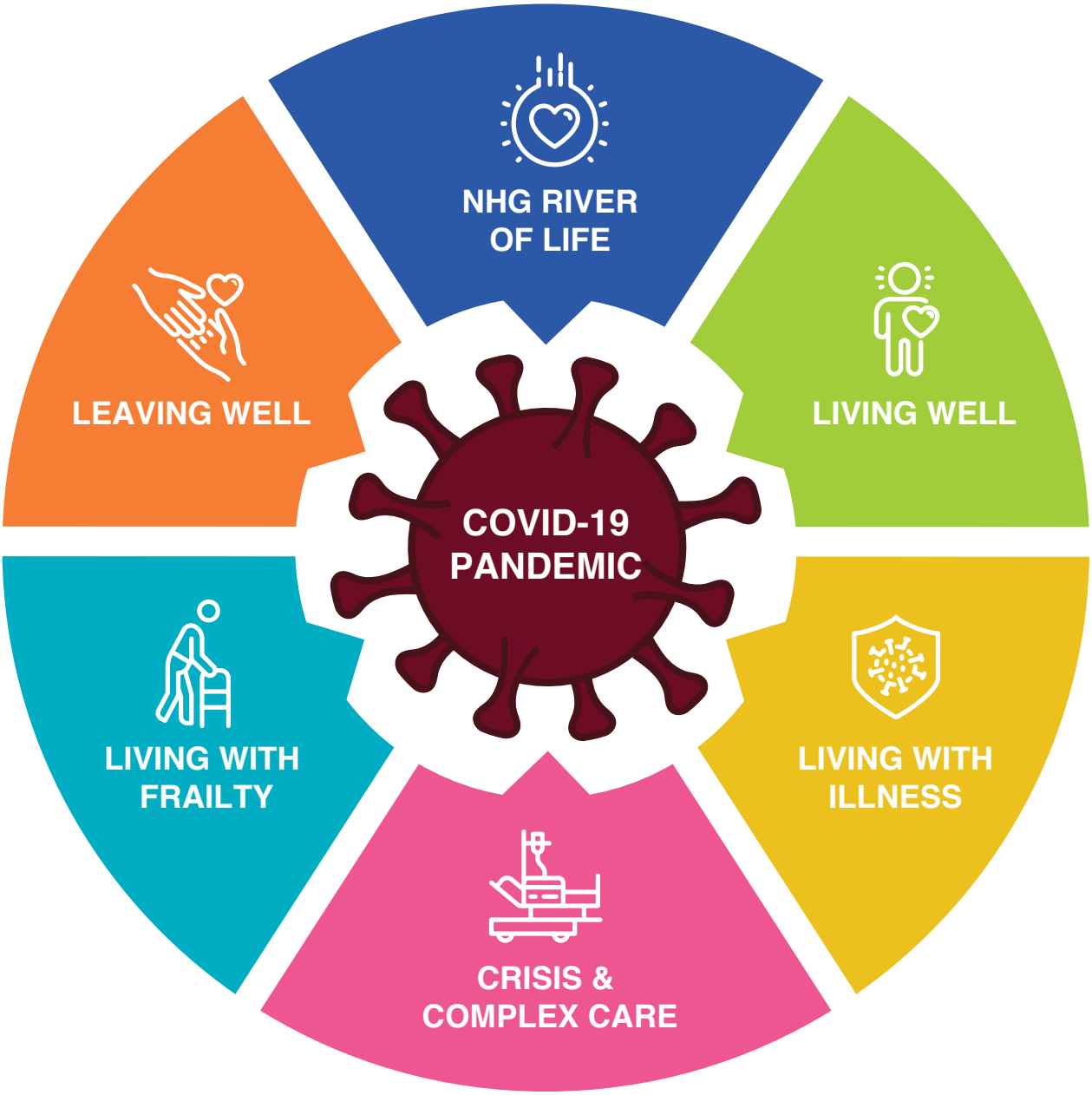
HSOR@NHG

The evidence behind your decisions



ANNUAL REPORT 2020

MISSION & VISION

& OUR VISION

To add years of healthy life to the people of Singapore through excellence in Health Services Research.

& OUR MISSION

To improve the quality of healthcare by providing best available evidence for decision making and knowledge translation; and build capacity and advance knowledge in Health Services Research.

2020 is synonymous with the COVID-19 pandemic; its arrival, acceptance and impact on work and society. As a health services and outcomes research department, whose work is both knowledge- and field-based, we faced challenges in shifting work to home. While we continued our knowledge-based work online, primary data collection processes that needed face-to-face interactions had to be adapted and put in place. These changes will continue post-pandemic, as new efficient ways are established in our methods of knowledge acquisition, dissemination and collaboration.

The dynamic evolution of COVID-19 demanded continuous decision support to critical stakeholders. Senior management were kept abreast through daily monitoring of the local and overseas outbreak, supported by assimilated evidence; assured of ICU capacity to cope with peak national load and informed of projections of incidence and prevalence. Our research work found early determination of salient transmission parameters of COVID-19 in the local community. Clinicians were supported with reviews of prognostic indicators for progression of hospitalized severe COVID-19 patients. An online research, from local press reports, showed that the general population's perceptions of the circuit breaker were wide ranging: an opportunity or inconvenience, compliance or challenge to restrictions, high or low risk threat. A Lancet publication chronicled the major state policy decisions and actions, and how our population reacted using a resilience framework.

