. The current study had a larger sample size (n = 2565) and investigators had translated the questionnaires into dialects to ensure further inclusivity. A person-level sampling frame was used and the response rate was 65.6%. The sample size was also determined to be adequate for estimating the lower prevalence established in the current study. Statistical power calculations for binary proportions after adjusting for design effect were re-estimated to determine the sample sizes for the overall prevalence estimates of depression, as well as for subgroups by age and ethnicity, with precision of 5%.[14] The design effect after oversampling by age and ethnicity was 2.345. Using 3.7% as a prevalence estimate for depression cases in the current study, we found that the margin of error for the overall prevalence estimate was 1.1%, while the margin of error for the strata defined by age and ethnicity ranged from 1% to 3.4%. Relative standard error (RSE) was calculated and ranged from 17% to 29% and was found to be below the acceptable range of 30%.[28] A target sample size of 2500 was thus estimated to be adequate to provide sufficient precision for the study. Both studies used the GMS-AGECAT to generate the diagnosis of depression. Thus, while there may have been other methodological reasons which may have resulted in a lower prevalence of depression in the current study, it could also indicate an actual decrease in the prevalence. This could largely be due to the national efforts through a Ministerial Committee on Ageing in March 2007, and the Council for Third Age (C3A) in May 2007. Targeted at achieving "Successful Ageing in Singapore", various risk areas for the elderly are addressed from employment and financial security to healthcare and activities.[29] The initiatives include multidisciplinary teams under the Community Psychogeriatric Programme (CPGP) who provide direct care and treatment to home-bound elderly with mental health issues under the National Mental Health Blueprint, 2008. Voluntary welfare organisations such as the Singapore Action Group of the Elders and Presbyterian Community Services have stepped in to support the government initiatives in engaging the elderly and early detection of mental health issues.

The odds of GMS-AGECAT depression and subsyndromal depression were significantly higher among Indians and Malays. Several studies conducted in the Singapore population have shown a higher prevalence of depression among those of Indian ethnicity.[30,31] A study by Soh et al[32] among older adults in Singapore similarly reported that the population prevalence of clinical depression among Malays (6.5%) and Indians (6.8%) was higher than that in Chinese (2.8%). However, such ethnic differences are difficult to explain. It is possible that Indians and Malays have a greater vulnerability that might arise from some genetic and/or sociocultural factors, or that Chinese are more resilient towards developing depression. However, it is also possible that there were ethnic differences in the endorsement of symptoms leading to these differences.

The association of chronic physical illnesses with depression is not surprising and has been reported by numerous other studies.[33,34] The relationship between depression and co-occurring medical illness is complex and studies suggest that depression may increase the risk of subsequent chronic illnesses.[35,36] Simon[37] suggested that while chronic medical conditions are associated with an increased risk of depression, the presence of a chronic medical illness may in fact decrease the chances of recognition and therefore treatment of depression in the setting. The author suggests the use of screening tools to ensure diagnosis and early initiation of treatment. A meta-analysis of interventions in patients with diabetes and depression showed that both psychotherapies and antidepressants were efficacious in treating depression among patients with diabetes.[38] The meta-analysis also examined collaborative care trials and found that collaborative care was more effective in reducing depressive symptoms compared with usual primary care. Studies on patients with cardiac diseases have similarly shown that antidepressants and cognitive behavioural therapy either separately or together[39,40] as well as collaborative care[41] are efficacious in treating patients with cardiac diseases. Thus, having a high index of suspicion and use of suitable screening instruments for diagnosis of depression in a setting that manages the care of older adults with chronic physical conditions, followed by treatment using evidence-based approaches can both reduce the burden of depression and that of the comorbid medical condition in the elderly.

Depression was associated with disability as measured by the WHODAS (2.0) scale in our study. Longitudinal studies suggest that disability is much more likely to affect the increase in the trajectory of depressive symptom over time, as compared to the influence of depressive symptoms on the increase of the disability trajectory over time.[42] Research has also pointed out that disability can be considered as a stressful condition and reactions to the disability such as feelings of worthlessness or hopelessness may contribute

to depression.[43] Our results confirm the widely known association between depression and decreased health-related quality of life in older adults.[44,45] The effect of depression on quality of life can be either direct or it may be indirect through the effect of factors associated with depression that influence quality of life. In our study, the association of depression with comorbid medical conditions, loneliness and lower perceived social support may all lead to a lower quality and satisfaction with life.

Loneliness was found to be positively associated with both depression and subsyndromal depression. A 5-year longitudinal study showed that loneliness predicted changes in depressive symptoms, but not vice versa.[46] However, Luo et al[47] tested the reciprocal associations of loneliness and health, and found that loneliness both affected and was affected by depressive symptoms. In contrast, social support had a protective role with those reporting a supportive social network having lower odds of depression in this study. While our finding is consistent with that of other studies,[48,49] this being a cross-sectional study, we are unable to speculate on the causality. While some longitudinal studies suggest that lack of social support leads to depression,[50] it is possible that depressed individuals shun contact with friends and neighbours as depressive cognition can negatively impact interpersonal functioning. Surprisingly, depression was associated with a lower perceived social support received by friends and neighbours while social support received from family was not perceived as significantly different between the 3 groups. This is in contrast to the study from Hong Kong on older adults that suggested that social support from family members is more important than support from friends.[50]

While there is considerable evidence among the general population that regular participation in physical activity is associated with reduced depression symptoms,[51] data examining this association among older adults is more sparse.[52,53] Thus, the association of depression with lack of physical exercise lends well to interventions that may not be considered stigmatising and older adults may be more receptive to exercise as a treatment for depression than treatments such as medication.

The findings of the study should be interpreted in the context of certain limitations. First, our response rate was 65.6% and it is possible that those who refused to participate in our study were more physically or mentally disabled and the prevalence of depression could have been higher in this group. This being a cross-sectional study, we are unable to establish any temporal relationships between depression and the associated factors. Physical activity was not measured by capturing specific activities in terms of intensity, frequency or time and loneliness was measured by a single question and not by a validated scale. Lastly, older adults may have been reluctant to talk about mental health problems to interviewers due to cultural barriers or the perceived stigma. The strengths of the study include its large sample size, single phase assessment, use of widely accepted assessments and questionnaires, inclusion of a representative sample of the general population that includes those who could speak only local dialects and superior quality control processes.

Our study identified risk factors of depression among older adults which are largely similar to that reported from other studies. We also corroborated the findings of other studies that subsyndromal depression was similar to depression in sharing many of the psychosocial correlates and risk factors, and associations with medical comorbidities. The impact of subsyndromal depression on disability, general health, satisfaction with quality of life and disability was significant, though the effect sizes were lower, emphasising the need to screen for and treat subsyndromal depression especially among older adults. Also a significant number of those with depression and subsyndromal depression endorse having suicidal thoughts and hence the need to stay vigilant and the role of active screening and treating those with depression cannot be over emphasised.

Most importantly, our study has shown a decrease in the prevalence of depression among older adults in Singapore over a period of 10 years. While there seems to be a positive trend brought about by a concerted effort across various disciplines and sectors, the efforts need to be further strengthened, monitored and evaluated.

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Original Article

# Elderly Hospitalised Patients—The Impact of Itch and its Prevalence

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## Abstract

**Introduction: Pruritus in elderly patients can have a significant impact on the quality of life but may be underestimated and poorly addressed by healthcare professionals. Materials and Methods: From March to May 2010, a structured interview questionnaire including the Dermatology Life Quality Index (DLQI) was administered to all patients admitted to the geriatric ward in Changi General Hospital, Singapore, except for those with cognitive impairment. Results: A total of 194 patients were enrolled in the study; 94 patients (48.5%) were experiencing itch at the point of the interview; mean DLQI score for patients with itch was 6.7; 35.1% of patients experienced sleep disruption whilst 30.9% reported impairment of concentration levels as a consequence of their itch. Of the patients who had informed their doctor about the problem, 73.7% felt that doctors had not adequately addressed the cause of the itch. Among patients who reported itch, the DLQI score correlates with the severity of pruritus with a regression coefficient of 0.2737 (*P* <0.001); 9.6% of patients with itch were independent with their activities of daily living compared to 21% of patients who did not experience itch. Conclusion: Almost half of the subjects in our study experienced itch and a third of them reported impairment of quality of life. Patients who were independent of their activities of daily living were also less likely to experience itch. This study highlights the importance of increasing awareness of pruritus among physicians as pruritus can have adverse consequences on patients' quality of life when left unaddressed.**

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**Key words: Concentration, Geriatric, Inpatient pruritus, Quality of life, Sleep**

## Introduction

Pruritus, or itching, is an uncomfortable sensation often leading to the urge to scratch. Although it is the commonest symptom in patients presenting to dermatologists, pruritus may or may not be associated with an underlying skin condition. It can lead to adverse consequences on patients' quality of life, including disruption of normal sleep patterns and poor day time concentration, essential for daily activities. A study by Beauregard and Gilchrest showed that 83% of octogenarians reported concerns about their skin, with pruritus being the most common complaint.[1] Another study showed that elderly patients had a 3-fold increased risk of pruritus due to the higher prevalence of common skin conditions such as dermatitis, fungal infections, benign tumours and viral infections.[2] Itch may also be contributed by coexisting illnesses e.g. renal impairment, hypothyroidism, iron deficiency and liver impairment, as well as their medications. Studies have shown that pruritus correlates with anxiety in patients with conditions such as atopic dermatitis, burns and psoriasis.[3-5]

The aim of this study is to ascertain the prevalence, perceived severity and impact of itch on the quality of life in an elderly inpatient population in a general hospital in Singapore.

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## Materials and Methods

### *Study Population and Patient Recruitment*

We conducted a hospital-based, cross-sectional observational study over a period of 3 months from March to May 2010. The study was approved by the Domain Specific Review Board. All patients aged 75 years and above who were admitted to the geriatric wards of Changi General Hospital, Singapore were invited to participate in the study. These patients were admitted for various medical problems, which may not have been related to their itch or skin condition. Verbal consent was obtained from patients. Patients who had a history of cognitive impairment were excluded from the study. All patients enrolled were interviewed using a structured questionnaire, which included a Dermatology Life Quality Index (DLQI) survey.

### *Questionnaire and Dermatology Life Quality Index (DLQI) Survey*

Information obtained included the presence and duration of itch. For patients with itch, the severity was graded by the patient on a scale of 1 to 10, with 1 being very mild and 10 being very severe. This was based on the current severity of pruritus on the day of the interview. The impact of itch on the patient's lifestyle was also graded on a scale of 1 to 10, with 1 being "not bothered" to 10 being "most bothered". The impact of itch on sleep disruption, concentration levels and social interaction was also recorded. Patients were also asked if they had prior discussion about their itch problem with a medical professional, and if they did, whether they had informed their primary care physician, geriatrician or other specialist. For patients who had informed their doctors about the problem, they were asked if they felt their doctor had adequately addressed the cause for the itch and what treatments were prescribed. The use of systemic and topical over-the-counter medications, and traditional medications, were also documented. In particular, we queried about the use of moisturisers, medicated oils, "snake-powder" (commonly available traditional powder containing sulphur), cold or hot water and/or ice. Patients were also asked whether they had a history or current skin diseases and if they felt that they had a problem with dry skin. The patients' social background was ascertained, specifically to determine the patients' living arrangements (i.e. living alone, with or without a caregiver, or if they were living in a nursing home). Finally, the patients were asked if they would prefer a dermatologist to assess and treat their itch.

All patients who experienced itch were assessed on the impact of pruritus on their quality of life with the DLQI. The DLQI consists of 10 questions covering 6 different aspects of day-to-day living: symptoms and feelings (2 questions), daily activities (2 questions), leisure (2 questions), work or studying (1 question), personal relationships (2 questions) and treatment (1 question). Each question is graded on a score of 0 to 3 and the total score was calculated by adding the score of each question. The minimum score is 0 and the maximum score is 30. The higher the score, the more a patient's quality of life was adversely affected. As Singapore has a few common languages, patients were asked the DLQI questions through an interpreter if English was not the patients' first language and if the interviewer was not fluent in the patients' first language.

### *Data and Statistical Analysis*

Statistical analysis was done using SPSS software (version 18.0; SPSS Inc, Chicago, IL). Continuous variables were presented as mean ± standard deviation or median (interquartile range). Categorical variables were expressed as percentages. The nominal qualitative variables were compared using the chi-squared test, or Fisher's exact test if the validity conditions of the chi-squared test were not met.

## Results

### *Survey Population Characteristics (Table 1)*

We enrolled a total of 194 patients, with a mean age of 85.4 years (range, 75 to 103 years) and a male to female ratio of 2:3. There was no significant difference between the mean age, gender ratio and ethnic distribution of patients with and without itch.

### *Characteristics of Patients with Itch*

Ninety-four of the 194 patients (48.5%) reported itch. The mean duration of itching was 15.3 months (95% CI, 9.6 to 21.0 months), with a mean severity score of 3.9/10. Sleep disruption was reported in 35.1% (33/94), and 30.9% (29/94) reported difficulty concentrating on their daily

Table 1. Demographic Data Comparing Patients With and Without Itch

| | With Itch (n = 94) | Without Itch (n = 100) | *P* Value |
|---|---|---|---|
| Age (years), mean (range) | 85.4 (75 – 103) | 84.6 (75 – 99) | 0.3752 |
| Gender, n (%) | | | |
| Male | 41 (44.7%) | 32 (32.0%) | 0.1047 |
| Female | 53 (56.3%) | 68 (68.0%) | 0.1047 |
| Ethnicity, n (%) | | | |
| Chinese | 75 (79.8%) | 85 (85.0%) | 0.3524 |
| Malay | 14 (14.9%) | 13 (13.0%) | 0.8360 |
| Indian | 4 (4.3%) | 2 (2.0%) | 0.4332 |
| Others | 1 (1.1%) | 0 (0.0%) | 0.4845 |

activities due to the itch. The mean DLQI score for patients who reported itch was 6.7.

Of the patients with itch, 60.6% (57/94) of them had discussed the problem with at least one of their doctors, with the highest proportion informing their general practitioner (70.2%, 40/57), and a smaller proportion informing their geriatrician (22.8%, 13/57). One patient had informed both the general practitioner and geriatrician, and one patient informed a gastroenterologist as part of an outpatient hospital consult. Amongst the patients who had informed their doctor about the problem, 73.7% (42/57) felt that the doctor had not adequately addressed the cause of the itch. Of these patients, 20 were diagnosed with a specific dermatosis, with 13 patients with a history or current diagnosis of eczema, 4 patients with dematophyte infection, 1 patient with lichen simplex chronicus, 1 patient with background eczema as well as irritant contact dermatitis to medicated oils and 1 patient with postherpetic neuralgia.

*Treatment for Itch*

Of the 57 patients who had consulted their doctors about itch, 33 (57.9%) were prescribed with topical treatments only, 2 patients (3.5%) were prescribed oral antihistamines only, 19 patients (33.3%) were treated with a combination of topical treatments and oral antihistamines, and 3 (5.3%) were not prescribed any medications. Of the topical treatments prescribed, 42 were prescribed with moisturisers, most commonly aqueous cream and 10% urea cream, 26 were prescribed a topical corticosteroid, 8 with topical antifungals and 4 with 10% methylsalicylic acid cream. Of the patients prescribed oral antihistamines, 81% (17/21) were given sedating antihistamines e.g. hydroxyzine, whilst 19% (4/21) were treated with a non-sedating antihistamine.

Self-medication was common among patients with itch, with 17% (16/94) self-medicating with over-the-counter topical preparations, and a further 28.7% (27/94) using traditional medicated oils or powders.