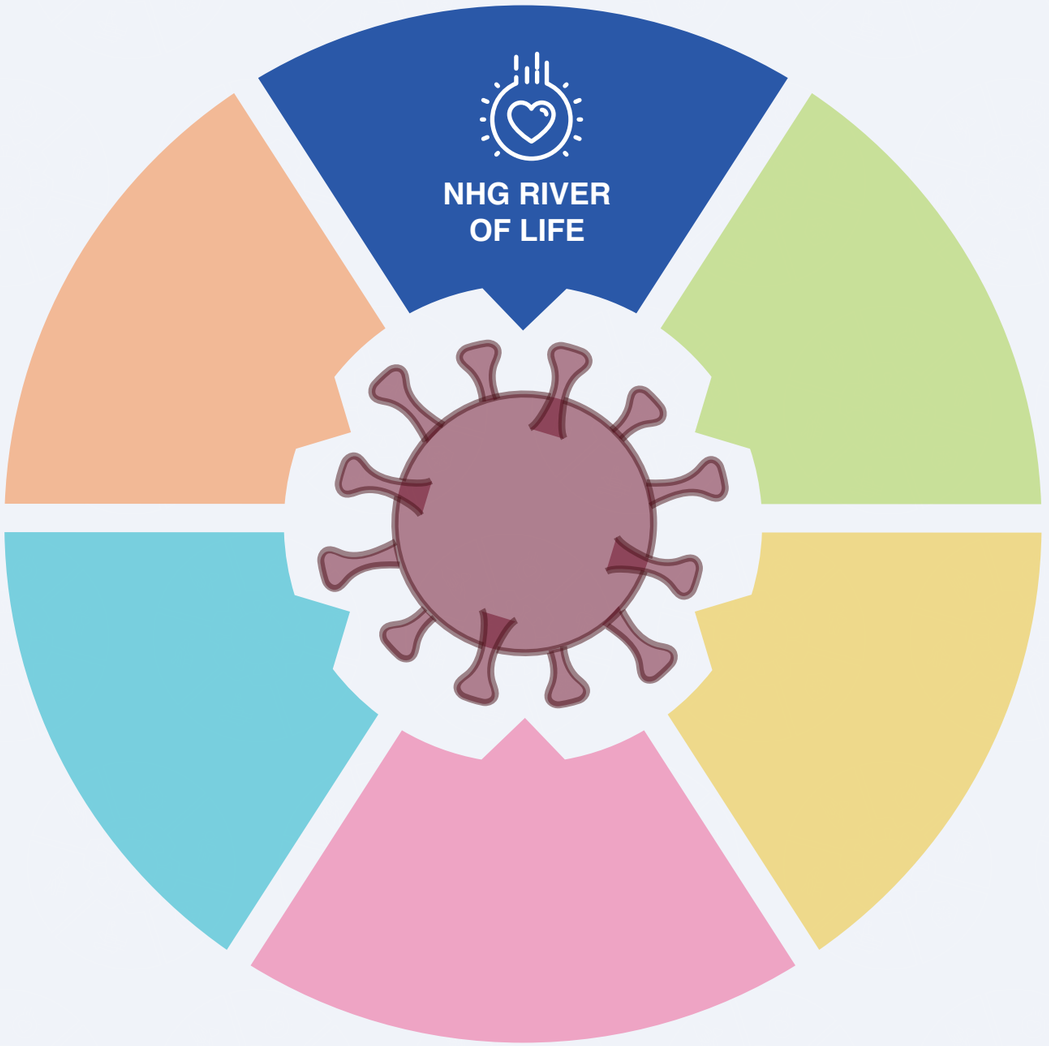
Programme design, and measuring programme effectiveness and care quality continued. The Emergency Department Interventions for the Frail Elderly (EDIFY) and Acute Internal Medicine Service (AIMS) programmes showed bed savings. The EDIFY programme showed that a comprehensive geriatric care team reduced acute admissions by 80% among emergency presentations. The AIMS programme demonstrated bed day savings in a medical short-stay ward through multi-disciplinary specialist care and front loading of investigations. Evaluation of single payments for hip fracture care showed inpatient rehabilitation length of stay savings by improving care coordination between acute and rehabilitative providers of different organisations, though implant cost is a differential factor. While our new multidisciplinary Diabetic Foot in Primary and Tertiary Care (DEFINITE) programme reduced or delayed amputation, the defaulter rate was a moderately high 20%.

NHG's vision of adding years of healthy and productive life to the people of Singapore will integrate fragmented care across partners, prevent or slow disease progression at a sustainable cost, with new contextualised organisational and delivery structures and funding models. HSOR provides the evidence in this new journey, while we continue to evaluate clinical and population programmes for efficacy and cost-effective care.

This report covers abstracts of the department's ongoing work. We hope you find them interesting and useful.

PROFESSOR PHILIP CHOO
Group Chief Executive Officer
National Healthcare Group

NHG RIVER OF LIFE



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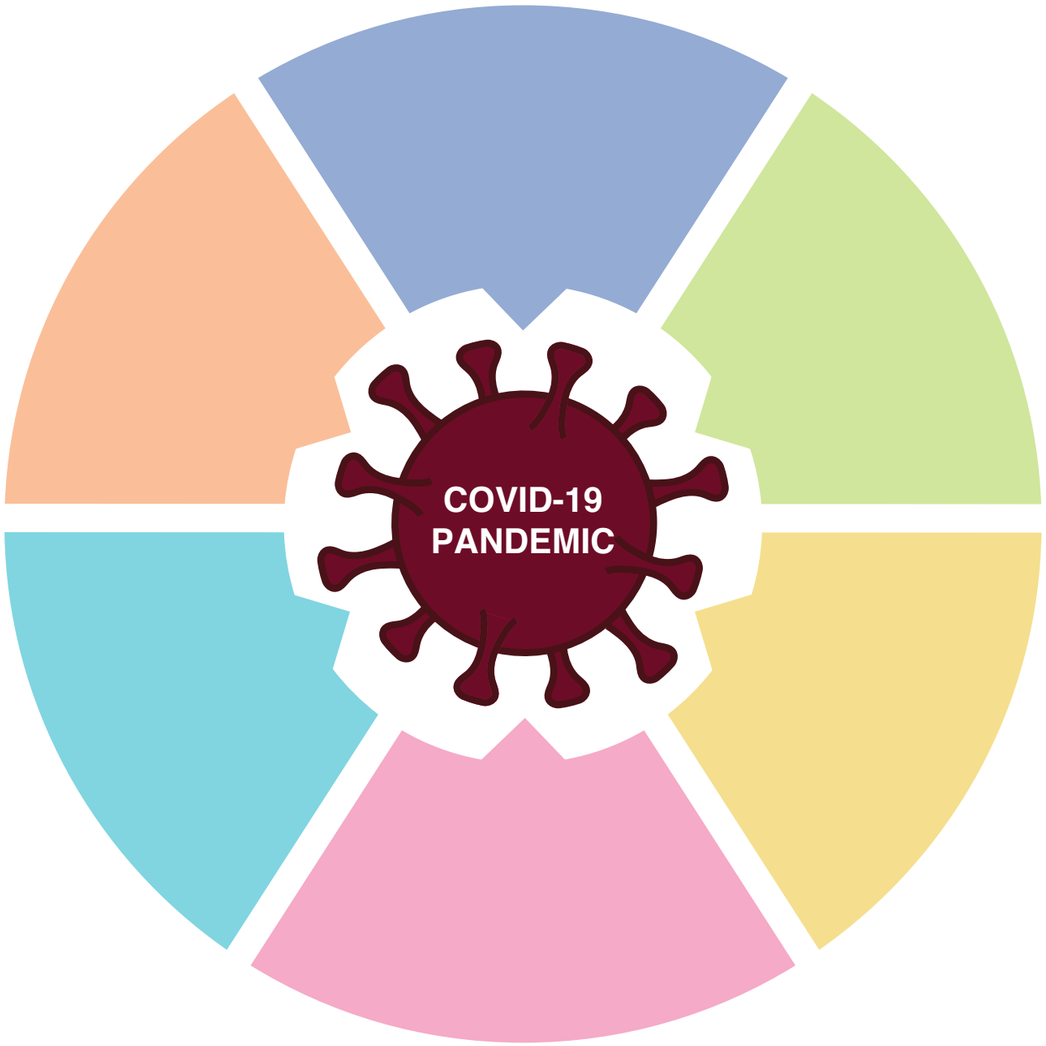

ESTIMATING TRANSMISSION PARAMETERS OF COVID-19 CLUSTERS IN SINGAPORE, JAN TO APR 2020

Sheryl Ng Hui Xian, Palvinder Kaur, Cecile Kremer[1], Dr Tan Woan Shin, Dr Aidan Lyanzhiang Tan, Dr Niel Hens[1,2], Adj Asst Prof Matthias Paul Toh Han Sim[3,4], Teow Kiok Liang, Palvannan R. K.

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HIGHLIGHTS

- A person infected with COVID-19 was estimated to pass the infection on to another individual in 3 days, and 72% of simulated infections were pre-symptomatic transmissions.
- The transmission dynamics of the COVID-19 outbreak require traditional public health strategies to be responsive to the short generation time and prevalent pre-symptomatic transmission in order to be effective.

INTRODUCTION

Understanding the underlying disease transmission dynamics of COVID-19 is pertinent to guide the use of outbreak control measures to minimise the impact of the pandemic. The basic reproduction number (R_0) of an epidemic denotes the average number of people a person infects in a completely susceptible population. However, knowledge of R_0 alone is insufficient. Other parameters, such as the incubation period, serial interval and generation interval (Tg), would provide pertinent information on the transmission chain.

Furthermore, as conventional outbreak control measures are centred around isolation, contact tracing and treatment of symptomatic cases, the prevalence of pre-symptomatic transmission (p) in a population would inform shifting measures to address potential transmission amongst those with no apparent symptoms. Hence, to guide control measures for the outbreak, the aim of this study was to generate estimates of Tg, R_0 and p, using published symptom onset data of cases in Singapore.

METHODS

A cross-sectional study design was implemented to estimate Tg, R_0 and p for the outbreak in Singapore from 23 January 2020 to 06 April 2020. Given that containment measures were initiated over the duration of the study, R_0 should be interpreted as the effective reproduction number of the outbreak throughout this report. All confirmed COVID-19 cases classified by the Ministry of Health, Singapore (MOH) as linked to a local cluster were included in this analysis and information was extracted from daily press releases published by MOH. Date of symptom onset (DOOs) for cases that were not available from press releases were extracted from a similar anonymized dataset of COVID-19 admissions to the National Centre for Infectious Diseases (NCID). Cases with DOOs not available from NCID were subsequently excluded from analysis.

We identified index cases and potential infectors of each case based on available information of the cases' known contacts, published case links, and a heuristic technique to sensibly include potential infectors who could have transmitted the infection to the cases. The infector-infectee pairs constructed were subsequently used to estimate the serial and generation interval distribution.

Assuming the same incubation period with mean of 5.2 days and SD of 2.8 days, we replicated the Bayesian Markov Chain Monte Carlo procedure detailed in Ganyani et. al. (1) to estimate the mean and SD of the Tg distribution. With the estimated parameters, we constructed the corresponding distribution of R_0, and subsequently p by simulating infections and computing the proportion of pre-symptomatic transmissions. For each parameter's posterior distribution, the median and 95% credible interval were reported.

RESULTS

There were 1,375 confirmed cases as of 06 April 2020, and we applied our exclusion criteria to obtain a final sample size of 257 cases. As there were 48 index cases who had no infector, a maximum of 209 infector-infectee pairs were constructed for analysis.

Analysing the 209 pairs, the mean Tg was estimated to be 3.44 (95% credible interval [CrI]: 2.79, 4.11) days, with an SD of 2.39 (95% CrI: 1.27, 3.45) days (Table 1). This corresponded to an R_0 of 1.09 (95% CrI: 1.08, 1.11) and p of 0.72 (95% CrI: 0.64, 0.80). Examining the 93 pairs with only one known contact, the estimates for mean Tg, SD Tg and R_0 increased, while p decreased. The 116 pairs that required identification of potential infectors reported a shorter mean Tg and a higher p in comparison.

CONCLUSION

The mean generation interval of the COVID-19 outbreak in Singapore was estimated at 3.44 days, suggesting that an infected person would be expected to pass on an infection to another individual in three days. The R_0 estimated for the clusters was slightly above 1, higher than other estimates reported for the outbreak up to March 2020 (2). We observed a high p, potentially a result of prompt isolation of symptomatic cases (3). Nonetheless, the high prevalence of pre-symptomatic transmission in the community requires public health strategies to be responsive to this characteristic in order to remain effective. These strategies would include universal mask wearing in the community, testing of individuals living in or working with confined populations, as well as expansion of contact tracing to include the period before symptom onset.

Table 1. Estimates of transmission parameters

	MEAN Tg	SD Tg	R_0	p
INFECTEE TYPE	MEDIAN (95% CREDIBLE INTERVAL)			
ALL CASES (N=209)	3.44 (2.79, 4.11)	2.39 (1.27, 3.45)	1.09 (1.08, 1.11)	0.72 (0.64, 0.80)
CASES WITH ONLY 1 KNOWN CONTACT (N=93)	3.93 (3.00, 4.93)	2.63 (1.10, 4.31)	1.11 (1.08, 1.14)	0.65 (0.54, 0.76)
CASES WITH ONLY MULTIPLE OR NO KNOWN CONTACT (N=116)	3.03 (2.13, 3.97)	2.45 (0.86, 4.21)	1.08 (1.06, 1.11)	0.76 (0.65, 0.86)

p: pre-symptomatic proportion; R_0: basic production number; SD: standard deviation; Tg: generation time

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FORECASTING STEADY STATE PREVALENCE OF COVID-19 IN FOREIGN WORKER DORMITORIES AS OF 24 MAY 2020

Palvannan R. K., Dr Aidan Lyanzhiang Tan, Teow Kiok Liang, Dr Heng Bee Hoon

HIGHLIGHTS

- The steady state prevalence of past and new infections in foreign worker dormitories was forecasted by modelling data as of 24 May 2020, with results being reasonably close to publicly available data published by Ministry of Health, Singapore on 14 December 2020.
- Key modelling assumptions: a) There was a large pool of infected and infectious cases in foreign worker dormitories at the end of March 2020 when attention was turned to this setting; b) There were separate streams for symptomatic and asymptomatic patient pathways.