*Social Background and Caregiver Status (Table 2)*

Patients without itch (21/100, 21%) were more likely to be independent with regard to activities of daily living as compared to patients who complained of itch (7/94, 9.6%) ($P$ = 0.024). The majority of patients in this study resided with family members and only a small proportion of them were either staying alone or in a sheltered or nursing home. There was no statistically significant difference with regards to living arrangements between the group with itch and the group without itch. Those who required help with activities of daily living depended mostly on their children or domestic help.

Table 2. Characteristics of the Social Background and their Main Caregivers in the Itch and Non-itch Groups

| | With Itch (n = 94) (%) | Without Itch (n = 100) (%) | *P* Value |
|---|---|---|---|
| Social background | | | |
| Living arrangement | | | |
| Staying alone | 5 (5.3%) | 4 (4%) | 0.742 |
| With other family members | 55 (58.5%) | 72 (72%) | 0.051 |
| With other family members and domestic helper | 21 (22.3%) | 17 (17%) | 0.371 |
| Domestic helper | 1 (1.1%) | 0 (0%) | 0.485 |
| Sheltered home | 2 (2.1%) | 0 (0%) | 0.234 |
| Nursing home | 10 (10.6%) | 7 (7%) | 0.450 |
| Main caregiver | | | |
| None | 7 (7.4%) | 21 (21%) | 0.024 |
| Family | 53 (56.4%) | 55 (55%) | 0.886 |
| Domestic helper | 22 (23.4%) | 17 (17%) | 0.287 |
| Sheltered home | 2 (2.1%) | 0 (0%) | 0.234 |
| Nursing home | 10 (10.6%) | 7 (7%) | 0.450 |

*Effect of Itch on DLQI Scores*

Among patients who reported itch, the DLQI score correlates with the severity of pruritus with a regression coefficient of 0.2737 ($P$ <0.001).

## Discussion

Itch may occur in the presence or absence of skin lesions. Acute pruritus lasts less than 6 weeks while chronic pruritus persists for longer than 6 weeks. The sensation of itch is mediated by the cutaneous afferent C-fibres in the skin. A study in mice has shown that reduction in the production of prostaglandin D2 may also lead to itch.[6] Elderly patients are also at increased risk of pruritus due to xerosis.[7]

Our study shows that pruritus is a common symptom in the geriatric population. This may be attributed to common dermatological conditions such as eczema and tinea infection as shown in a study by Liao et al. However, this study was a retrospective analysis studying the prevalence of skin conditions amongst patients presenting to a university dermatology outpatient clinic. The prevalence of itch in our study population is similar to a study by Thaipissuttikul which showed that 41% of an elderly population in Thailand had pruritus.[8] This study was however different from ours as patients were recruited from a dermatology clinic. In a large study in Turkey involving 4099 subjects who were either admitted or evaluated in clinic, the pattern of skin conditions observed were similar to our study

with a predominance of eczema, dermatophyte and viral infections.[9] In a retrospective analysis of patients above 65 years of age admitted to a dermatology department in Eastern Turkey, eczema, fungal infections, urticaria and bacterial infections were the most commonly observed dermatological conditions. This study however included all-comers and did not specifically include elderly patients who presented with pruritus.[10] The study by Beauregard and Gilchrest included a questionnaire although it was performed on non-institutionalised subjects. In their cohort of patients between 50 and 91 years, many subjects especially those above the age of 80 years were particularly less able to perform daily tasks including bathing, shampooing, and nail care. This may be the reason why our study showed that patients who were independent were less likely to have itch.[1]

In our study, patients reported that their pruritus was not well addressed by their doctors. This may be because many of these patients do not manifest any specific skin lesions and doctors may lack the expertise and knowledge to treat pruritus. Primary physicians may also selectively focus on managing other comorbidities in these patients. Our study emphasises the need for primary care doctors and geriatricians, who regularly see elderly patients in their practices, to be mindful of the increased prevalence of itch and its effects on the quality of life in this population of patients. Early evaluation and treatment or onward referral to a dermatologist is important to reduce the psychosocial morbidity associated with severe itch in the elderly.

There were several limitations in our cross-sectional study. As our patients were enrolled from an inpatient geriatric ward in a general hospital, they may have represented a select group of elderly patients with more comorbid problems as compared to the general elderly population. The data collected is based on the patients' history and may be affected by recall bias.

## Conclusion

In summary, our study demonstrates that pruritus is a common problem among the elderly. It can have considerable effect on patients' quality of life, in particular their ability to carry out their activities of daily living and also importantly affect their sleep.

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Original Article

# Alcohol Use Disorders amongst Inpatients in a General Hospital in Singapore: Estimated Prevalence, Rates of Identification and Intervention

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## Abstract

**Introduction: Many alcohol-related problems often go undetected and untreated. In Singapore, no epidemiological studies have been done in general hospitals on alcohol use disorders (AUD), i.e. alcohol dependence and abuse (DSM-IV-TR). Such findings are useful in planning AUD liaison services. In this study, we aim to estimate the prevalence of AUD among non-psychiatric inpatients and to determine the rates of identification and intervention rendered by medical staff. Materials and Methods: Non-psychiatric medical and surgical wards inpatients aged 21 years and above were recruited over a 3-month period. The Alcohol Use Disorders Identification Test (AUDIT) was used to screen for AUD and the MINI International Neuropsychiatric Interview (MINI English Version 5.0.0) was administered to diagnose AUD if the AUDIT score was 8 or above. Case notes were independently reviewed for AUD identification and if interventions were offered during admissions. Results: A total of 5599 inpatients were screened, of which 673 (12%) completed the screening using the AUDIT, and of these, 154 (2.8% of total sample) were positive for AUDIT. In this group, 107 were diagnosed with AUD. The estimated prevalence was 1.9% (approximately 400 cases per year per hospital). The medical staff identified only 25 (23.4%) cases of AUD, out of which, majority of them (76%) were rendered interventions. Conclusion: The rate of AUD identification by medical staff was low. Of those identified, majority were given interventions. Thus, the training of health care staff to identify AUD together with the implementation of brief interventions should be considered.**

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**Key words: Alcoholism, Consultation liaison, Epidemiology**

## Introduction

Alcohol consumption is common worldwide. Global prevalence rates of alcohol use disorders (AUD) i.e. alcohol dependence and alcohol abuse according to 'Text Revision' of the Diagnostic and Statistical Manual of Mental Disorders Version 4 (DSM-IV-TR) among adults were estimated to range from 0% to 16% in 2004, with the highest prevalence rates found in Eastern Europe. The point prevalence of AUD for males is estimated to be highest in Eastern European countries, in parts of Southeast Asia and in selected countries in the Americas. For females, the highest estimated prevalence rates of AUD were found in Eastern European countries and in selected countries in the Americas and in the Western Pacific Region.[1] In Singapore, according to the National Health Surveillance Survey in 2007, 1.2% of local residents aged 18 to 69 years, consumed alcohol regularly (more than 4 days per week).[2] A population-based survey of mental disorders in Singapore conducted from 2009 to 2010 revealed that the lifetime prevalence of alcohol abuse and alcohol dependence was 3.1% and 0.5%, while the 12-month prevalence of alcohol abuse and alcohol dependence was 0.5% and 0.3%, respectively. The lifetime and 12-month prevalence of AUD was 3.6% and 0.8% respectively.[3]

AUD poses a major impact on public health.[4] It was the fourth leading disease accounting for 3.5% of the life loss measured as disability-adjusted life-years in developed countries in 2000[5] and may cause different physical illnesses

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and mishaps.[6] Among hospitalised patients, it was found that the prevalence of AUD ranged from 7.4% to 48%, which was greater compared to the general population.[7-18] This large variation in the prevalence of AUD is largely attributed to the different methodologies used to define alcohol abuse or dependence and population heterogeneity.

Despite the high prevalence and associated morbidity and mortality, diagnosing AUD as part of the medical assessment is often neglected by the medical team and, as a result, is often under-reported in hospital records and hence undertreated. Some studies have shown that identification of AUD by the medical team ranges from 7% to 89%, depending on the department where the patient is hospitalised and the methodology used for diagnosis.[15-20] There is evidence to support the use of screening questionnaires to help identify patients with alcohol problems and that brief interventions during hospitalisation would be effective in reducing alcohol consumption.[20-23] Hospitalisation is, therefore, an excellent opportunity to identify patients with AUD and initiate brief interventions.

In Singapore, there have been no previous epidemiological studies done on inpatients with AUD or reviews conducted to determine the rates of identification and intervention of this problem by general hospital medical staff. The findings from this study will be useful in planning liaison services for AUD in the general hospital.

The purposes of this study are to estimate the prevalence of AUD among non-psychiatric inpatients in a general hospital, and to determine the rates of identification and intervention rendered by the medical staff.

## Materials and Methods

### *Study Setting*

Changi General Hospital (CGH) is a 790-bedded restructured hospital (in 2008) covering the eastern region of Singapore's population in an island of 710.2 $km^2$ with a multi-ethnic (Chinese 74.1%, Malays 13.4%, Indians 9.2% and Others 3.3%), multireligious population of 5.18 million.[24] The local hospital data shows a slightly higher proportion of Malays (17.1%) admitted compared to the demographics of Singapore (13.4%). The monthly average number of admissions was 3500 in 2008. CGH has both medical and surgical wards with no paediatric, obstetric and gynaecological inpatients.

### *Study Subjects*

The study population consisted of CGH patients who were admitted consecutively and subsequently remained in the hospital for at least 24 hours between 8 September 2008 and 5 December 2008.

The exclusion criteria were: 1) patients below 21 years of age; 2) patients from the psychiatric ward; the forensic and infectious disease wards, and the medical and surgical intensive care units; 3) patients who were recruited during earlier admission within the study period; and 4) patients who lacked physical or cognitive capacity to give consent. Approval was sought from the Institutional Ethics Committee to conduct the study.

### *Measures*

Four research coordinators, who were psychology graduates, carried out the study procedure. They first asked the patient a brief question on whether they had consumed alcohol over the past 1 year. If the answer was yes, they proceeded with the following:

1. Screening phase: the research coordinator administered the Alcohol Use Disorders Identification Test, World Health Organization (AUDIT)[23] to screen for AUD.

   AUDIT is a 10-item questionnaire, covering quantity, frequency, inability to control drinking, withdrawal relief, loss of memory, injury and concern by others in the last 12 months. The final score of this test ranges from 0 to 40, with scores greater than or equal to 8 (the cutoff point generally used in research) indicating that the patient most likely has an alcohol-related disorder. This test's sensitivity lies between 61% and 96% and its specificity lies between 84% and 96%.[25-28]

   AUDIT was administered by the interviewers using the English version and the mean length of the interviews was about 5 minutes. When the inpatients were not conversant in English, the interviewers were trained to ask the questions in Mandarin or Malay in a consistent manner. Neither the English version nor any other translations of the AUDIT have been validated in Singapore although they are commonly used to screen for AUD here.

2. Diagnostic phase: for patients screened positive (i.e. AUDIT = 8 points or more), the diagnostic interview (MINI International Neuropsychiatric Interview MINI English Version 5.0.0 – alcohol abuse and dependence section) was conducted by the same research coordinator. The MINI provided a DSM-IV-TR diagnosis of alcohol abuse or dependence (AUD) in this study.

   An additional questionnaire was administered to these patients to obtain basic demographic information such as age, gender, marital status and ethnicity.

*The Survey*

This is a cross-sectional hospital-based study. Of the 6527 potential patients, 5599 patients consented to the study. Basic demographic data collection and AUDIT were administered to 673 patients who had indicated having consumed alcohol over the past one year.

Patients (n = 154) with AUDIT score ≥8 points, were further subjected to the MINI diagnostic interview. In total, 107 patients were diagnosed with AUD. Case records of these patients were traced after discharge, looking specifically for documentation of AUD identification by the medical staff during the same admission of study and alcohol interventions rendered.

The following were considered to be alcohol interventions: inpatient interventions (e.g. counselling, psychoeducation on AUD, inpatient detoxification, inpatient referral to psychiatrist for detoxification and alcohol treatment); outpatient alcohol-related management plans (e.g. general hospital psychiatric clinic, mental hospital for alcohol treatment, self-help groups like Alcoholics Anonymous, counselling services like Family Service Centre or others); or both.

As part of ethical concerns, all patients who had consumed alcohol in the previous one year were given a brochure ('Alcohol and Your Health') advising on various addiction services available. This was deemed necessary by the study team as the attending physicians and nurses were not alerted to the presence of alcohol consumption or AUD as per study protocol.

*Statistical Analysis*

Statistical data analyses were performed using SPSS, version 15.0 (SPSS, Chicago, IL). The prevalence of AUD with its corresponding 95% confidence interval (CI) was calculated. We examined the sociodemographic data (age, gender, marital status and ethnicity) for significant association for patients identified to have AUD. The chi square test or Fisher's Exact test was applied for these categorical variables. Statistical significance was set at $P < 0.05$. We postulated that the prevalence of AUD was around 20% and to achieve a precision of ±0.2%, 1500 subjects would have to be screened.

## Results

*Clinical Characteristics*

In total, there were 10,818 patients admitted during the 3-month study period. Although we had data on the number of readmissions (2104) to the hospital, we omitted keeping track of the number of cases that were excluded because they were studied in earlier admissions during that period.

Following exclusion, we had 6527 potential participants; 908 of them who could not be recruited for reasons of discharge or transfer before the research coordinator could reach them, and 20 refused to participate in the study. The rest (5599 or 85.8% of potential participants) were asked if they had consumed alcohol over the past one year, of which 673 (12%) of them said they did. There were 154 participants who were screened positive for AUD using AUDIT, of which 107 of them were diagnosed to have AUD after undergoing the MINI diagnostic interview (Fig. 1).

The sociodemographic characteristics of the 107 patients diagnosed to have AUD using MINI (i.e. MINI positive) are shown in Table 1.

*Age*

The mean age was 38.5 years old (standard deviation (SD) 14.0) and the median was 34 years old. Majority of them (57%) were in the age group between 21 to 39 years

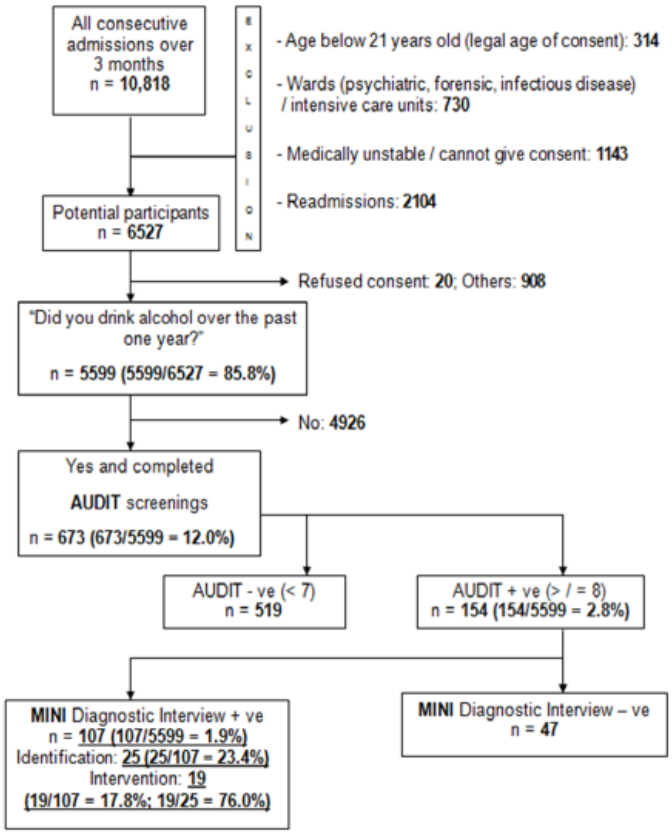


Fig. 1. Procedural flow diagram.
AUDIT: Alcohol Use Disorders Identification Test; MINI: Alcohol abuse and dependence section of MINI International Neuropsychiatric Interview (MINI English Version 5.0.0).