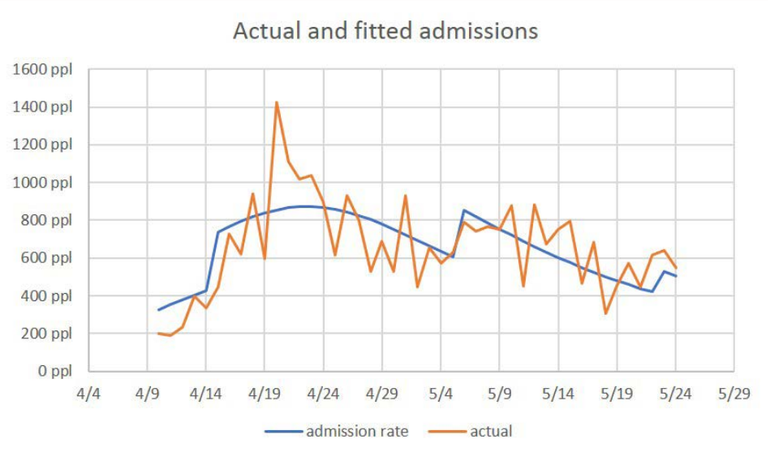
INTRODUCTION

In Singapore, COVID-19 transmissions in the general community and foreign workers were reported separately, and even considered independent. Foreign worker dormitories (FWDs) collectively housed about 320,000 workers of foreign nationalities across multiple buildings of different layouts. In this article, we report a forecast of infections in FWDs using infectious disease transmission modelling and assumptions on baseline parameters.

METHODS

A 2-flow (asymptomatic and symptomatic) Susceptible-Infectious-Recovered (SIR) model was built to baseline and forecast transmissions of COVID-19. The baseline historical transient incidences from April to May 2020 used to feed the model are shown in Figure 1. Baseline model parameters which were calibrated or based on assumptions from literature are described in Table 1. Transmission flows using Powersim Studio 6a®, a system dynamics modelling software, are shown in Figure 2. The model executes numerical deterministic simulations of a set of coupled non-linear ordinary differential equations. They assumed aggregate scope and complete mixing of infectious and susceptible populations in this study.

Figure 1. Baseline historical transmissions



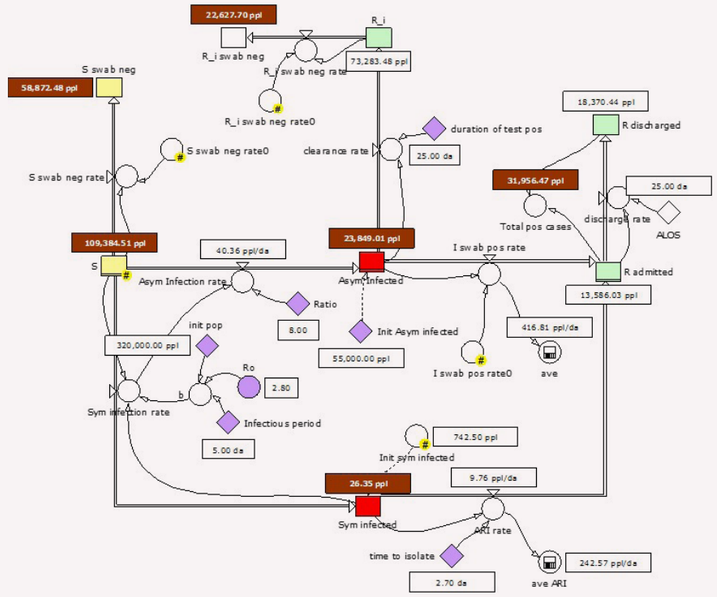
RESULTS

The steady state model forecast was 45,000 PCR (new infections) cases and 106,000 seropositive (past infections) cases, while Ministry of Health reported on 14 December 2020 that the actual cases in the FWDs were 54,000 PCR cases and 98,000 seropositive cases. Results were similar for varying testing capacities of the FWDs.

Table 1. Estimates of transmission parameters

PARAMETERS	VALUE	REMARKS
POPULATION	320,000	FW Population
BASIC REPRODUCTION NUMBER (R_0)	2.6	Assume natural R_0
INITIAL ASYMPTOMATIC PATIENTS	55,000	Assume to reach based on R_0=4 from 20 April 2020
INITIAL SYMPTOMATIC PATIENTS	400	Function of initial asymptomatic state
RATIO OF ASYMPTOMATIC : SYMPTOMATIC INFECTION RATES	8:1	Anecdotal assumption/calibrated
INFECTIOUS PERIOD	5 Days	
TIME TO ISOLATE SYMPTOMATIC PATIENT	2.5-3 Days	2 days as pre-symptomatic, 1 day to isolate
MEAN DURATION OF INFECTION IN ASYMPTOMATIC PATIENT	25 Days	Patient will be PCR+ for 25 days
SWAB TEST CAPACITY	1,000-3,000 Patients/Day	Ramped up from 10 Apr 2020
AVERAGE LENGTH OF STAY (ALOS) IN COMMUNITY ISOLATION FACILITY	25 Days	

Figure 2. SIR transmission model



CONCLUSION

A SIR model was built to forecast steady state prevalence of COVID-19 in FWDs that was reasonably close to actual numbers. While we do not rule out that the proximity of our results to the actual data may be coincidental, the results suggest the potential validity of the model assumptions and approach adopted in this study.

TEMPORAL CHANGES OF HAEMATOLOGICAL AND RADIOLOGICAL FINDINGS OF THE COVID-19 INFECTION: A REVIEW OF LITERATURE

Adj Asst Prof Albert Yick Hou Lim[1], Goh Jun Leng[2], Chua Chui Wei Mae[2],Dr Heng Bee Hoon, Clin Assoc Prof John Arputham Abisheganadan[1], Dr Pradeep Paul George Gunapal

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HIGHLIGHTS

- Review findings suggest a positive correlation between temporal changes in haematological and radiological results with disease severity.
- Awareness of these trends in blood results and imaging changes may assist clinicians in making ICU admission decisions when resources are limited.

INTRODUCTION

COVID-19 is a systemic viral infection with many clinical manifestations affecting the hematopoietic system and haemostasis. Few studies have highlighted the prognostic value of blood findings such as lymphopenia, neutrophil/lymphocyte ratio, platelet/lymphocyte ratio, lactate dehydrogenase (LDH), C-Reactive Protein (CRP), cardiac troponin, low-density lipoproteins and chest radiographic abnormality. A study of progressions of blood and radiological results may help to identify patients at high risk of severe outcomes. This systematic review aimed to assess the temporal progression of blood and radiology findings of patients with COVID-19.

METHODS

A comprehensive systematic literature search was conducted on Medline, Embase and Cochrane databases to identify articles published for peripheral blood investigation and radiological results of COVID-19 patients.

RESULTS

A total of 27 studies were included in this review. The common laboratory features reported include lymphopenia, elevated levels of LDH and CRPs. For radiological signs, ground-glass opacifications (GGO), consolidations, and crazy paving patterns were frequently reported. There were correlations between lymphocyte count, neutrophil count and biomarkers such as LDH and CRPs; at the later phase of the disease (more than 7 days since onset of symptoms), lymphopenia worsens while neutrophil count, LDH and CRPs levels increase (Figure 1). Frequencies of GGO and GGO with consolidations decrease at the later phase of the disease while that of consolidation and crazy paving pattern rises as the disease progresses. More extensive lung involvement was also seen more frequently in later phases (Table 4).

CONCLUSION

Reported changes in blood and radiological results over time may be helpful to monitor and evaluate disease progression and severity.

Figure 1. Temporal trends in haematological findings

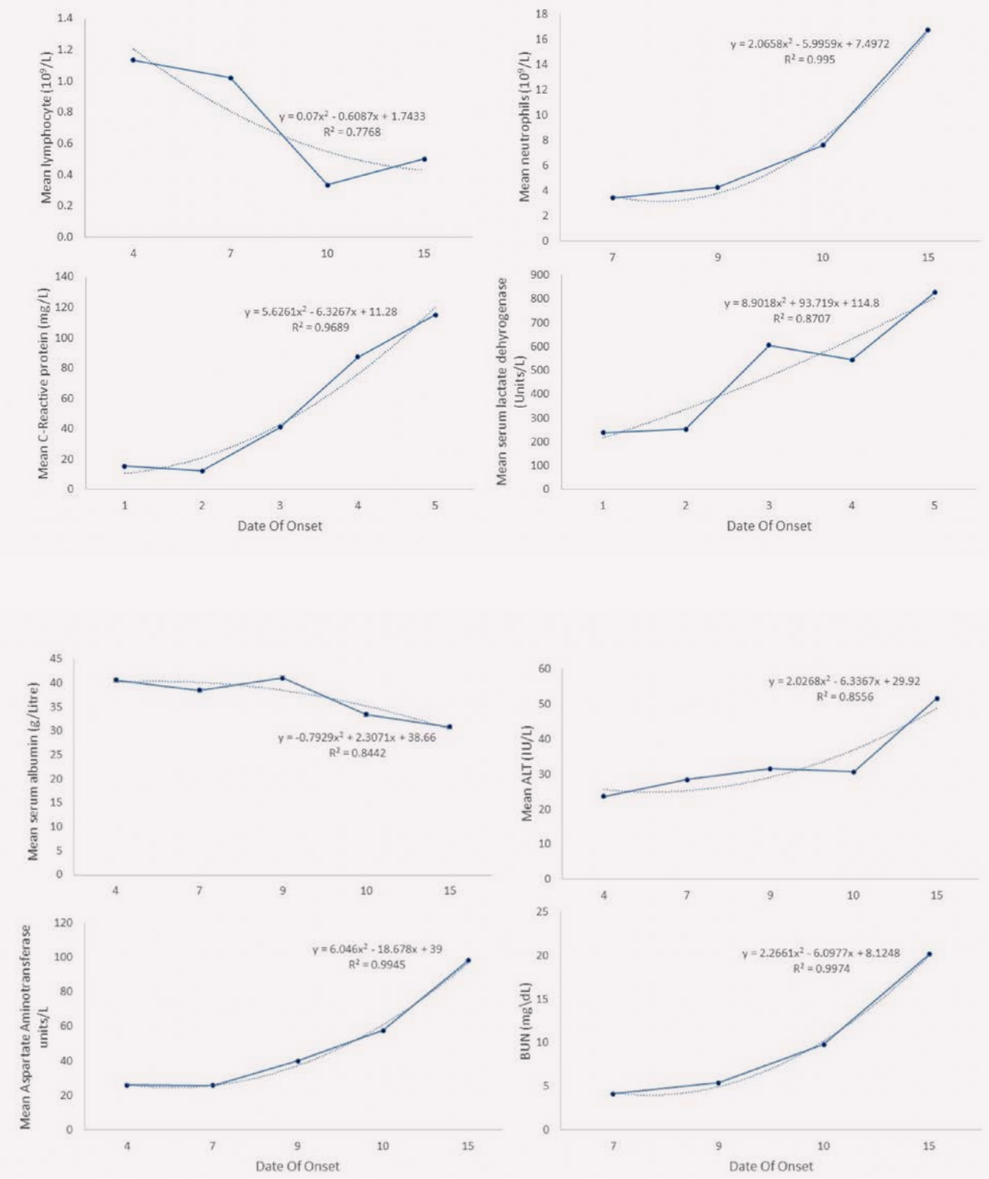

Table 1. Comparison between early and late phase chest CT findings

	LUNG CHANGES									LESION DISTRIBUTION		
PHASE	GCO	CONSO-LIDATION	GGO+ CONSO-LIDATION	CRAZY PAVING PATTERN	BI-LATERAL LUNG	UNI-LATERAL LUNG	NO. OF LOBES: 1	NO. OF LOBES: 2 OR 3	NO. OF LOBES: 4 OR 5	PERI-PHERAL	CENTRAL	PERI-PHERAL+ CENTRAL
EARLY	827/1108 (74.6%)	394/1053 (49.5%)	157/317 (49.5%)	191/872 (21.9%)	800/1042 (76.8%)	131/814 (16.1%)	95/444 (21.4%)	83/403 (20.6%)	188/403 (46.7%)	506/698 (72.5%)	49/720 (6.81%)	109/518 (21.0%)
LATE	164/292 (56.2%)	126/287 (43.9%)	8/27 (29.6%)	76/265 (28.7%)	423/461 (91.8%)	23/207 (11.1%)	11/108 (10.2%)	6/67 (8.96%)	56/67 (83.6%)	52/139 (37.4%)	3/139 (2.16%)	77/114 (67.5%)