Table 1. Basic Sociodemographic Features of Patients Diagnosed with AUD Using MINI Positive

| | MINI Positive (n = 107) |
|---|---|
| Age (years) | |
| Mean (SD) | 38.5 (14.0) |
| Median | 34 |
| Minimum, maximum | 21, 77 |
| Age (years), n (%) | |
| 21 – 29 | 38 (35.5)<br>Abuse/dependence: 9/29 |
| 30 – 39 | 23 (21.5)<br>Abuse/dependence: 3/20 |
| 40 – 49 | 17 (15.9)<br>Abuse/dependence: 5/12 |
| 50 – 59 | 20 (18.7)<br>Abuse / Dependence: 2/18 |
| 60 – 69 | 7 (6.5)<br>Abuse/dependence: 2/5 |
| 70 & over | 2 (1.9)<br>Abuse/dependence:1/1 |
| Gender, n (%) | |
| Male | 96 (89.7)<br>Abuse/dependence: 21/75 |
| Female | 11 (10.3)<br>Abuse/dependence: 1/10 |
| Marital status, n (%) | |
| Married | 39 (36.5)<br>Abuse/dependence: 10/29 |
| Others (single, divorced, widowed) | 68 (63.6)<br>Abuse/dependence: 12/56 |
| Ethnicity, n (%) | |
| Chinese | 61 (57.0)<br>Abuse/dependence: 17/44 |
| Malay | 13 (12.2)<br>Abuse/dependence: 3/10 |
| Indian | 25 (23.4)<br>Abuse/dependence: 2/23 |
| Others | 8 (7.5)<br>Abuse/dependence: 0/8 |

AUD: Alcohol use disorders; MINI: MINI International Neuropsychiatric Interview; SD: Standard deviation

old. Within the same age group, although there were more patients with alcohol dependence compared to those with abuse, this was not statistically significant ($P = 0.37$).

*Gender*

There were 96 (89.7%) male and 11 (10.3%) female patients. Within the same gender, although there were more patients with alcohol dependence compared to abuse, this was not statistically significant ($P = 0.29$).

*Marital Status*

There were 39 (36.5%) participants who were married and the majority (68, 63.6%) were single, divorced or widowed. Within the same marital status, although there were more patients with alcohol dependence compared to abuse, this was not statistically significant ($P = 0.33$).

*Ethnicity*

There were 61 (57%) Chinese, 13 (12.2%) Malays, 25 (23.4%) Indians and 8 (7.5%) of Other ethnic group. Within the same ethnic group, although there were more patients with alcohol dependence compared to abuse, this was not statistically significant ($P = 0.09$).

For the 107 AUD (MINI positive) patients, 62 (57.9%) had AUDIT score of 8-12, and 45 (42.1%) had AUDIT score of 13 or more. However, following MINI diagnostic interview, 22 (20.6%) were diagnosed to have alcohol abuse and 85 (79.4%) were diagnosed to have alcohol dependence. Of those with AUDIT score of 8-12, only 21% were diagnosed to have alcohol abuse using MINI while the rest were diagnosed to have alcohol dependence. For the 47 patients who were screened positive using AUDIT but not diagnosed to have AUD (MINI negative), 36 had AUDIT scores of 8-12 and 11 had AUDIT scores of 13 or more.

These reflect the variation in sensitivity and specificity of AUDIT screening in our local population. As there may be possible under-reporting of alcohol usage from patients when screened using AUDIT, a lower AUDIT score may have to be used as a cutoff point for our local population to increase the specificity of AUDIT.

*Estimated Prevalence of AUD*

The estimated prevalence of AUD over the 3-month period was 1.9% (107/5599), 95% confidence interval (CI) (1.6% to 2.3%; EB Wilson 1927).

*Physician's Identification of AUD*

The medical records of the 107 patients diagnosed to have AUD (MINI positive) were reviewed. The medical staff correctly identified 23.4% (25/107) of the AUD (MINI positive) cases.

Comparison of the sociodemographic characteristics of the 25 patients who were correctly identified to have AUD by the medical staff versus the 82 patients who were not identified to have AUD is shown in Table 2.

*Age*

For the 25 patients, their mean age was 46.6 years old (standard deviation 9.8) and the median was 49 years old.

Majority of them (18, 72%) were in the age group between 40 to 59 years old. For the other 82 patients, their mean age was younger at 36.1 years old (SD 14.2) and the median was 31 years old. Majority of them (56, 68.3%) were in the younger age group between 21 to 39 years old. The rate of identification of AUD was lower in patients who were younger and this was statistically significant ($P$ <0.05).

*Gender*

For the 25 patients, majority (24, 96%) were males. For the other 82 patients, 72 (87.8%) were males and 10 (12.2%) were females. There were more males than females in both the AUD identified and AUD non-identified groups, with no significant difference in the two groups ($P$ = 0.22).

*Marital Status*

For the 25 patients, majority (20, 80%) were single, divorced or widowed. For the other 82 patients, 34 (41.5%) were married and 48 (58.5%) were single, divorced or widowed. There were more patients who were single, divorced or widowed than those married in both the AUD identified and AUD non-identified groups, with no significant difference in the two groups ($P$ = 0.06).

*Ethnicity*

For the 25 patients, majority (15, 60%) were Indians, followed by Chinese (6, 24%), Malay (2, 8%) and Others (2, 8%). For the other 82 patients, majority (55, 67.1%) were Chinese, followed by Malay (11, 13.4%), Indian (10, 12.2%) and Others (6, 7.3%). It is noted that the percentage of Malays served in this sector is slightly higher at 17.1% as compared to 13.4% in the general population. The rate of identification of AUD was higher in patients who were Indians as compared to those who were non-Indians, specifically the Chinese, and this was statistically significant ($P$ <0.05).

Table 2. Basic Sociodemographic Features of Patients Identified/Not Identified to Have AUD by Medical Staff

| | AUD Identified by Medical Staff (n = 25) | AUD Not Identified by Medical Staff (n = 82) | *P* Value |
|---|---|---|---|
| Age (years) | | | |
| Mean (SD) | 46.6 (9.8) | 36.1 (14.2) | |
| Median | 49 | 31 | - |
| Minimum, maximum | 25, 62 | 21, 77 | |
| Age (years), n (%) | | | |
| 21 – 29 | 1 (4.0) | 37 (45.1) | |
| 30 – 39 | 4 (16.0) | 19 (23.2) | |
| 40 – 49 | 8 (32.0) | 9 (11.0) | <0.05 |
| 50 – 59 | 10 (40.0) | 10 (12.2) | |
| 60 – 69 | 2 (8.0) | 5 (6.1) | |
| 70 & over | 0 (0.0) | 2 (2.4) | |
| Gender, n (%) | | | |
| Male | 24 (96.0) | 72 (87.8) | 0.22 |
| Female | 1 (4.0) | 10 (12.2) | |
| Marital status, n (%) | | | |
| Married | 5 (20.0) | 34 (41.5) | 0.06 |
| Others | 20 (80.0) | 48 (58.5) | |
| Ethnicity, n (%) | | | |
| Chinese | 6 (24.0) | 55 (67.1) | |
| Malay | 2 (8.0) | 11 (13.4) | <0.05 |
| Indian | 15 (60.0) | 10 (12.2) | |
| Others | 2 (8.0) | 6 (7.3) | |

AUD: Alcohol use disorders; SD: Standard deviation

*Physician's Interventions for AUD*

Of the 25 patients diagnosed to have AUD, 19 of them (76%) were rendered interventions. Comparison of the sociodemographic characteristics of the 19 patients who were rendered interventions by the medical staff versus the 88 patients who were not rendered interventions is shown in Table 3.

*Age*

For the 19 patients, their mean age was 47.5 years old (SD 9.4) and the median was 50 years old. Majority of them (14, 73.7%) were in the age group between 40 to 59 years old. For the 88 patients, their mean age was younger at 36.6 years old (standard deviation of 14.1) and the median was 31 years old. Majority of them (58, 65.9%) were in the age group between 21 to 39 years old. The rate of intervention of AUD was lower in patients who were younger and this was statistically significant ($P$ <0.05).

*Gender*

For the 19 patients, majority (18, 94.7%) were males. For the other 88 patients, 78 (88.6%) were males and 10 (11.4%) were females. There were more males than females in both groups, with no significant difference between the two groups ($P$ = 0.38).

*Marital Status*

For the 19 patients, majority (16, 84.2%) were single, divorced or widowed. For the other 88 patients, 36 (40.9%) were married and 52 (59.1%) were single, divorced or

Table 3. Basic Sociodemographic Features of Patients Rendered/Not Rendered Interventions by Medical Staff

| | Interventions Rendered by Medical Staff (n = 19) | Not Rendered Interventions by Medical Staff (n = 88) | *P* Value |
|---|---|---|---|
| Age (years) | | | |
| Mean (SD) | 47.5 (9.4) | 36.6 (14.1) | |
| Median | 50 | 31 | - |
| Minimum, maximum | 25, 62 | 21, 77 | |
| Age (years), n (%) | | | |
| 21 – 29 | 1 (5.3) | 37 (42.1) | |
| 30 – 39 | 2 (10.5) | 21 (23.9) | |
| 40 – 49 | 6 (31.6) | 11 (12.5) | <0.05 |
| 50 – 59 | 8 (42.1) | 12 (13.6) | |
| 60 – 69 | 2 (10.5) | 5 (5.7) | |
| 70 & over | 0 (0.0) | 2 (2.3) | |
| Gender, n (%) | | | |
| Male | 18 (94.7) | 78 (88.6) | 0.38 |
| Female | 1 (5.3) | 10 (11.4) | |
| Marital status, n (%) | | | |
| Married | 3 (15.8) | 36 (40.9) | 0.06 |
| Others | 16 (84.2) | 52 (59.1) | |
| Ethnicity, n (%) | | | |
| Chinese | 2 (10.5) | 59 (67.1) | |
| Malay | 2 (10.5) | 11 (12.5) | <0.05 |
| Indian | 14 (73.7) | 11 (12.5) | |
| Others | 1 (5.3) | 7 (8.0) | |

SD: Standard deviation

widowed. There were more patients who were single, divorced or widowed than those married in both groups, with no significant difference between the two groups ($P = 0.06$).

*Ethnicity*

For the 19 patients, majority (14, 73.7%) were Indians, followed by Chinese (2, 10.5%) and Malay (2, 10.5%), and Others (1, 5.3%). For the other 88 patients, majority (59, 67.1%) were Chinese, followed by Malay (11, 12.5%) and Indian (11, 12.5%), and Others (7, 8%). The rate of intervention of AUD was higher in Indian patients as compared to the non-Indians, specifically the Chinese, and this was statistically significant ($P <0.05$).

## Discussion

*Estimated Prevalence of AUD and its Associated Factors*

The estimated prevalence of AUD amongst the non-psychiatric inpatients over a 3-month period in this study was 1.9%. This equates to approximately 400 cases of AUD being presented to CGH every year. The prevalence in this study is higher than the 12-month prevalence of AUD in the general population of Singapore (0.8%),[3] which is similar to other international reports where the prevalence of AUD is higher in general hospitals compared to the general population.

The prevalence of AUD in this study is lower than the variation of prevalence described in the international literature (7.4% to 48.0%).[7-18] The prevalence in this study may have been underestimated for various reasons.

Firstly, the exclusion criteria may have an impact on the study results. Patients below 21 years old who may have alcohol consumption have been excluded from the study due to the legal age of obtaining informed consent for participation in the study. There is the possibility of missing out a number of patients with alcohol problems in the psychiatric, forensic, infectious disease wards, as well as the medical and surgical intensive care units. Those who were cognitively or physically incapable of participating in this study may have alcohol-related conditions (e.g. alcohol intoxication, withdrawal delirium etc.).

Secondly, 14.2% (928/6527) of potential participants did not take part in the study due to refusal of consent or could not be recruited before the research coordinator could reach them. This group of patients, especially the 908 potential participants who could not be recruited in time, could have potentially affected the outcome of the study.

Thirdly, the AUDIT cutoff point used in this study was 8, which is higher compared to a lower cutoff point of 6 in another Asian study with a more homogenous population,[17] in which the AUDIT was validated with 2-phase identification strategy. As discussed, the variation in sensitivity and specificity of AUDIT screening in our local population together with the possibility of under-reporting of AUD from them may have led to a misclassification during the screening phase, leading to false negatives.

Last but not least, as there is a higher proportion of Malay ethnic group in our catchment area (17.1%) as compared to the general population in Singapore (13.4%), there may be lesser consumption of alcohol due to religious practices amongst the population surveyed. This may not be representative of the general population in Singapore.

Cases of AUD could possibly have been studied in the busy emergency department and short-stay unit (less than 24 hours admissions) of the hospital, which may have led to a higher estimated prevalence rate. However for the sake of comparison, most other studies studied inpatients and emergency department patients separately.[10,14,16,18,29] The geriatric services available in the hospital could however have led to a lowered rate, as frail or cognitively impaired patients were excluded.

With regards to the sociodemographic characteristics of patients diagnosed with AUD (MINI positive), majority were young adults (57%, in the age group between 21 to 39 years old), Chinese (57.0%), males (89.7%) who were single, divorced or widowed (63.6%). Although females represent a lower proportion of those diagnosed with AUD at 10.3% in this study, there is a trend showing an increase in alcohol consumption amongst women over the years. Alcohol consumption, in particular binge drinking, had increased among Singaporean drinkers between 1992 and 2004, from 5.1% to 10%, in both genders. It is most evident among adults aged between 18 to 29 years old, and frequent drinking increase was most pronounced among women aged between 18 to 29 years old.[30]

*Rate of Identification of AUD by Medical Staff*

There was a low rate of identification of AUD by the medical staff. Only 23.4% (25/107) of the AUD (MINI positive) cases were correctly identified by them after reviewing the case records.

The under-identification of cases with AUD at hospital admission is a problem that has been described previously.[15-17,19,31] Several explanations have been advanced for the low rate of identification of AUD by physicians in general. Firstly, physicians may be reluctant to diagnose AUD because they view it as a moral rather than a medical problem, or judge the patient to be self-destructive. Secondly, they may lack the knowledge to diagnose or differentiate various symptoms or signs caused by AUD.[29] Thirdly, physicians other than psychiatrists believe they have been trained to treat physical problems. If they regard alcohol abuse as a psychological disorder, they may feel ill-equipped to deal with it. Lastly, patients with AUD often express anger, hostility, denial, delusions or are uncooperative. Medical professionals who react to such attitudes with frustration may feel discouraged and unable to provide further help.[19]

The low rate of identification of AUD by the medical staff in this study indicates that more effort can be focused on training health care staff to identify AUD (e.g. giving educational talks on AUD or using alcohol screening tools etc.) to improve the rate of identification of AUD.

*Rate of Intervention for Patients with AUD Rendered by Medical Staff*

Even though the overall rate of intervention was low among the AUD (MINI positive) patients at 17.8% (19/107), most of the cases (76%, 19/25) identified by the medical staff were rendered interventions. Thus, the low overall rate of intervention was mainly due to low identification rate since most of the identified patients received interventions. Having said that, this rate of intervention post-identification can be further enhanced through training of health care staff so as to raise awareness of the existing inpatient and outpatient resources available to manage patients with AUD.

*Sociodemographic Features of AUD Patients Identified/ Rendered Intervention by Medical Staff*

The sociodemographic features of patients identified to have AUD by medical staff and of those rendered intervention by them were striking in that the rates were significantly lower in patients who were younger or were Chinese compared to those who were older or were Indians (Figs. 2 and 3).

We did not capture the clinical profile of those who were identified to have AUD by the medical staff. However it is reasonable to believe that the physicians would more readily identify those who had more severe alcohol-related disease such as hepatic cirrhosis. The so-called "silent" AUD, especially in the younger patients, would be those without such clinical clues due to less severe medical complications. They would probably be identified only by taking a proper alcohol history or AUD screening. There may also be possible ethnic bias in the identification as well as interventions rendered for patients with AUD.