ESTIMATING INTENSIVE CARE UNIT BED CAPACITY DURING THE COVID-19 PANDEMIC USING WHAT-IF ANALYSIS

Dr Meng Fanwen, Teow Kiok Liang, Dr Heng Bee Hoon

HIGHLIGHTS

- Surge demand on intensive care unit beds during the outbreak of the COVID-19 pandemic was investigated under various scenarios with different admission rates and average length of stay.

INTRODUCTION

Healthcare capacity management is a significant concern in the management of disease outbreaks. As of January 2021, more than 105 million COVID-19 cases have been confirmed, with more than 2.28 million deaths attributed to COVID-19 worldwide. The first case of COVID-19 infection in Singapore was confirmed on 23 January 2020, and the spread was limited with contained community transmission and few imported cases. By late March to April 2020, COVID-19 clusters were detected at multiple foreign worker dormitories, which soon contributed to an overwhelming number of new cases in the country.

COVID-19 mortality rates across the globe are affected by multiple factors, including hospital resources, healthcare manpower, and intensive care unit (ICU) bed capacity, amongst others. In the early phase of the pandemic, due to limited data and many uncertainties, it was challenging to make informed decisions regarding the management of scarce healthcare resources. In this study, we aimed to estimate surge demand on ICU beds from COVID-19 patients, based on limited patient data during the early phase of the pandemic in Singapore. The results obtained can inform decision makers in planning surge bed capacity to meet the needs of critically ill patients requiring ICU care.

METHODS

We estimated the average number of cases using local admissions, and applied what-if analysis to assess ICU bed demand. The values of the underlying parameters, i.e., ICU admission rate and average length of stay (ALOS), were either estimated from Singapore reports (1), or taken from references based on China data (2, 3). In our analysis, we assumed that 5 to 20% of confirmed cases would be admitted to ICU, and that ALOS in ICU ranged from 7 to 15 days. With the number of daily new cases, the total number of ICU beds needed was calculated using Little's Law in queuing theory. For brevity, we considered finite discretized scenarios of ICU admission rates and ALOS, where ICU admission rates were 5%, and 20%; and ALOS were 7 and 15 days, respectively.

RESULTS

Based on the number of daily cases (i.e. 10 or 40), we estimated ICU bed demand for the different scenarios of ICU admission rates and ALOS. These results are presented in Tables 1 – 2.

Table 1. Bed estimation for an ICU admission rate of 5%

DAILY CASES	ICU ALOS = 7	ICU ALOS = 15
10	4	8
40	14	30

Table 2. Bed estimation for an ICU admission rate of 20%

DAILY CASES	ICU ALOS = 7	ICU ALOS = 15
10	14	30
40	56	120

The above sensitivity analysis could be fine-tuned with more data and certainty around included parameters.

COVID-19 PANDEMIC

CONCLUSION

We estimated ICU bed demand using what-if analysis by considering different scenarios of ICU admission rates and ALOS. The obtained results can potentially be helpful for healthcare providers to better plan and allocate critical hospital resources, such as ICU beds, during the COVID-19 pandemic.

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SINGAPORE'S COVID-19 'CIRCUIT BREAKER' INTERVENTION: PERCEPTIONS AND IMPACT OF MEASURES

Dr Aidan Lyanzhiang Tan, Dr Delfinn S Tan[1], Dr Mee Lian Wong[2]

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HIGHLIGHTS

- Perceptions of the circuit-breaker were mixed.
- Perceived facilitators and barriers to compliance related to impacts of the measures on the individual, and the implementation and enforcement of the measures.

INTRODUCTION

Public health measures to control COVID-19 have varying effectiveness between countries, influenced by differences in perceived facilitators or barriers, and recipients' eventual compliance or non-compliance. We aimed to explore recipients' (the general population) perceptions regarding Singapore's public health response to the COVID-19 crisis ("Circuit Breaker", CB) that contributed to the suppression of COVID-19 in the country.

METHODS

Recipients of CB measures were the Singapore general population. A qualitative study was conducted on the general public's perceptions regarding CB measures and their perceived facilitators or barriers to compliance with these measures. We conducted a thematic analysis using an iterative process until thematic saturation, using comments on online local English newspaper articles related to COVID-19 a week prior to and during the circuit-breaker period.

RESULTS

We identified 7,193 comments across 29 articles, with 244 comments relevant to our study. Four themes emerged, with related positive or negative subthemes (Table 1). These themes tie into the observed behaviour and compliance as shown in Figure 1. Two related to perception regarding CB measures: 'Belief in the necessity and effectiveness of the measures', and 'Individual perception of disease threat' (20, 8.2%). The latter involved subthemes of infection risk and the disease severity should infection occur. The other two themes related to perceived facilitators or barriers to compliance: 'Impact of compliance with CB measures on the individual' (123, 50.4%); and 'Implementation and enforcement of the measures' (43, 17.6%). Impacts include social activities, financial situations and mental or psychological health.