*Strengths, Limitations and Improvements*

There are several strengths in this study. Firstly, case finding was based on a semi-structured, standardised clinical interview which provided diagnostic criteria for AUD. Secondly, the interviews were conducted by trained psychology graduates. This minimises any potential bias derived from either the unsatisfactory validity of lay interview for AUD or the screening instruments. Thirdly, the data was collected over a 3-month period to reduce intermonth variation as much as possible.

Some of the limitations of this study are that the study subjects were not representative of all non-psychiatric inpatients in a general hospital during the study period or to the population of Singapore in general. Also, there was neither validation of AUDIT done in Singapore nor any validated translations used in the study.

With regards to improving future related studies, we can consider using a lower cutoff score for AUDIT screening (e.g. 6) so as to reduce possible false negatives. In addition, we can collect more clinical data to allow us to have a better picture of the clinical profile of those identified to have AUD by the medical staff.

*Implications*

Our study demonstrates that hospitalisation provides an opportunity to identify and provide interventions for AUD.

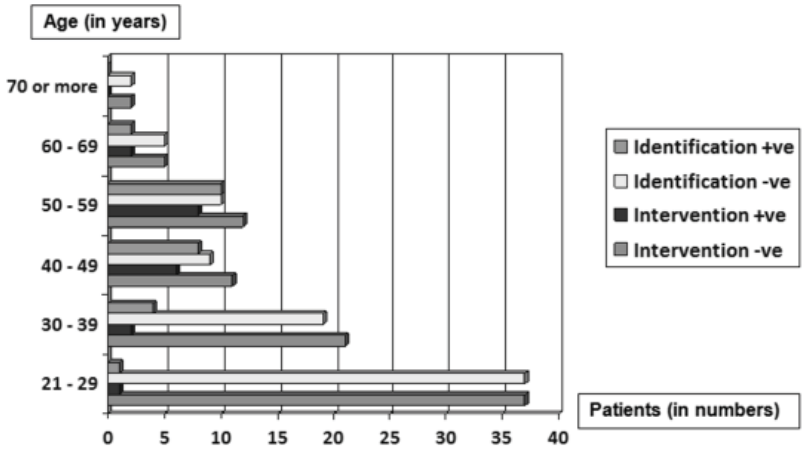


Fig. 2. Chart showing comparison of AUD (MINI positive). Patients identified or not identified to have AUD/intervention given or not given by medical staff versus age group. AUDIT: Alcohol use disorders identification test; MINI: Alcohol abuse and dependence section of MINI International Neuropsychiatric Interview (MINI English Version 5.0.0).

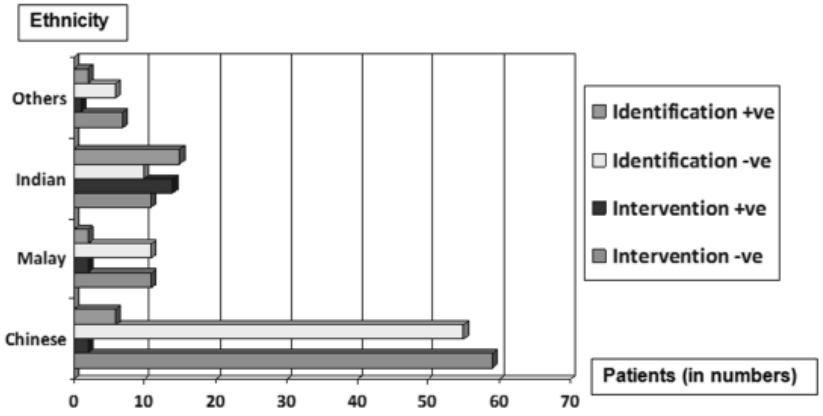


Fig. 3. Chart showing comparison of AUD (MINI positive). Patients identified or not identified to have AUD/intervention given or not given by medical staff versus ethnicity. AUDIT: Alcohol use disorders identification test; MINI: Alcohol abuse and dependence section of MINI International Neuropsychiatric Interview (MINI English Version 5.0.0).

Successful achievement of abstinence or harm reduction may require early involvement by physicians who are treating the patients for other medical conditions. In the busy setting of a general hospital, we recommend some approaches to diagnosis and treatment of AUD.

Firstly, incorporating short questionnaires or instruments to screen possible misuse of alcohol into routine history taking is suggested. The main purpose of routine screening does not only help to enhance physicians' detection of AUD, but also to remind the physicians to initiate interventions.[19] Indeed, even the use of a single screening question, 'Did you drink alcohol in the past one year?' could lead to the identification of a large number of patients with AUD in the general hospital (107/673, i.e. 15.8% of those who responded 'yes' to this question were found to have AUD in this study).

Secondly, acknowledging the sociodemographic variables associated with AUD unique to our local population may allow us to establish a risk profile for AUD patients in future. Certainly, these variables must not lead to stereotyping of patients with AUD. Recognising this risk profile may alert the medical staff to patients at high risk for AUD, making the use of the diagnostic instrument more effective, and consequently, increase the predictive value of the applied test, although this risk factor-based approach would have to be tested and validated in future studies. This study also highlighted the fact that AUD patients with certain characteristics i.e. those who were younger or were Chinese, had poorer identification and intervention rates. This implies that further psychoeducation may be needed among the medical staff so that we can address not only the rate of identification or intervention, but also deal with the neglected qualitative aspects of patients with AUD in our local setting.

Last but not least, health administrators planning for postgraduate continuous educational programmes for medical professionals regarding AUD should focus on encouraging staff to enhance patients' motivations of

abstinence and to give health advice regarding alcohol use, as well as to set up appropriate addiction consultation-liaison services. The hospital, since 2008, has since grown in number of patients, beds, staff and services (inpatient, outpatient and community). Training of all health care professionals is more feasible than just focusing on addiction specialists or allied health so that more patients with AUD can be identified and treated.

## Conclusion

Although the prevalence of AUDs among the non-psychiatric general hospital inpatients in this study was 1.9%, it is likely to be only the tip of the iceberg and an underestimate of the extent of alcohol problem drinking among general hospital inpatients in Singapore. The rate of recognition of this problem was low. However, once a patient with AUD is identified by medical staff, the delivery of interventions is relatively good.

Thus, the implementation of systematic alcohol screening with brief interventions should be considered. These would lead to higher detection rates of problem drinking. In addition, it would remind physicians to initiate subsequent counselling or brief interventions for these patients tailored to the type of problem drinking such as referral to alcohol treatment programmes.

More effort should be put into training and increasing the awareness of medical, nursing and allied health care professionals about AUD. Health policy and educational programmes should focus on training health care professionals to recognise AUDs, carry out brief interventions and direct patients toward appropriate interventions.

***Acknowledgement***

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Commentary

# Zika Virus: An Evolving Public Health Threat

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Zika virus (ZIKV), a relatively unknown arbovirus, has suddenly come under the spotlight of the media and is causing major concern in public health, infectious disease and perinatal circles. When the Pan American Health Organization (PAHO) issued an alert reporting possible ZIKV transmission in northeast Brazil on 7 May 2015, the geographical spread of the virus from Africa through Asia and the Pacific islands was not surprising.[1] Multiple factors including climate change, urbanisation, air travel and trade had perpetuated previous global spread of arboviruses such as dengue (DENV) and chikungunya (CHIKV) viruses. However, on 1 December 2015, PAHO issued an epidemiological alert warning of a suspected link between ZIKV and neurological syndrome or congenital malformation.[2] Public health authorities in Brazil had detected a 20-fold increase in infants born with microcephaly which correlated with the introduction of ZIKV into the country. On 2 February 2016, the World Health Organization (WHO) declared ZIKV as a public health emergency of international concern (PHEIC).

ZIKV is a flavivirus from the *Flaviviridae* family. DENV, yellow fever and West Nile viruses belong to the same family of viruses.[3] It was first identified in 1947 in Uganda in the rhesus macaque population of Zika forest, from which it derives its name. Since then, it has spread to Southeast Asia with reports of sporadic infections. In 2007, for the first time outside Africa and Asia, a major outbreak occurred on the Yap Islands of Micronesia.[3] This was followed by a bigger outbreak in French Polynesia in 2013 where an estimated 70% of the population on some islands may have been infected.[4] Reports of Guillain-Barre syndrome in adults were reported in association with ZIKV infection but not birth defects. Before these reports, ZIKV was believed to only cause mild disease.

Clinically, ZIKV usually presents with low-grade fever (<38.5˚C), transient arthritis or arthralgia, maculopapular rash and conjunctivitis. It is also associated with general non-specific symptoms such as myalgia, lethargy and headaches. The incubation period is between 3 to 12 days and the symptoms described are short-lived, lasting only 2 to 7 days. Only 20% of people will exhibit symptoms following infection.[3] Therefore, most infections are not recognised or get misdiagnosed as DENV or CHIKV in the absence of laboratory testing. Currently, laboratory confirmation of ZIKV is via polymerase chain reaction (PCR) detection of viral ribonucleic acid (RNA) from clinical specimens, usually blood. However, the viraemic period is short, lasting only for 3 to 5 days after disease onset. ZIKV IgM/IgG antibodies can be detected by serological assays 5 or 6 days postsymptom onset but false positive results due to cross-reactions with related flaviviruses such as DENV or yellow fever do occur.[5-7] Virus neutralisation tests may give more specific results, but this method is not suitable for routine clinical testing.

Microcephaly, the condition currently linked to ZIKV, is a neurodevelopmental anomaly usually defined as head circumference that measures more than 2 or 3 standard deviations (SD) below the mean for age, gender and ethnicity. The SD cutoff, diagnosis and clinical definitions can vary between clinicians and regions.[8] The causes of background microcephaly are not all known but various factors such as host genetics, congenital infections, drugs, alcohol and environmental exposures have been implicated. Laboratory investigations to date have confirmed the presence of ZIKV

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RNA in brain tissue, placenta, and amniotic fluid of a handful of infants with microcephaly and from postmortem samples of foetuses of mothers infected with ZIKV during pregnancy.[9,10] However, it is still not known if ZIKV is the causative agent for microcephaly and/or foetal loss. Children with microcephaly are at risk for long-term developmental problems. Although there is no treatment, early diagnosis and intervention may improve the child's quality of life. Public health authorities in Brazil and globally are extremely worried as a steep increase in such a condition will have important implications in terms of the burden on healthcare systems as well as the economic contributions of a generation or multiple generations if ZIKV becomes endemic. Reports from Brazil have indicated a 20-fold increase but caution is required in interpreting this figure due to changes in case definitions, increased ascertainment following alerts, and the absence of controlled epidemiological studies to quantify excess risk.[2]

The transmission cycle of ZIKV is similar to DENV. ZIKV in east Africa is maintained in a sylvatic cycle. It causes cyclical epizootics amongst non-human primates with transmission via a wide variety of sylvatic and peridomestic *Aedes* mosquitoes.[11-14] The *Aedes aegypti* mosquito which is also the main vector for dengue is considered an important vector for ZIKV. The virus has been detected in wild-caught *Aedes aegypti* mosquitoes in Malaysia in the 1960s.[15,16] Experimental infection work including studies done using mosquitoes caught locally in Singapore have confirmed the ability of both *Aedes aegypti* as well as *Aedes albopictus* to transmit ZIKV.[17] Similar laboratory experiments have also identified the *Aedes hensilli* mosquito as the species behind the Yap island outbreak.[18] From a vector perspective, it is highly plausible for ZIKV to follow a similar path to the spread of DENV following the global expansion of the *Aedes* mosquito. Being an emerging arbovirus, populations will be immunologically naïve with virtually no protection, which will facilitate its transmission. Any country or region with endemic DENV and the presence of *Aedes* mosquitoes including Singapore is vulnerable. Furthermore, current reports of relatively high *Aedes aegypti* population from prolonged warmer weather due to El Nino is worrying.[19] Immediate intensified effort amongst all stakeholders in reducing mosquito population is required.

As of 1 February 2015, there has been no reported cases of ZIKV in Singapore. Testing of residual blood from 690 febrile patients negative for DENV and CHIV in 2009 and 2010 did not identify any ZIKV positive cases.[20] This surveillance has been enhanced, with 150 samples tested each week and ZIKV has not been detected. However, as highlighted above, the duration of ZIKV viremia is short-lived and hence, these small surveys have limited sensitivity to pick up low disease prevalence. Furthermore, febrile patients only represent a small proportion of infected cases due to the high asymptomatic rate. Amongst our neighbouring countries in Southeast Asia, acute ZIKV infection have been detected in Thailand, Cambodia, Philippines and Indonesia while serological evidence of ZIKV has been reported from Malaysia.[21-25] The reported numbers are likely the tip of the iceberg. The absence of any systematic surveillance and testing for ZIKV means that the true epidemiology and burden of ZIKV in our region remains unknown. Interestingly, despite evidence of dispersed circulation in Southeast Asia over 30 years (60 years in Africa), no reported increase in microcephaly or Guillain-Barre syndrome had been reported. Genomic sequencing of the virus did not identify any major change or mutation which could explain an increase in virulence.[26] It is possible that previous outbreaks may have been too small or health systems were just not able to recognise new cases of these neurological disorders.

There is currently no medical treatment or vaccine available for ZIKV. Public health prevention, education, outbreak control and risk communication will be the predominant strategy against ZIKV. Singapore's dengue vector control programme will contribute to containing or mitigating any ZIKV introduction into the country. However, escalating surveillance systems with more systematic notification and testing of suspected human cases, particularly amongst pregnant women may urgently need to be set up. Healthcare professionals will need to be provided with information on the signs and symptoms of ZIKV and criteria for testing. Testing for ZIKV amongst symptomatic pregnant women should be considered in view of the challenges of clinical diagnosis due to similarities with dengue infection. Early identification of at-risk pregnant ZIKV cases will ensure they are managed and counselled appropriately with referral to specialist centres. Furthermore, this would also allow early detection to inform vector control activities as well as provide updates to engage with at risk neighbourhoods for community mobilisation. The detection of foetal microcephaly may also warrant testing of serum and possibly amniotic fluid for ZIKV as an aetiologic pathogen in addition to excluding the common intrauterine infections viz. cytomegalovirus, toxoplasmosis, herpes simplex, syphilis and rubella. Pregnant women are currently being advised by the United States of America (USA) Centers for Disease Control and Prevention (CDC) against travelling to ZIKV affected countries.[7] If a pregnant woman chooses to travel, she should be provided with information to reduce the risk of mosquito bites including wearing long-sleeved shirts, long trousers, staying in screened or air-conditioned rooms and use insect repellents. Insect repellents (DEET, picaridin and IR3535) are safe for pregnant women but must be used as directed in the product label.[7]

It is important to emphasise that the association between ZIKV infection and microcephaly is still being investigated. Evidence of ZIKV infection have been found in placentas of aborted foetuses and in the brains of babies with microcephaly who died soon after birth.[9,27,28] Further epidemiological analysis with controls, molecular analysis and experimental laboratory work are urgently needed. Regardless, investment in public health preparedness is warranted as the consequences of inaction can prove to be very damaging from an individual as well as societal perspective if the link is confirmed. Worryingly, the first controlled analysis of the link between Guillain-Barre syndrome in adults and ZIKV in French Polynesia have shown a strong causative association. A surge in Guillain-Barre syndrome will also need to be considered as part of preparedness plans.[29] Locally, the Ministry of Health Singapore has added ZIKV to the list of notifiable diseases.[30] Doctors suspecting a case of ZIKV must inform the Ministry of Health. Currently, one of the criteria for a suspect case is having travelled to ZIKV-affected areas in the last 2 weeks prior to the onset of symptoms. The emergence of ZIKV following Ebola virus from West Africa and nosocomial outbreak of Middle East respiratory syndrome coronavirus (MERS-CoV) in South Korea, is a timely reminder of the ease with which infectious diseases can spread globally. Hence, improving clinical vigilance, developing strong epidemiological and public health infrastructures, and engaging with the community will provide dividends for us in the long run against future novel pathogens.

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Commentary

# Clinical Ward Rounds—Challenges and Opportunities

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## Abstract

**Hospitalised patients' needs are complex and the ward environment is demanding of time and resources that must be optimised. Clinical ward rounds in hospitalised patients are fundamental to patient care. Ward rounds in recent years have undergone changes which have contributed to reduced professionalism and opportunities to learn as well as increased distrust of patients of the care they receive. Calls for a revival of the traditional ward rounds have been sounded which we must contextualise in modern settings. This commentary calls for a clearer definition of the purpose of ward rounds, outlines the roles and responsibilities of those involved in rounds, defines a 4-step process in the conduct of a ward round, and seeks support from hospitals' management in the facilitation and implementation of these.**


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**Key words: Patients, Process, Professionalism, Teaching**

## Introduction

Doctors must provide safe and quality care in a respectful and empathetic manner weaved within a holistic perspective. The patients' needs are complex and the ward environment is demanding of time and resources that must be optimised.

Clinical ward rounds in hospitalised patients are fundamental to patient care as they provide a dynamic vehicle to optimise the coordinated care that includes discharge planning by a multidisciplinary team.

The wards provide a rich learning real-life environment for healthcare professionals. Ward rounds can provide an excellent opportunity to demonstrate and inculcate values, knowledge and training for junior staff. A well-conducted ward round can improve patient care, provide immense learning opportunities, and inspire the next generation of healthcare professionals.

## Historical Background

Ward rounds are a routine in hospitals around the world. The traditional ward round used to be conducted in a coordinated hierarchical fashion with strict rules and rituals. There were stereotypic roles where the doctor had a masculine role of curing patients and the nurse a feminine role of caring.[1] The most senior doctor conducted a ward round in an authoritarian manner with little room for conflicting views. Humiliation during ward rounds, particularly of junior staff, was recognised as part of learning.

The ward rounds of yesteryears conducted by doyens such as Professor Seah Cheng Siang and Professor GA Ransome were renowned for their educational value, demonstration of diagnostic skills by a master clinician, the inspiration it created for the juniors, and the "wow" factor.

Grand rounds, where selected cases were brought to a centralised venue with clinicians discussing the case, were also held regularly. A grand round is a form of teaching round meant for education and sharing of experiences and it should continue in our environment. While grand rounds continue to be an avenue of education involving patients selected from the ward, these would not be discussed in this commentary which explores issues related to clinical ward rounds.

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## Problems Within Current Ward Rounds

It is common to find bewildered patients who sense an impersonal approach of healthcare professionals displaying a paucity of eye contact. Doctors and nurses are increasingly perceived as being preoccupied with computer screens, figures and charts, leading patients to believe that they are inconsiderate and uncaring with a mislaid sense of purpose in the profession. It adds to the distrust of healthcare professionals and contributes to a negative impact on clinical and emotional outcomes of patients.

Nurses play a vital and central role in the process of ward rounds[2] yet their accompaniment has become increasingly invisible; this can be attributed to both nursing and doctor factors.[3]

Considerable variability exists in both the purpose and conduct of ward rounds. Succumbing to the pressures of service loads, wards rounds have not infrequently been substituted by "walk" rounds, "dashing" rounds, "board" rounds, "simulated" rounds, or "paper"/"PowerPoint" rounds. Routines of questionable relevance have crept into medical records, with less emphasis on clinical examination and greater reliance on investigations.

Ward rounds may be negatively perceived as "mundane and boring" or positively as "interesting and educational" depending on their conduct. It has been observed that the use of bedside rounds for clinical education has been underutilised—it is estimated that less than 25% of patient encounters occur at the bedside[4-7] despite the fact that ward rounds help achieve clinical competence.[8-11]

Recent reports have suggested a gradual erosion of "good ward rounds" and have proposed a revival of the traditional ward round which has to be contextualised in the modern setting.[12-14]

## A Proposal for Improvement

The author proposes a framework for the improvement and enhancement of (general) ward rounds for public hospitals in Singapore in 4 specific areas.

### *1. Clearer Definition of the Purpose of Ward Rounds*

A ward round must be clearly distinguished from a clinical review of individual patients which are additional to rounds. Ward rounds are conducted in a coordinated manner by teams on a regular basis. Clinical reviews are for patients who require specific resolution of medical problems, for example, someone admitted for abdominal pain and needs a review to examine a changing clinical state. It would be expected that with a well-conducted ward round, clinical and social problems can be anticipated, well-delineated, and managed. The patient and the team must be clear of the treatment plans which must be well-coordinated.

The 10 important roles of ward round are summarised in Table 1.

### *2. Roles and Responsibilities*

A ward round needs an adequate groundwork (pre-ward round) as well as a follow-up of plans and decisions made during the round (post-ward round). Different members of the multidisciplinary team have their own roles in each of the 3 phases outlined in Table 2.

### *3. A Structure and Process to a Ward Round*

A structure and process of the necessities in ward rounds are summarised in Figure 1. Teaching can and must occur at every level. Consultants have to facilitate their work based on thinking aloud, demonstrating, generating questions, getting team members to research on doubts, and encouraging observations (clinical signs).[14]

Patients appreciate a simple greeting that acknowledges and emphasises their existence. Self or proxy introduction can help avert the frequent complaint that doctors lack eye contact as they are too preoccupied with computer screens. The clinical assessment is best led by a senior doctor for new patients aided by his registrar or senior resident and must incorporate a succinct problem summary presented by the junior staff. Any subjective complaints by a patient can thus be ascertained. A relevant and appropriate clinical examination documents the objective findings. An input from the junior staff (including nurses) on updates records the new developments that have occurred since the previous round.

The team should anticipate short- and long-term problems of the patient as well as conduct regular reviews of any monitoring or therapeutic interventions. The need

Table 1. Ten Important Roles of Ward Rounds

| Roles |
|---|
| Define and refine a clinical diagnosis in a timely fashion. |
| Review of patients' progress. |
| Decision on need for monitoring parameters (reduce waste, save time). |
| Decision and review on lines (intravenous plugs), instrumentation (urinary catheters, drainage tubes). This will indirectly reduce infections. |
| Prescribing, deprescribing and dose modification that includes modalities (intravenous vs oral). |
| Decision on the extent of care and where appropriate on the futility of treatment. |
| A multidisciplinary input forum. |
| Formulation of discharge plans. |
| Communication of diagnosis and plans to patients/relatives. |
| Teaching and training. |

Table 2. Roles and Responsibilities during the Different Phases of Ward Rounds

| Pre-Ward Round | Ward Round Proper[†,‡] | Post-Ward Round |
|---|---|---|
| Relevant investigations update by junior doctors. | Doctor: leads the round, updates the patient and team, and reviews all information. | Ensure follow-through of decisions. |
| Ensure follow-through of decisions. | Senior nurse: updates on current status and performs safety checks (e.g. fall risk, infection control), assists in communicating patient needs. Junior nurses are encouraged to present findings. | Divide jobs amongst team members. |
| Junior staff get relevant input from other team members unable to attend rounds (e.g. social worker). | Pharmacist: reviews medications, adherence, side effects. | Consents, further tests, individual reviews. |
| Person leading the round assigns tasks[*] to all attending and ensures rounds do not stretch and impact on ward routines. | Allied health professionals: update care and discharge planning. | Alert those absent in regard to multidisciplinary team. |
| | Carers/advocates: participate in bedside discussions when a patient wishes. | Disease notification. |
| | | Written summaries of discussion may be helpful for patients.[‡] |
| | | Patients or carers may follow-through in-depth discussion. |
| | | Clinical review of selected patients. |

[*]Carpenter J. Doctors and nurses: stereotypes and stereotype change in interprofessional education. Journal of Interprofessional Care 1995;9:151-61.
[†]Lees L. The nurse's role in hospital ward rounds. Nurs Times 2013;109:12-4.
[‡]Royal College of Physicians and Royal College of Nursing. Ward rounds in medicine: principles for best practice. Available at: http://www.rcplondon.ac.uk/resources/ward-rounds-medicine-principles-best-practice. Accessed on 9 January 2013.

and frequency of monitoring parameters such as blood pressure, pulse oximetry, input and output, and glucometer monitoring, require evaluations at every round. Its cessation will help reduce resource wastage, patient inconveniences, and make the patient feel less sick. Team members should raise their concerns if the patient is deemed to warrant closer monitoring in a different setup like a high dependency unit; if the decision is postponed, it must be clearly documented and a decision made on who should review the patient and at what time intervals.

A review of the need for intravenous lines, urinary catheters and drainage tubes would help reduce hospital-acquired infections and patient discomfort. Deprescription must be routine for resolved symptoms (e.g. antipyretics, anti-emetics, laxatives) or when drugs are deemed to provide no therapeutic benefit to the patient. A pharmacologic review must include route of administration and discussions on futile or risky interventions.

Communication with patients must convey the clinical impressions, evaluation of plans, goals of therapy, and patient education as well as set realistic expectations for the patient's hospital stay. The patient must be given good assurance that the team knows what they are doing, has definite plans, and allows them to clarify issues and express wishes.

The most senior doctor must lead the management plan while junior staff must clearly understand the reasons for requesting tests. An atmosphere of academia may prevail where junior staffs are allowed to clarify the rationale for these decisions. The juniors could be given learning tasks based on clinical assessments and investigations. Ward rounds provide an excellent educational tool to teach and learn the art of obtaining a history of clinical examinations, as well as communication and counselling skills by the consultant and registrar/senior resident.

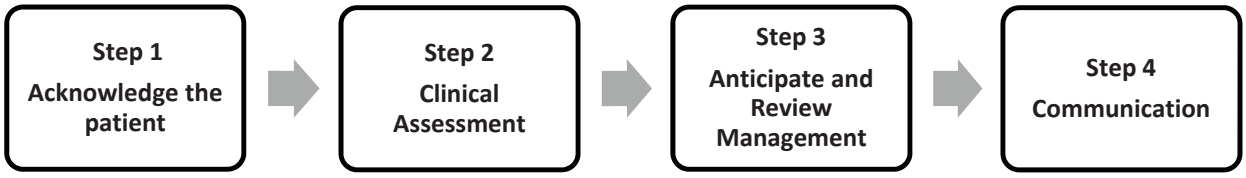


Fig. 1. The 4-step structure and process of a ward round.

A defined flow of the ward round must be decided by the entire team. This allows for routine tasks (e.g. patient showering) to be performed prior to or post rounds as well as ensuring that there is sufficient time to get "missing patients" back for review during rounds. Patients who are not reviewed or missed during the ward round must have a separate clinical review at the earliest appropriate opportunity by at least the registrar or senior resident. Where a patient is moved to a new setting, there must be a thorough documentation and handover for transfer of care.

*4. Hospital Support*

A successful ward round structure and support with facilitation from hospital administration will enhance patient experience, facilitate speedy discharge, avoid harm, and improve team communication. Five areas where hospital administration can enhance this support[12] are:

a) Efforts to minimise "patient overflows" in the ward environment which have rushed ward rounds with time wasted in searching to find patients.
b) Avoidance of multispecialty wards with its inevitable "multiple simultaneous ward rounds". This will help promote greater nursing participation.
c) Encouragement of multidisciplinary team members' attendance at ward round.
d) Information systems should be tweaked to support and assist healthcare workers to support efficient ward rounds. The group from Jonkoping University in Sweden[15] have discussed this in great detail and it would be valuable to borrow some of their concepts.
e) Ward round practice should be incorporated in new staff inductions.

## Conclusion

A well-run ward round is good for both patients and clinicians. It provides a daily reminder to healthcare professionals of why they chose a caring profession in the first place.[16] They must work collectively to coordinate and enhance the value of good patient care. The juniors learn by seeing numerous patients with different pathology particularly when taught by an experienced consultant who are also role models. It provides one of the best opportunities to integrate theoretical knowledge with practical skills. The motivation that a well-conducted round provides to juniors cannot be overstated.

When deciding on planned management strategies, consultants can gain much from succinct summaries with a multidisciplinary input of the problems presented. Nursing and other paramedical staff can learn about their patients and be enlightened by participating in patient care through their inputs.

The patients gain by listening to the multidisciplinary teams and learning about their own illness as well as correcting any misinformation that may be inadvertently presented.

It offers an excellent prospect for holistic medical education and training including the "soft skills" of communication, ethics, patient safety and professionalism. Moreover, the bedside clinical round provides a perfect environment to demonstrate teamwork.

It is time the clinical ward round shifts from a ritual to an optimised and efficient care process.

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Commentary

# Prevention and Management of Adverse Reactions Induced by Iodinated Contrast Media

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## Abstract

**Iodinated radiocontrast media (IRCM) is widely used in current clinical practice. Although IRCM is generally safe, serious adverse drug reactions (ADRs) may still occur. IRCM-induced ADRs may be subdivided into chemotoxic and hypersensitivity reactions. Several factors have been shown to be associated with an increased risk of ADRs, including previous contrast media reactions, history of asthma and allergic disease, etc. Contrast media with lower osmolality is generally recommended for at-risk patients to prevent ADRs. Current premedication prophylaxis in at-risk patients may reduce the risk of ADRs. However, there is still a lack of consensus on the prophylactic role of premedication. Contrast-induced nephropathy (CIN) is another component of IRCM-related ADRs. Hydration remains the mainstay of CIN prophylaxis in at-risk patients. Despite several preventive measures, ADRs may still occur. Treatment strategies for potential contrast reactions are also summarised in this article. This article summarises the pathophysiology, epidemiology and risk factors of ADRs with emphasis on prevention and treatment strategies. This will allow readers to understand the rationale behind appropriate patient preparation for diagnostic imaging involving IRCM.**


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**Key words: Contrast-induced nephropathy, Hypersensitivity, Premedication**

## Introduction

Since the introduction of the first iodinated radiocontrast media (IRCM) by Dr Moses Swick in 1929, it has been widely used in a variety of radiological examinations, with more than 50 million studies performed per year.[1,2]

Iodine is the core element in radiocontrast media, which is required in certain amounts to provide adequate film-screen radio-opacity.[3] The design of the contrast media aims to maximise the amount of iodine atoms to ensure the image quality and to minimise the osmolality in order to reduce toxicity.[4]

There are 4 types of IRCMs: ionic monomers, ionic dimers, non-ionic monomers and non-ionic dimers (Table 1). The ionic monomers such as diatrizoate (Urografin) and iothalamate (Conray) were introduced in 1950 to 1960 and were considered high osmolar ionic contrast media (HOCM), with the highest osmolality of 1500 mOsm/kg. Osmolality was subsequently reduced by dimerisation of monomers and by producing non-ionic contrast media. Non-ionic monomers (metrizamide) were first introduced in 1969 by Dr Torsten Almén with a much lower osmolality (around 600 mOsm/kg) compared to the former. Newer non-ionic monomers such as iohexol or iopamidol were developed in 2006 and are more stable and less toxic. Ioxaglate (Hexabrix) is one of the ionic dimers with osmolality of 560 mOsm/kg and was first introduced into the United States in the 1980s. Because of the lower osmolality nature of non-ionic monomers and ionic dimers, these contrast media are categorised as low osmolar contrast media (LOCM). Non-ionic dimers (e.g. iodixanol, iotrolan) are the most recently developed IRCM. These contrast agents possess the lowest osmolality and are physiologically isotonic (300 mOsm/kg, the origin of the term iso-osmolar contrast media, IOCM).[2,3] Currently, iohexol (Omnipaque 350) is used in almost all the major hospitals in Singapore as contrast

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Table 1. Comparison of Iodinated Radiocontrast Media*

| Types | Examples | Osmolality (mOsm/kg) |
|---|---|---|
| Ionic monomer (HOCM) | Diatrizoate<br>Iothalamate | 1500 |
| Non-ionic monomer (LOCM) | Metrilamide<br>Iohexol<br>Iopamidol<br>Ioversol | 600 – 800 |
| Ionic dimer (LOCM) | Ioxaglate | 560 |
| Non-ionic dimer (IOCM) | Iodixanol<br>Iotrolan | 300 |

*Source: McClennan BL. Preston M. Hickey memorial lecture. Ionic and nonionic iodinated contrast media: evolution and strategies for use. AJR Am J Roentgenol 1990;155:225-33; and Grainger RG. Intravascular radiological iodinated contrast media. In: Grainger & Allison's Diagnostic Radiology. 5th ed. Elsevier Churchill Livingstone; 2007.