CONCLUSION

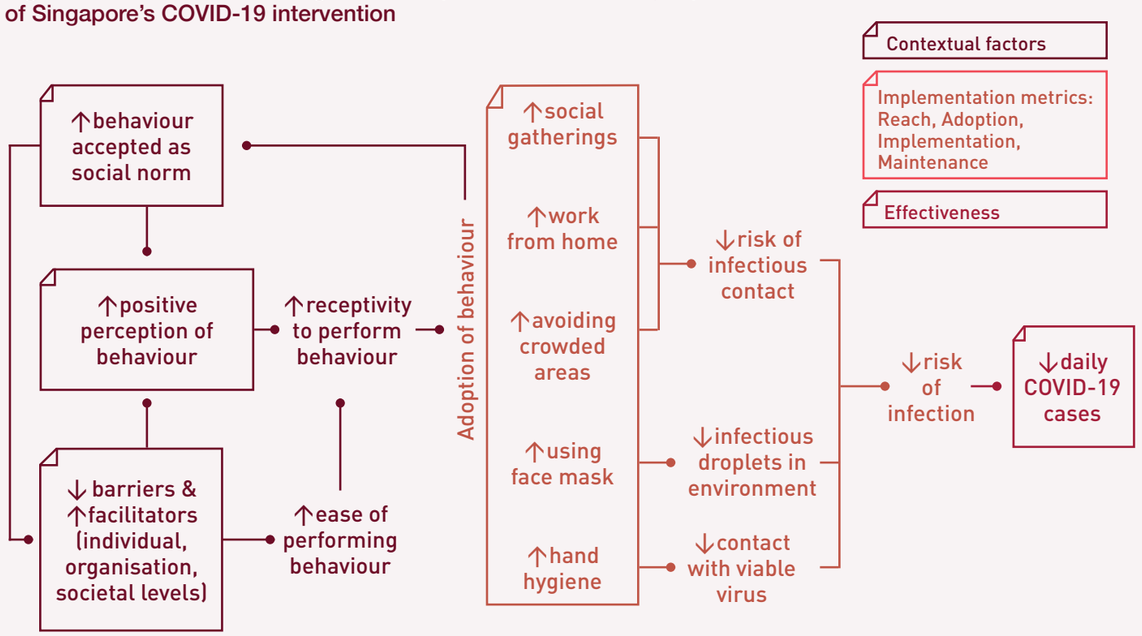
Multiple factors were identified that facilitate or obstruct behavioural compliance with CB measures despite good intentions. These could explain the observed compliance levels with Singapore's intervention and aid in future design and implementation of preventive and protection measures in the general population against pandemics.

Table 1. Identified Themes

THEME	
BELIEF IN NECESSITY AND EFFECTIVENESS OF MEASURES	
Acceptance as effective and as a necessity	Challenging the effectiveness of measures
Compliance now leads to lesser restrictions (duration, severity) in future	Challenging the necessity of measures
Earlier compliance would have avoided current restrictions	Challenging the effectiveness of measures
INDIVIDUAL PERCEPTION OF DISEASE THREAT	
High risk of infection	
High severity of disease	Low severity of disease
IMPACT OF CB MEASURES	
CB as an opportunity for improvement	CB as an inconvenience or cost
	Deprivation of medical or support services
	Family as a stressor (source of conflict, or additional demands)
	Financial concerns: loss of income, higher costs, unsupportive workplaces
IMPLEMENTATION AND ENFORCEMENT OF MEASURES	
Understanding and compliance with the 'spirit of the law'	Ignorance and compliance with the 'word of the law'
	Deliberate misuse of ambiguity in the measures
Presence of enforcement with severe penalties	Low enforcement with insufficient penalties

CB: Circuit Breaker

Figure 1. Model demonstrating relationships between Context, Implementation metrics and Effectiveness of Singapore's COVID-19 intervention



SINGAPORE'S COVID-19 'CIRCUIT BREAKER' INTERVENTION: SHORT AND LONG-TERM EFFECTIVENESS

Dr Aidan Lyanzhiang Tan, Sheryl Ng Hui Xian, Dr Michelle Jessica Pereira

HIGHLIGHTS

- Facemask usage and work-from-home increased during the 'circuit breaker'.
- COVID-19 incidence in the local community peaked and subsequently decreased during the CB period.
- Singapore's COVID-19 intervention (Circuit-breaker) appeared effective in suppressing local community transmission.

INTRODUCTION

The effectiveness of interventions is a combination of efficacy and implementation success. During the COVID-19 pandemic, many countries enacted similar interventions but achieved differing results. We describe the effectiveness of Singapore's national public health response (termed "circuit-breaker or "CB") to the COVID-19 crisis on short-term and long-term outcomes.

METHODS

We performed an interrupted-time series study using retrospective secondary data. Short-term outcomes include proportion working-from-home, behaviours of hand-hygiene, facemask usage, and avoidance of crowded areas. The long-term effectiveness outcome was COVID-19 incidence. We compared compliance levels and trends across different time periods to assess effectiveness of the CB in Singapore. We compared before (1 Jan – 6 Apr 2020) with during CB (7 Apr – 1 Jun 2020), and during with after CB (2 Jun 2020 – 5 Aug 2020).

RESULTS

In the short-term, facemask usage increased by 46.9% (95%CI: 34.9%-58.8%, p <0.01) during CB. Other self-reported behaviours showed no statistically significant changes. Work-from-home proportion increased by 20.4% (95%CI: 11.7%-29.2%, p<0.01), compared to before CB (Figure 1).

COVID-19 incidence decreased but not significantly during CB. However, incidence growth rate changed from positive (+0.73 cases daily, SD0.05) to negative (-0.55, SD0.07) during CB (p<0.01). Aside from a gentler but still negative incidence (-0.11, SD 0.06), there was no significant difference in all other outcomes between during and after CB (Figure 2).

CONCLUSION

Singapore's nation-wide COVID-19 intervention appeared effective in reducing local community COVID-19 incidence. However, it is unlikely to influence other sources of COVID-19 such as imported cases or within foreign worker dormitories. Drivers of effectiveness include universal facemask usage and social distancing compliance.