Table 2. Adverse Reactions of Iodinated Radiocontrast Media

| | Chemotoxic Reactions | Hypersensitivity Reactions | |
|---|---|---|---|
| | | Acute | Late |
| **Reactions** | Nausea | Mild: | Skin reactions: |
| | Vomiting | Itching, erythema | Urticaria |
| | Flushing | Urticaria | Persistent rash |
| | Arrhythmia | Moderate: | Steven-Johnson syndrome* |
| | Pulmonary edema | Bronchospasm | |
| | Seizure | Angioedema | |
| | Renal toxicity | Severe: | |
| | Vasovagal attacks | Anaphylaxis | |

*Source: Savill JS, Barrie R, Ghosh S, Muhlemann M, Dawson P, Pusey CD. Fatal Stevens-Johnson syndrome following urography with iopamidol in systemic lupus erythematosus. Postgrad Med J 1988;64:392-4.

media for enhanced computed tomography (CT) studies and intravenous urograms. Omnipaque 350 has osmolality of 844 mOsm/kg and is one of the non-ionic LOCM. Another commonly used IRCM in Singapore is ioversol (Optiray), which is a non-ionic LOCM with lower osmolality (502 to 792 mOsm/kg) and associated with lower risk of reactions. This contrast agent is more frequently used for inpatient settings.

Various adverse drug reactions (ADRs) to IRCM are published in the literature. The reaction spectrum is wide, ranging from rash to anaphylaxis.[5] The introduction of LOCM has significantly decreased the incidence of ADRs.[5] Although most of the ADRs are mild and almost self-limiting, severe reactions do occur and could be life-threatening.[6] Therefore, it is crucial for both radiologists and referring physicians to keep updated with information on IRCM-related ADRs. In our institution, prednisolone is prescribed prior to contrast injection to prevent possible reactions for patients with asthma, multiple drug allergies (>3 drugs) and previous contrast reactions. Moreover, oral or intravenous hydration is recommended prior to contrast injection to prevent contrast-induced nephropathy.

There are 4 major international guidelines addressing this topic: European Society of Urogenital Radiology Contrast Media Safety Committee guidelines (ESUR CMSC) version 8.1, American College of Radiology (ACR) Manual on Contrast Media version 9 and Standards for Intravascular Contrast Agent Administration to Adult Patients by the Royal College of Radiologists (RCR) Second Edition 2010 and Consensus Guidelines for the Prevention of Contrast Induced Nephropathy by Canadian Association of Radiologists (CAR) 2011. This article reviews and summarises these guidelines and relevant articles in PubMed to provide practitioners with a comprehensive overview on this topic.

## Classification and Pathophysiology of Adverse Reactions

In general, ADRs of IRCM are classified based on the severity and timing of symptoms[7] and the underlying pathophysiology.[6,8] However, the classification system of ADRs is diverse and lack universal consensus. In this article, we adopt the classification system of the ACR guidelines, which is based on pathophysiology and onset timing of clinical presentation.

### *Chemotoxic or Physiologic Reactions*

Chemotoxic reactions, also known as physiologic reactions, are ADRs caused directly by the physiochemical effect of the IRCM.[9] Hyperosmolality, the binding ability of IRCM with calcium ions and the concentration of IRCM's cations are believed to play an important role in the pathogenesis of chemotoxic reactions.[9] Mild chemotoxic reactions usually manifest as warmth, nausea, vomiting or flushing. Severe reactions may be related to organ toxicity, such as arrhythmia, pulmonary edema, seizure or renal toxicity[6,9-11] (Table 2).

Vasovagal reactions are classified under this category in the ACR guidelines.[6] Increased vagal tone from the central nervous system depresses and inhibits the cardiac conduction system. Therefore, patients who have vasovagal reactions may present with combined hypotension and bradycardia.[6,9]

### *Hypersensitivity Reactions*

Hypersensitivity reactions (HRs) are also known as allergic-like, pseudoallergic or anaphylactoid reactions in the literature. Different from chemotoxic reactions, the

incidence and severity of HRs are independent of the dose and injection rate of IRCM.[12] HRs are further divided into acute (within 1 hour) and late reactions (from 1 hour to days).[13,14]

Symptoms of acute HRs include urticaria, erythema, angioedema, bronchospasm, laryngeal edema and anaphylactic shock[5,9,13] (Table 2). The underlying pathogenesis is dominated by non Ig-E mediated anaphylactoid reactions.[15] These reactions are mediated by direct IRCM-activation of mast cells and basophils, activation of coagulation/kinin system and complement cascades.[16] Nevertheless, Ig-E mediated allergic reactions may also play a role in the acute HRs as reported in several studies.[17-19]

Late HRs are usually mild to moderate in severity and self-limiting. Despite various reported late HRs, the majority of symptoms consist of skin manifestations[20] (Table 2). Late skin reactions are believed to be related to T cell-mediated allergic reactions, which are similar to most of the drug-related skin reactions.[20,21] The awareness of this subset of delayed allergy reaction among radiologists is important in the process of patient counselling on the aftercare of the use of IRCM.

Table 3. Risk Factors of Hypersensitivity Reactions

| | Acute Hypersensitivity Reactions | Chronic Hypersensitivity Reactions |
|---|---|---|
| **Risk Factors** | Previous acute HRs | Previous late HRs |
| | Asthma | Allergic disease |
| | Allergic disease | Iso-osmolar dimer |
| | Old age* | Women, Japanese descent† |
| | Medical treatment of beta-blocker‡ | Systemic disease, such as SLE IL2 treatment |

HRs: Hypersensitivity reactions; IL-2: Interleukin-2; SLE: Systemic lupus erythematosus

*Source: Cashman JD, McCredie J, Henry DA. Intravenous contrast media: use and associated mortality. Med J Aust 1991;155:618-23.

†Source: Bellin MF, Stacul F, Webb JA, Thomsen HS, Morcos SK, Almen T, et al. Late adverse reactions to intravascular iodine based contrast media: an update. Eur Radiol 2011;21:2305-10.

‡Source: Lang DM, Alpern MB, Visintainer PF, Smith ST. Elevated risk of anaphylactoid reaction from radiographic contrast media is associated with both beta-blocker exposure and cardiovascular disorders. Arch Intern Med 1993;153:2033-40.

## Epidemiology

### *Acute Adverse/Hypersensitivity Reactions*

The actual prevalence of acute ADR is difficult to assess.[6] A few factors may affect the prevalence of ADRs, such as the physiochemical property of IRCM and premedication.[16] Generally, patients receiving HOCM are at higher risk of developing acute reactions (mild: 5% to 15%, moderate: 1% to 2% and severe: 0.2%) compared to LOCM (mild: 3%, moderate: 0.2% to 0.4% and severe: 0.04%).[14] The introduction of LOCM has significantly reduced the non-fatal adverse events. However, the incidence of rare mortality is similar between HOCM and LOCM (1:170,000).[22,23]

The prevalence of acute ADRs in patients receiving IOCM is similar compared to LOCM. In one observational study, acute ADR rate was reported as 0.3% and severe ADR rate as 0.05% after intravenous administration of iodixanol.[24]

The ACR, RCR and ESUR guidelines identify previous hypersensitivity reactions (especially moderate to severe), asthma and allergic disease (multiple severe allergies or allergy disease requiring treatment) as substantial risk factors for acute HRs[6,7,25] (Table 3).

Previous allergic reaction to IRCM is the most important risk factor with a recurrence rate ranging from 10% to 35%.[6] A study by Katayama et al supported this fact, with the highest reported incidence of ADRs coming from patients with previous acute HRs to IRCM.[5]

Asthmatic patients are at an increased risk of severe ADR by 10 folds with intravenous HOCM injection and by 6 folds with non-ionic LOCM or IOCM injection.[5,25] Among the subgroups of atopic diseases, asthmatic patients have the highest risk of developing severe HRs.[5]

Multiple allergies or a single severe allergy requiring treatment is another risk factor for acute HRs.[7,25] Katayama et al has demonstrated that there was an increased risk of overall ADRs, with 3 folds severe reaction in patients of prior history of allergy.[5] Notably, the risk of ADR in patients with seafood allergy is not significantly higher than other allergic disease.[15,26] Therefore, seafood allergy is not considered as an independent risk factor.[6]

### *Late Hypersensitivity Reactions*

According to the ACR guidelines, the incidence of late hypersensitivity reaction ranges from 0.5% to 14%.[6,27,28]

Iso-osmolar dimer is associated with a higher incidence of late ADR compared with other IRCMs.[20] History of allergy and previous late reactions are the other substantial risk factors[14,20] (Table 3).

Patients of systemic diseases such as systemic lupus erythematosus (SLE) are more prone to develop late reactions.[20,29,30] Besides, there is a 2 to 4 folds increased risk of late reactions among patients receiving IL-2 immunotherapy[6,20] (Table 3).

## Prevention of Hypersensitivity Reactions

### *Prevention of Acute Hypersensitivity Reactions*

Life threatening IRCM-induced HRs are rare. A systemic review assessed the effectiveness of applying premedication

in general population. The result was not cost-effective due to a large number needed to treat to prevent one potential severe life threatening reaction.[31] Therefore, current practice mainly focuses on at-risk patients only.

*Premedication in At-Risk Patients*

The underlying pathophysiology of acute HRs following IRCM has been discussed earlier. It is believed that the allergic-like reactions secondary to IRCM are induced by histamine and other mediators released by activated basophils and eosinophils.[16] In a study conducted by Dunsky et al, corticosteroids demonstrated significant suppression effect on the number of these circulating immune cells. The effect reached statistical significance at 4-hour and peaked at 8-hour.[32] This finding explains the basis of premedication, at least 4 hours prior to the IRCM administration.[6,33,34]

A series of studies have been carried out to gather evidence on the efficacy of steroid prophylaxis in clinical circumstances. In the first place, steroids are unable to provide prophylaxis if given immediately prior to the administration of IRCM.[35,36] Nevertheless, multidose regimen with 1 dose given at least 4 hours prior to IRCM that dominates current clinical practice has been advocated in a few studies. Lasser et al applied a 2-dose regimen of methylprednisolone 32 mg per oral (PO) (one dose 6 hours and the other 2 hours prior to the contrast administration). The results showed significant reduction in overall acute HRs and severe reactions in patients who received HOCM injections.[36] Another randomised study in 1994 was performed in patients who received non-ionic LOCM. The result again showed the 2-dose regimen conferred significant protection in overall and mild reactions. However, the reduction in severe reactions has not achieved statistical significance.[34]

In the current ACR guidelines, premedication for at-risk patients is not routinely recommended, in view of the lack of solid evidence to support the effects on severe reaction prevention.[6] However, several premedication regimens are still recognised for potential prophylactic effects.[6] In the clinical setting of elective premedication, the ACR guidelines list 2 commonly used regimens (Table 4):

1. Prednisolone 50 mg PO at 13-hour, 7-hour and 1-hour before contrast media injection + diphenhydramine 50 mg IV, IM or PO 1-hour before contrast media.
2. Methylprednisolone 32 mg PO at 12-hour and 2-hour before contrast media +/- antihistamine.

For emergency premedication, methylprednisolone sodium succinate 40 mg or hydrocortisone sodium succinate 200 mg IV q4h until contrast study + diphenhydramine 50 mg IV 1-hour before contrast injection is proposed by the ACR guidelines[6] (Table 4).

Both ESUR and RCR guidelines state that there is not enough evidence to confirm the effectiveness of premedication. However, if the premedication is deemed to be used, the suggested regimen in the ESUR guidelines is prednisolone 30 mg (or methylprednisolone 32 mg) PO at 12-hour and 2-hour before contrast media[7] (Table 4).

It is worth emphasising that premedication doesn't prevent chemotoxic reactions due to different underlying pathophysiology.

*Selection of IRCM to Prevent Acute HRs*

The osmolality of IRCM has been shown to be positively correlated with histamine release in basic scientific study.[37] A study by Katayama et al built up more clinical evidence on the application of non-ionic LOCM in practice. They reported a significant reduction of overall ADRs in the group of non-ionic LOCM compared to the HOCM.[5] However, there is still a lack of well organised studies to demonstrate the preventive role of LOCM in severe life threatening ADRs.[12]

Based on these evidence, the ACR guidelines clearly state that the safety margin of LOCM is better than HOCM.[6] In the ESUR guidelines, HOCM is categorised as an independent risk factor for acute ADRs and non-ionic LOCM is recommended in every patient.[7] The RCR guidelines also suggest that high risk patients should receive non-ionic LOCM or IOCM, if administration of IRCM is deemed necessary.[25]

Table 4. Premedication Regimens

| Guidelines | | Regimen |
|---|---|---|
| ACR guidelines | General | Prednisolone 50 mg PO at 13-hour, 7-hour and 1-hour before contrast media injection + diphenhydramine 50 mg IV, IM or PO 1-hour before contrast media |
| | | Methylprednisolone 32 mg PO at 12-hour and 2-hour before contrast media +/- antihistamine |
| | Emergency | Methylprednisolone 40 mg IV or hydrocortisone 200 mg IV q4h until contrast study + diphenhydramine 50 mg IV 1-hour before contrast media |
| ESUR guidelines | | Prednisolone 30 mg PO or methylprednisolone 32 mg PO at 12-hour and 2-hour before contrast media |

ACR: American College of Radiology; ESUR: European Society of Urogenital Radiology; IM: Intramuscular injection; IV: Intravenous injection; PO: Per oral

*Previous Hypersensitivity to IRCM*

Previous hypersensitivity reaction to IRCM is the most important risk factor for recurrent allergic-like reactions. Despite the use of premedication, breakthrough reactions after IRCM administration may still occur.[38,39] Davenport et al conducted a study to analyse the frequency and severity of breakthrough reactions after LOCM injection in premedicated patients with history of contrast media allergies.[39] It showed that 81% of the breakthrough reactions were of similar severity to the prior ones. In patients with previous breakthrough reactions, only 12% of the subsequent LOCM injections resulted in recurrent reactions. Risk factors associated with severe breakthrough reactions include chronic oral corticosteroid use, drug or severe allergies and multiple allergies to 4 or more allergens.[39]

The effectiveness of using a different IRCM agent to prevent recurrent reactions has not been fully established.[13,39,40] However, both RCR and ESUR guidelines suggest using a different non-ionic LOCM or IOCM, if injection of IRCM is necessary.[7,25]

*Asthma Patients and Patients with Severe Atopic Disease*

Asthmatic patients are at higher risk of developing acute HRs after IRCM administration. However, evidence shows that treated asthma doesn't add extra risk compared to the general population.[41] Therefore, the RCR guidelines advise that the premise of proceeding with contrast study is to ensure that the patient's asthma status is under control. If the asthma is poorly controlled and the study is not urgent, the procedure should be rescheduled until asthma status is stabilised.

The type and severity of allergy should be clarified before proceeding with contrast injection. If the patient has severe allergy or multiple allergies, radiologists should consider the risks and benefits of a contrast study and look for other alternative imaging studies without using IRCM.[25]

Both RCR and ESUR guidelines recommend non-ionic LOCM or IOCM in patients having asthma, multiple allergies or severe allergy requiring treatment. In addition, patients should be monitored for 30 minutes after the procedure and medical staff in the radiology department should be ready to treat any ADRs.[7,25]

*Prevention of Late Hypersensitive Reactions*

Late HRs are usually mild in severity and self-limiting. No special instruction is needed for patients without risk factors.[20]

For patients with known history of late HRs, no solid evidence is reported to support the utility of corticosteroid and antihistamine to prevent recurrent late HRs.[6,42] Due to the rarity of severe late HRs, drug prophylaxis is generally not recommended.[6,7] However, in our institution, we will still counsel the patient on the existence of this subset of delayed allergy reaction as part of the process of holistic informed consent. The patients will be educated on appropriate action plan at home if any of the allergy reactions occur or worsen.

The ESUR guidelines recommend using the intradermal test to confirm the contrast agent that leads to late HRs and to study cross-reactivity to other IRCMs. In order to reduce the risk of recurrent late HRs, another IRCM without cross-reactivity may be considered. On the other hand, IRCMs that demonstrated cross-reactivity on intradermal tests should be avoided.[7,20]

## Contrast-Induced Nephropathy (CIN): Preventive Measures

Besides hypersensitivity reactions, contrast-induced nephropathy (CIN) is another important IRCM-induced ADR. CIN is defined as a deterioration of renal function (defined as increase in serum creatinine by more than 25% or 44 μmol/l) within 3 days of intravascular administration of IRCM in the absence of an alternative aetiology.[7]

Risk factors associated with increased CIN risks are summarised in Table 5.[43] Renal impairment is by far the most important predictor of CIN.[6,43,44] It increases the risk of CIN by more than 20 times.[6,45] Conventionally, the threshold of eGFR is 60 mL/min. However, in the updated ESUR guidelines, the precautious cutoff level has been lowered from eGFR <60 mL/min to eGFR <45 mL/min.[7,43] This is because data and review of the intravenous IRCM administration studies showed that the risk of CIN increases only if eGFR is <45 mL/min.[46]

Fluid volume expansion and avoidance of dehydration are the main measures to prevent CIN.[43,47] Nephrotoxic drugs should be stopped for at least 24 to 48 hours after discussing with the referring clinician, for example non-steroid anti-inflammatory drugs.[7]

To reduce the risk of CIN, the majority of guidelines recommend the use of LOCM, for example iohexol, or IOCM, for example iodixanol.[6,7,25,43,44]

After contrast-enhanced imaging studies are performed, volume expansion therapy should be continued and eGFR values at 48 to 72 hours after should be obtained.[7,43]

## Treatment of Adverse Reactions

Despite the use of LOCM and premedication, ADRs may still occur in a sporadic and unpredicted manner. All guidelines emphasise on well equipped preparation for any possible ADRs.[6,7,25] Prompt management requires early recognition, well trained medical staff and easy access to

Table 5. Risk Factors for CIN*

| 1. Patient-Related Risk Factors |
|---|
| Renal impairment is the most important predictor |
| Diabetic nephropathy |
| Congestive heart failure |
| Dehydration |
| Age >70 years |
| Anaemia |
| Concurrent use of nephrotoxic drugs |
| Known or suspected acute kidney injury |
| Cardiovascular instability |
| **2. Procedure-Related Risk Factors** |
| Intra-arterial administration |
| High osmolality contrast media |
| Large doses of contrast media |
| Multiple administrations within a few days interval |

*Source: European Society of Urogenital Radiology contrast media Safety Committee guidelines; and Leow KS, Wu YW, Tan CH. Renal-related adverse effects of intravenous contrast media in computed tomography. Singapore Med J 2015;56:186-93.

Table 6. Treatments for Adverse Contrast Reactions

| Signs and Symptoms | | Treatments |
|---|---|---|
| Nausea/vomiting | | Supportive treatment<br>Anti-emetic for severe cases |
| Urticaria/erythema | | Supportive treatment<br>Adrenaline 1:1000, 0.1 – 0.3 mg IM for severe cases |
| Bronchospasm | Normotensive | $O_2$ supply and beta-2 agonist<br>Adrenaline 1:1000, 0.1 – 0.3 mg IM |
| | Hypotensive | $O_2$ supply and beta-2 agonist<br>Adrenaline 1:1000, 0.5 mg IM |
| Laryngeal edema | | $O_2$ supply and beta-2 agonist<br>Adrenaline 1:1000, 0.5 mg IM |
| Isolated hypotension | | Elevation of legs, $O_2$ supply and intravenous fluid challenging<br>Adrenaline 1:1000, 0.5 mg IM |
| Vasovagal reaction | | Elevation of legs, $O_2$ supply and intravenous fluid challenging<br>Atropine 0.6 – 1.0 mg IV (up to total 3 mg) |
| Acute cardiopulmonary collapse | | Follow the American Heart Association Advanced Cardiac Life Support guidelines |
| ACR guidelines: adrenaline 1:10000, 0.3 mg IV (up to total 1 mg) for hypotensive patients | | |
| Late reactions | | Supportive treatments |

ACR: American College of Radiology; IM: Intramuscular injection; IV: Intravenous injection; $O_2$: Oxygen

resuscitation facilities.[6]

It is important to evaluate patients' allergic signs and symptoms before planning further treatment. Symptoms, conscious level, vital signs, skin appearance, auscultation and phonation should be assessed, followed by determination of the severity of reactions.[6]

In the case of acute cardiopulmonary collapse, the American Heart Association Advanced Cardiac Life Support (AHA ACLS) guidelines should be followed. Treatment strategies for specific reactions, such as urticaria, bronchospasm, laryngeal edema, hypotension and vagal reaction, are advised by main international guidelines and summarised in Table 6.[6,7,25]

In contrary to the RCR and ESUR guidelines, ACR guidelines proposed the use of adrenaline 1:10000, 0.3 mg IV (up to total 1 mg) in hypotensive patients, reason being the poor perfusion to the extremity in hypotensive patients may decrease the absorption rate of adrenaline via intramuscular injection.[6] In our local practice, we think this approach is reasonable and preferred.

Late reactions are usually self-limiting and require no specific therapy except for symptomatic treatments such as antihistamines and corticosteroids.[6,25] If symptoms are prolonged or progressively worsening, referral to allergic specialists for further management should be considered.[6]

## Conclusion

ADRs to IRCM are divided into chemotoxic and hypersensitivity reactions based on the underlying pathophysiology. There are several factors associated with an increased risk of ADRs, such as previous contrast media reactions, history of asthma, allergic disease and Interleukin-2 (IL2) therapy, etc.

Non-ionic LOCM and IOCM are generally recommended in at-risk patients. Premedication is routinely employed in clinical practice, and may be helpful to reduce mild acute HRs. However, there is no conclusive evidence available to support its prophylactic efficacy in severe ADRs. Late reaction is normally mild and self-limiting, hence no preventive procedure is needed.

In patients receiving intravenous IRCM administration, the previously accepted threshold of eGFR <60 mL/min has been lowered to eGFR <45 mL/min, whilst the threshold of <60 mL/min remains for intra-arterial IRCM administration. To reduce risk of CIN, hydration is the most important measure to prevent CIN in at-risk group, and it should be continued into the postprocedural period.

Despite the use of non-ionic IRCM and premedication, severe life-threatening ADRs may still occur. Therefore, the risk and benefits of IRCM must be balanced with consideration of possible alternatives. Radiologists and clinicians must be well prepared to treat any ADRs promptly with standby emergency drugs and equipment.

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Letter to the Editor

# Itemised or Prose Radiology Reports? A Survey of Referring Physicians' and Radiologists' Preferences

**Dear Editor,**

A radiology report contains a radiologist's analysis of radiological findings and is a reflection of the radiologist's experience and expertise. It serves as a record of the procedure and acts as a medium of communication to the referring physician. It is also a legal document that is used for billing, as well as for research, teaching and accreditation purposes. As part of clinical quality improvement and customers' satisfaction endeavour, we surveyed the referring physicians' and radiologists' preferences with regard to the presentation style of the radiology report, and investigated the reasons for and barriers to the adoption of these differing reporting styles.

**Materials and Methods**

The study was a questionnaire-based study with sets of itemised and prose reports for 4 hypothetical clinical scenarios commonly encountered (ultrasound of hepatic-biliary system with normal findings, ultrasound of hepatic-biliary system with abnormal findings, computerised tomography [CT] abdomen with normal findings, and CT abdomen with abnormal findings). Each set of report was identical in terms of content (Table 1). The referring physicians were to rank their level of satisfaction for prose and itemised reports and state the reasons for their responses. For the radiologists' survey, radiologists were further asked if they had utilised the itemised reporting format in his or her daily reporting and their reasons for doing so. They were also invited to choose the imaging modalities (plain radiography, fluoroscopy, mammography, ultrasound, CT, magnetic resonance imaging [MRI]) they thought were suitable for reporting in the itemised format. The radiologists' survey was distributed to all practising faculty radiologists within our institution's diagnostic radiology department. The referring physicians' survey was distributed to all practising referring physicians from various departments via their department secretaries and during a hospital grand round. Sign test was used to determine the statistical significance of the differences between the referring physicians' and radiologists' preference for itemised reporting over prose reporting. *P* values less than or equal to 0.05 were considered statistically significant.

**Results**

Of the 300 questionnaires distributed to the referring physicians, a total of 92 responses were received. A wide range of specialties, including anaesthesia, cardiology, emergency medicine, general medicine, geriatric medicine, oncology, endocrinology, family medicine, psychiatry, general surgery, orthopaedic surgery, sports medicine, ophthalmology, otorhinolaryngology and urology were represented. Of the 30 questionnaires distributed to the radiologists, 30 responded (100% reply rate). Table 2 summarises the results of the survey. Itemised reporting style was the preferred style of report by most referring physicians for all the 4 scenarios ($P < 0.05$). In contrast, although not statistically significant, a trend toward a preference for prose report was observed for majority of radiologists. The preference for a particular style was independent of the scan findings (abnormal or normal findings) and the scan modality (ultrasound or CT). No associations with clinical specialties were found. Reasons cited by the referring physicians for preference of itemised reporting included ease of comprehension and enhanced clarity of radiology report. A 5-point critical finding indicator was included at the end of every report which provides referring physicians with an indication of the level of severity of the radiological findings (Fig.1). Referring physicians found the critical finding indicators a helpful guide (senior physicians 76%, junior doctors 62.5%, $P > 0.05$, overall, 69.7%) in their resource management of care delivery, for example, the provision of appropriate level and timeliness of care, and for the more junior doctors, the threshold to activate the next level of care.

A total of 31.3% of replying radiologists used itemised reports in their daily reporting while another 37.5% sometimes used itemised reporting. The remaining 31.3% did not use itemised reporting at all. Reasons cited for using itemised reporting included the increased speed of reporting and improvement in the clarity of the report. Those who did not use itemised reporting at all cited familiarity with the prose reporting style and perceived it as providing more detailed report although the contents in both reports were the same. They also find itemised reporting monotonous, akin to the task of a data entry clerk, and mechanical,

Table 1. CT Scan Report for Abnormal Findings

| **A. Itemised Report*** | |
|---|---|
| Findings | |
| Stomach | |
| Site | Body and pylorus. |
| Wall thickening | Eccentric irregular enhancing mural thickening, compatible with submitted history of gastric tumour. |
| Perigastric changes | Surrounding mild perigastric fat stranding, suggestive of serosal involvement. |
| Lymphadenopathy | Perigastric, region, gastro-oesophageal junction, and gastrohepatic region (largest node measures 1.5 cm in short axis diameter); foramen of Winslow (measuring up to 1.6 cm in short axis diameter), and celiac axis, aortocaval nodes, left para-aortic node at level of left renal hilum. |
| Small bowel | Normal calibre. No abnormal mass or wall thickening. |
| Large bowel | Normal calibre. No abnormal mass or wall thickening. |
| Liver | Normal. No focal lesion. |
| Gallbladder | Normal. No gallstone. Biliary duct not dilated. |
| Pancreas | Normal. No focal lesion. |
| Spleen | Normal. No focal lesion. |
| Kidneys | Normal. Symmetrical excretion. No stone or hydronephrosis. |
| Adrenals | Normal. No focal lesion. |
| Ascites | Present, with small amount of free pelvic fluid. |
| Mesentery/peritoneum | Normal. |
| Blood vessels | Normal. |
| Pelvic adenopathy | No. |
| Pelvic organs | Normal. |
| Bony lesions | No. |
| Lung bases | Right pleural effusion with adjacent compressive atelectasis. |
| Impression | Large tumour involving body and pylorus stomach with multiple enlarged lymph nodes as described. |
| **B. Prose Report*** | |
| Findings | There is eccentric irregular enhancing mural thickening of the body and pylorus of the stomach compatible with the submitted history of gastric tumour. The surrounding perigastric fat show mild fat stranding suggestive of serosal involvement.<br>There are enlarged perigastric nodes, gastro-oesophageal junction nodes and gastrohepatic nodes, largest measuring 1.5 cm in short axis diameter. There are also enlarged nodes at the foramen of Winslow, measuring up to 1.6 cm in short axis diameter. Clusters of small celiac axis nodes are evident. Small aortocaval nodes are evident. There is an enlarged left para-aortic node at the level of the left renal hilum measuring 1.2 cm in short axis diameter.<br>There is a small sliver of ascites in the abdomen and a small amount of free pelvic fluid. Included lung bases show dependent atelectasis. There is a sliver of right pleural effusion with adjacent compressive atelectasis.<br>The liver shows normal size, shape and attenuation with no focal lesion. There is no dilatation of the biliary tree and the gallbladder has normal features. No gallstone detected. The hepatic veins and the splenoportal axis are well-opacified. No filling defects are noted.<br>Spleen is not enlarged. No adrenal masses identified. Both kidneys enhance symmetrically with no hydronephrosis identified. Pancreatic outline and enhancement are preserved. The uterus is unremarkable. No adnexal masses identified. The visualised bowel is normal in calibre. No destructive bone lesion identified. |
| Impression | Large tumour involving body and pylorus stomach with multiple enlarged perigastric nodes as described. |

CT: Computerised tomography
*Both reports are for the same abdominal CT examination with a clinical scenario of "Loss of weight? Gastric tumour".

as if reported by machine. More radiologists felt that advanced imaging, such as ultrasound, CT and MRI, which required longer and detailed report due to the multiple findings and numerous structures examined, were most suitable for itemised reporting than film-screen radiography such as plain radiography, fluoroscopy, and mammogram (advanced imaging, 50% to 66.7% vs film-screen radiography, 3.3% to 23.3%). We felt that itemised reporting style remains relevant for mammography and fluoroscopy.

Table 2. Referring Physicians' and Radiologists' Preference for Itemised and Prose Reporting Styles in Each Given Scenario

| Itemised Report vs Prose Report | Clinicians (n = 92)* | | Radiologists (n = 30)* | |
|---|---|---|---|---|
| Normal ultrasound | | | | |
| Positive ranks | 43 | (48.30%) | 8 | (26.70%) |
| Negative ranks | 24 | (27.00%) | 10 | (33.30%) |
| Ties | 22 | (24.70%) | 12 | (40.00%) |
| Number of respondents | 89* | | 30 | |
| | | $P = 0.028$ | | $P = 0.815$ |
| Abnormal ultrasound | | | | |
| Positive ranks | 43 | (48.30%) | 7 | (23.30%) |
| Negative ranks | 25 | (28.10%) | 16 | (53.30%) |
| Ties | 21 | (23.60%) | 7 | (23.30%) |
| Number of respondents | 89* | | 30 | |
| | | $P = 0.039$ | | $P = 0.093$ |
| Normal CT | | | | |
| Positive ranks | 41 | (47.10%) | 9 | (30.00%) |
| Negative ranks | 24 | (27.60%) | 13 | (43.30%) |
| Ties | 22 | (25.30%) | 8 | (26.70%) |
| Number of respondents | 87* | | 30 | |
| | | $P = 0.047$ | | $P = 0.523$ |
| Abnormal CT | | | | |
| Positive ranks | 47 | (53.40%) | 11 | (37.90%) |
| Negative ranks | 21 | (23.90%) | 11 | (37.90%) |
| Ties | 20 | (22.70%) | 7 | (24.10%) |
| Number of respondents | 88* | | 29* | |
| | | $P = 0.002$ | | $P = 1.000$ |

CT: Computerised tomography
*Some respondents did not answer all questions.

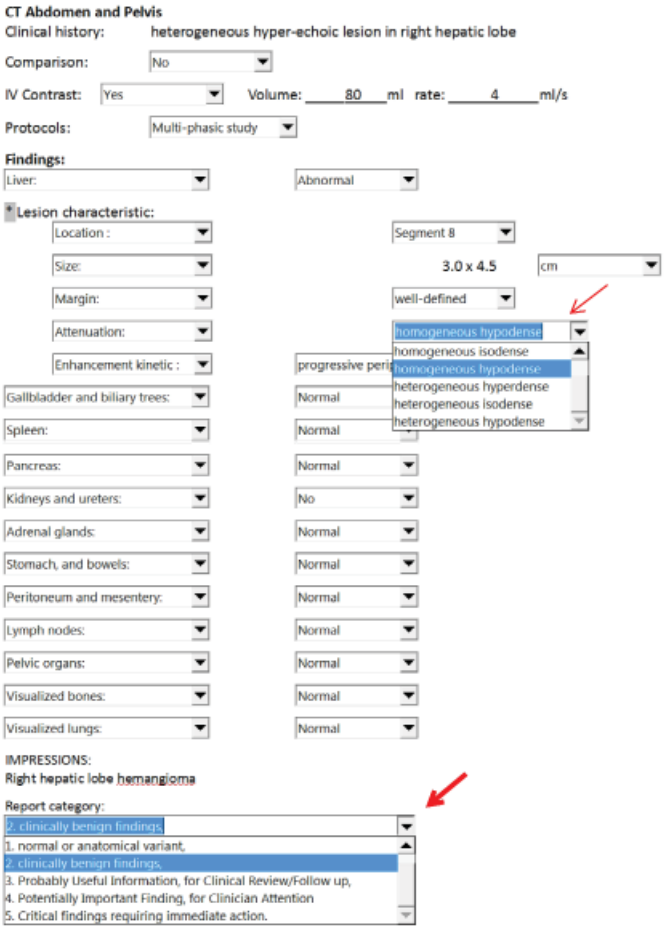


Fig.1. An example of a structured itemised report for CT abdomen and pelvis of a patient with hepatic haemangioma. There is a drop-down list using the "point-and-click" input method in the reporting (indicated by an arrow) for a patient with a liver mass. The choices in the drop-down list allow the use of an appropriate lexicon that is relevant for describing the imaging findings. The choices in the list also provide a structured checklist that guides and aids radiologists in the accuracy and completeness of their reporting so that pertinent data are not omitted. A 5-point critical finding indicator at the end of the report is indicated by an open arrow. Referring physicians found this to be a useful guide in the provision of appropriate level and timeliness of care to patients.

## Discussion

Traditionally, radiological report is created using prose dictation by radiologists. There is often a wide variation and lack of standardisation in the narratives reported by different radiologists, and not uncommonly, by the same radiologist at different times, despite similar interpretation on the same set of images, leading to inconsistency in reports.[1] Consistency in processes is known to improve outcome while reducing variability of radiology reports is thought to improve quality. A way to standardise would be the use of a structured itemised report with standardised coherent radiological lexicon. Consistent terminology and presentation will improve communication, reducing errors of omission and enhance clarity of radiology report.

Structured itemised report is considered easier to read and provides report completeness and legibility.[2-4] Similar to other studies,[2-7] referring physicians in our survey preferred the itemised reports to the prose reports and cited ease of comprehension and enhanced clarity of the radiology report for their preference. This observation is independent of the examination results. On the other hand, majority of our radiologists expressed preference for the prose reports. One critical obstacle to adopting itemised reporting may lie with the current methods for the creation of this type of report, which some radiologists found to be time-consuming and a distraction from the core task of analysing and interpreting the images.[3,8] A disruptive technological innovation for generating a structured itemised report can occur in

tandem with an evolving workflow-optimised advanced image visualisation software. It raises the capability of radiologists to manage the challenge of an enormous amount of radiological information in a systematic and organised fashion. The benefit of this efficiency advantage is the production of a prompt radiology report[2,5,8] within the context of a balanced sustainable turnaround time (TAT).[9] One example is the incorporation of a drop-down list permitting a "point-and-click" input method (Fig. 1) instead of manual typing or dictation. Compared to traditional prose report, itemised structured reports enable information and values to be extracted for analysis and decision-making with greater ease.

## Conclusion

Structured itemised reporting style has been the preferred style of report for referring physicians, because it allows for the ease of comprehension and enhances clarity of radiology report. Workflow re-engineering through structured itemised reporting potentially improves our supply-chain efficiency in the reporting TATs. It expands our core business competency in the delivery of a quality radiology report, enabling consistency in the work that we do and positively impacting patient management.

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# An Evaluation on the Effects of Inpatient Pulmonary Rehabilitation Following Acute Exacerbation of Chronic Obstructive Pulmonary Disease in a Singapore Hospital

**Dear Editor,**

To minimise rapid decline in physical function, current consensus have now supported the initiation of an early pulmonary rehabilitation programme (PRP) during hospitalisation or within 1 month after discharge for people with an acute exacerbation of chronic obstructive pulmonary disease (AECOPD).[1,2] A Cochrane meta-analysis in people with AECOPD reported clinically significant improvements in exercise capacity, health-related quality-of-life (QOL) and hospitalisation rate following early PRP over usual care.[3] However, these findings were based on a heterogeneous mix of service delivery designs, i.e. inpatient PRP without a convalescence period (administered during hospitalisation), elective inpatient PRP after home convalescence and outpatient PRP. Findings on effects of inpatient PRP without a convalescence period for AECOPD are few, with only 2 studies[4,5] in the Cochrane meta-analysis and a recent randomised controlled trial.[6]

The aim of this retrospective study is to examine the effects of our hospital's inpatient PRP without a convalescence period (referred to as inpatient PRP hereon) on exercise capacity, health status and 30-day readmission following an AECOPD. As there is a paucity of studies on inpatient PRP for AECOPD, our retrospective analysis may add evidence to earlier prospective studies.[4-6]

## Methods

*Design and Participants*

An observational retrospective analysis of our inpatient PRP was performed from its inception in October 2012 to December 2013. Prior to enrolment, patients admitted for AECOPD were screened for eligibility, deemed medically stable by the attending respiratory physicians and gave consent. Patients were ineligible for the programme if they had severe cognitive impairment, psychotic disturbance, severe premorbid clinical depression, or musculoskeletal, neurological or unstable cardiovascular disease precluding exercise. Ethics was approved by the National Healthcare Group Domain Specific Review Board.

*Inpatient PRP*

Enrolled patients remained in the hospital for a further 2 weeks. Our inpatient PRP consisted of 20 physiotherapy exercise sessions (twice daily), 3 occupational therapy sessions and a diet counselling session. Each exercise session consisted of 30 minutes of aerobic and strength training, with at least 10 minutes spent in walking exercise.[7] Walking exercise intensity was prescribed using 80% of the average speed achieved in the 6-minute walking test.[8] Other exercises were prescribed at a moderate intensity using symptom score of 3 to 4 on the modified Borg dyspnoea scale 0 to 10.[7] The occupational therapy sessions consisted of pacing and energy conservation strategies during activities of daily living. Those who were on long-term oxygen therapy (LTOT) trained with supplemental oxygen.

*Outcome Measures*

The outcomes investigated in this study were the distance walked during the 6-minute walk test (6MWT distance), the COPD Assessment Test (CAT) scores and 30-day hospital readmission. The 6MWT was performed on a straight 25-metre indoor corridor according to guidelines.[9] The minimal important differences (MID) for the 6MWT and CAT score are 25 metres[10] and 2 points[11] respectively for individuals with COPD. Negative CAT score change indicates improvement in health status.[11]

*Data Analysis*

Group values were reported as mean and standard deviation (SD), unless otherwise stated. Pre- and post-programme 6MWT and CAT scores were compared using a paired t-test. A Pearson's correlation was performed to examine the relationship between changes in 6MWT distance and in CAT scores. Odds ratio was calculated to examine the likelihood that any changes in outcomes or patients' characteristics would affect 30-day hospital readmission. The level of significance was set at $P < 0.05$. Statistical analysis was performed using IBM SPSS (IBM SPSS Statistics for Windows, Version 19.0. Armonk, NY: IBM Corp).

## Results

Of 93 patients with AECOPD screened, 30 (32%) agreed to enrol into the inpatient PRP, 9 (10%) were unsuitable and 54 (58%) declined enrolment. The main reasons for rejecting inpatient PRP were fear of increased dyspnoea

from exertion, prolonged hospital stay and uncomfortable hospital environment. Of the enrolled patients, 2 were taken off the programme due to the administration of antibiotics for hospital-acquired pneumonia and 3 asked to be discharged before they completed at least 12 physiotherapy sessions.[2] Therefore, data of the remaining 25 (27%) enrolled patients were analysed.

Table 1 shows the characteristics of the enrolled patients. They were male and predominantly in Group D classifications.[12] The median number of physiotherapy exercise sessions completed was 18 (interquartile range [IQR], 15 to 20). Missed exercise sessions were due to complaints of fatigue and breathlessness. All enrolled patients completed occupational therapy and dietician sessions. The median number of days from admission to commencement of PRP was 4 (range, 3 to 7 days). None of the patients had previously undergone a PRP.

The 6MWT distance increased significantly by 54 metres (95% CI, 30 to 77 metres, $P$ <0.001) and CAT scores reduced significantly by 6 points (95% CI, -9 to -3 points, $P$ <0.001). The increase in 6MWT distance is moderately correlated with the reduction in CAT score (r = -0.533, $P$ = 0.006) (Fig. 1).

Of the 13 patients who had been admitted previously for AECOPD in the past 30 days, 9 (69%) did not readmit within the next 30 days following inpatient PRP. Altogether, 20 patients (80%) did not readmit within 30 days. The likelihood ratios between 30-day readmission rate and other outcomes or patient characteristics were not significant (Table 2).

Table 1. Baseline Characteristics of Patients

| Characteristics | n = 25 |
|---|---|
| Age, years | 72 (1) |
| GOLD classification | |
| Group A, n (%) | 1 (4%) |
| Group B, n (%) | 1 (4%) |
| Group C, n (%) | 2 (8%) |
| Group D, n (%) | 21 (84%) |
| Smoker, n (%) | 8 (32%) |
| LTOT, n (%) | 9 (36%) |
| $FEV_1$, % predicted | 40 (2) |
| mMRC score | 2 (1) |
| BMI, kg/m$^2$ | 21.0 (5.4) |
| 6MWT distance, metres | 204 (119) |
| CAT score, units | 19 (10) |

6MWT: Six-minute walk test; BMI: Body mass index; CAT: Chronic obstructive pulmonary disease Assessment Test; $FEV_1$: Forced expiratory volume in one second; GOLD: Global initiative for Obstructive Lung Disease classification; LTOT: Long-term oxygen therapy
*The values are presented in mean (SD), unless otherwise stated.

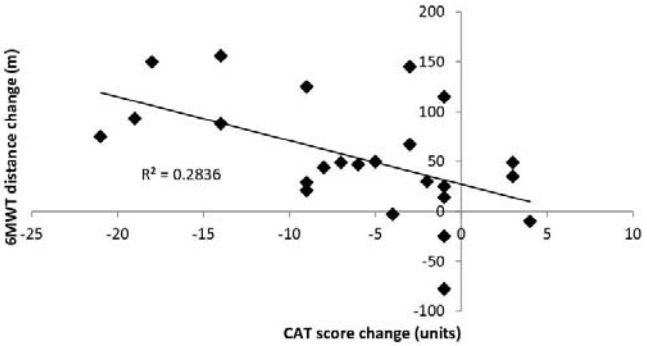


Fig. 1. Relationship between changes in 6MWT distance and in CAT score. Negative CAT score changes indicate better perceived quality of life.

## Discussion

The findings from our retrospective study demonstrated that an inpatient PRP elicited clinical and significant improvements in exercise capacity and health status in patients admitted for AECOPD. In patients with a 30-day readmission history of exacerbation prior to current admission, more than half did not readmit in the next 30 days following PRP. However, improvements in exercise capacity and health status achieved during PRP did not explain readmission rate. It appears that an inpatient PRP during AECOPD may minimise the deleterious consequences from hospital stay and exacerbations.

Our use of moderate intensity for exercise training closely reflected training protocols recommended for stable COPD[7] and elicited clinically important improvements in the 6MWT distance and CAT scores, adding to the positive results of other trials investigating exercise rehabilitation during hospitalisation.[4-6] The finding of a median of 90% completed sessions seemed to indicate that moderate exercise intensity was tolerable by our patients with AECOPD, despite exercising twice daily. While an exercise-based intervention during acute illness has raised safety concerns,[13] serious adverse events were reported to be minimal.[6] An inpatient

Table 2. Likelihood of Variables Affecting 30-day Readmission Rate

| Variables | Odds Ratio (95% CI) | $P$ Value |
|---|---|---|
| Change in 6WMT distance | 1.02 (1.00 – 1.04) | 0.13 |
| Change in CAT score | 0.92 (0.78 – 1.10) | 0.38 |
| Age | 0.95 (0.81 – 1.10) | 0.50 |
| BMI | 1.02 (0.82 – 1.28) | 0.83 |
| $FEV_1$ % predicted | 0.99 (0.91 – 1.07) | 0.74 |
| Smoking history | 0.22 (0.02 – 1.74) | 0.15 |
| LTOT use | 0.81 (0.11 – 6.04) | 0.83 |

6MWT: Six-minute walk test; BMI: Body mass index; CAT: Chronic obstructive pulmonary disease Assessment Test; CI: Confidence interval; $FEV_1$: Force expiratory volume in 1 second; LTOT: Long-term oxygen therapy

PRP using moderate intensity training is therefore feasible and safe for patients with AECOPD.

While outcomes could not explain 30-day readmission rate in our study, an important factor strongly associated with readmission is physical activity,[14] which was not measured. It is possible that, with PRP, patients had improved motivation, confidence and self-efficacy[15] to regain physical activity levels following discharge. This could explain our finding of more than half of our PR patients not being readmitted despite having consecutive admissions within a month. More studies are needed, however, to examine the short- and long-term effects of inpatient PRP on self-efficacy and physical activity levels.[1]

The value of an inpatient PRP prior to discharge lies in providing an earlier opportunity to initiate gains in exercise capacity and health status, which may otherwise decline without rehabilitation.[1] The finding of a moderate relationship between improvements in 6MWT distance and CAT score shows the degree of contribution walking capacity has on health status and further supports the recommendation of starting an inpatient PRP early prior to discharge.

There was no comparative data on the group who declined the inpatient programme which limits the interpretation of our findings. The sample size was also small and therefore, the study may be underpowered. Furthermore, selection bias may be introduced into our results as more patients declined PRP (58%) than those who enrolled. Our programme would benefit from a reassessment of patients to determine how long benefits of inpatient PRP, including physical activity, are retained following discharge.[1]

## Conclusion

Our intensive inpatient PRP is feasible to be delivered to patients with AECOPD, resulting in clinical and significant improvements in exercise capacity and health status and reduced 30-day readmission rate.

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