Figure 1. Reported adherence to Singapore's 'Circuit Breaker' measures

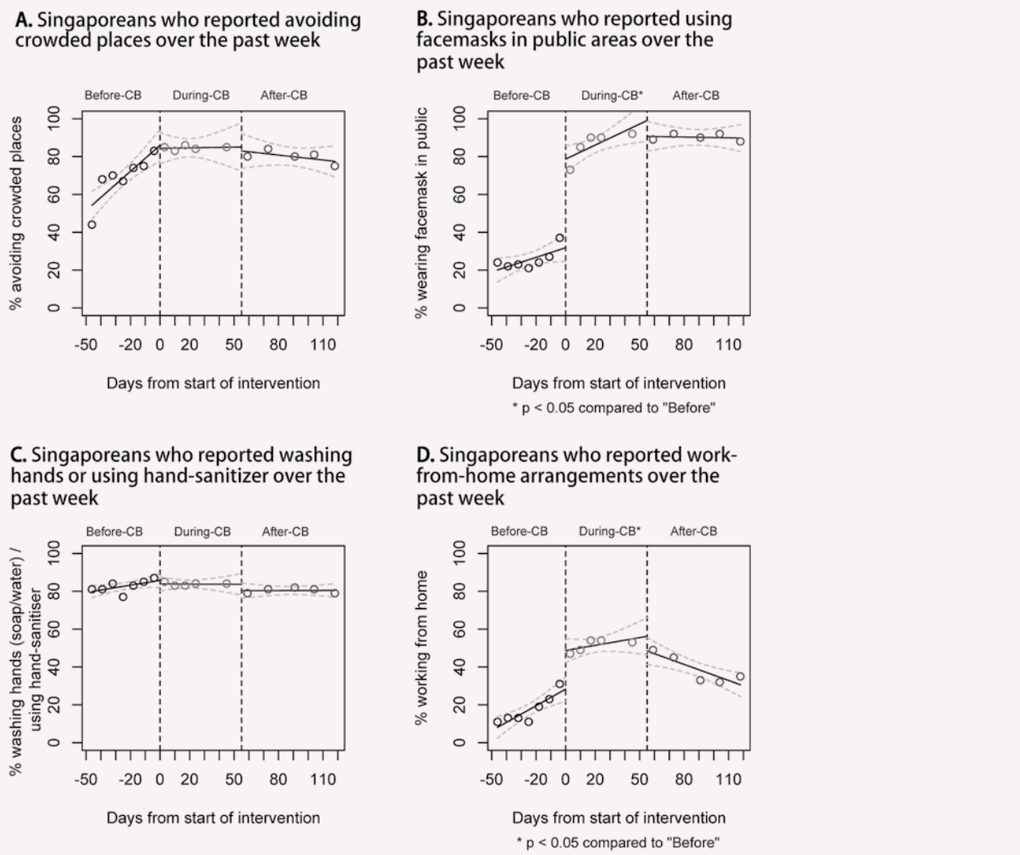
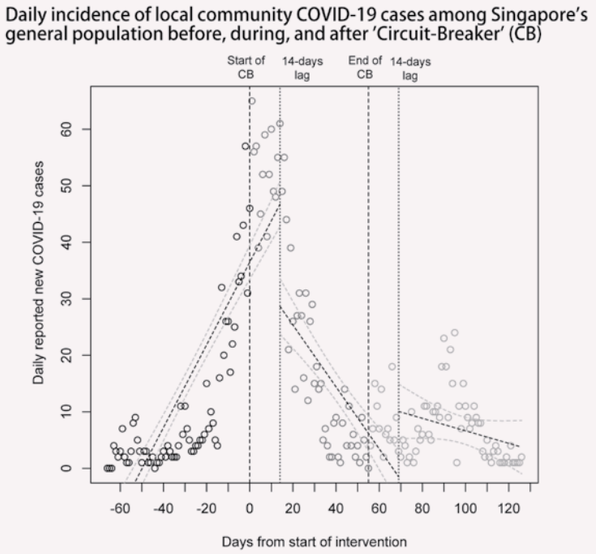


Figure 2. Incidence of community COVID-19 in Singapore



A COLLECTIVE RESPONSIBILITY TOWARDS PATIENTS WITH CHRONIC RESPIRATORY DISEASE AT A TIME OF GLOBAL CRISIS

Palvinder Kaur, Dr Pradeep Paul George Gunapal, Clin Assoc Prof John Arputhan Abisheganaden[1], Asst Prof Sanjay Haresh Chotirmall[2]

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HIGHLIGHTS

- Underlying respiratory diseases, specifically chronic obstructive pulmonary disorder and smoking are associated with poorer COVID-19 outcomes.

INTRODUCTION

Early characterisation of patients admitted to the hospital during the COVID-19 pandemic showed a lower prevalence of asthma and chronic obstructive pulmonary disorder (COPD). Published as a commentary in Lancet Respiratory Medicine on April 3rd, 2020, Halpin and colleagues identified an important underrepresentation of patients with chronic respiratory disease (CRD) affected by coronavirus disease 2019 (COVID-19).[1] The author offered a balanced view of three explanatory possibilities (1) underdiagnosis, (2) immune protection and (3) an effect of therapy. We propose an alternate and evidence-based perspective.

METHODS

We performed a rapid review on the available literature in April 2020. PubMed and Google Scholar were used to search for all published articles on 'COVID-19 AND Comorbidities', 'COVID-19 AND Risk Factors', and 'COVID-19 AND Clinical Characteristics' between 1st December 2019 to 8th April 2020. Title, abstract and full text of all articles captured within the search criteria were evaluated and studies that reported prevalence of comorbidities were included. We identified 25 articles, of which 2 were excluded as they did not meet the criteria.

RESULTS

Of the included studies (n=23), 19 (82.6%) were based in China, and one each from Singapore, Taipei, Italy, and the United States (US). Among the included studies, 15 (87% based in China) studies reported the prevalence of comorbidities including CRDs amongst COVID-19 infected patients.

(1) Is the prevalence of CRDs low amongst COVID-19 infected patients?

Sample sizes from these 15 studies ranged from 12 to 7,162, with the prevalence of having at least one CRD ranging from 1% to 9.2%. China has high COPD prevalence but significant underdiagnosis, and it is likely that the CRD statistics are underestimated.[2] In contrast with China-based studies, a Morbidity and Mortality Weekly Report from the Centers for Disease Control and Prevention evaluating COVID-19 hospitalisations in 99 counties across 14 US states illustrated that in March 2020, a significant proportion (up to 40%) of mainly older patients (>50 years) had existing CRDs.[3] Eight studies that compared severe groups or those admitted to intensive care unit (ICU) with those less severe or non-ICU patients, found a higher proportion of patients with at least one CRD amongst those with severe disease. Meta-analysis from pooled studies found that COPD strongly predicted severe illness with COVID-19 (pooled Odds ratio (OR): 5.69; 95% CI:2.49 to 13.0); (pooled OR: 6.42; 95%CI: 2.44 to 16.9), ICU admission (17.8; 95% CI:6.56 to 48.2) and composite outcomes such as increased risk of ICU admission, invasive ventilation, or death (HR: 2.68, 95% CI: 1.42 to 5.04). This seems to suggest CRD to be a risk factor for severe COVID-19 patients versus those without severe illness from this disease.

Update as of 27 Jan 2021: A meta-analysis from 22 studies reported that patients with underlying respiratory diseases, specifically COPD, and smoking were associated with severe COVID-19 outcomes.[4]

(2) Are there mechanisms by which CRD patients are more susceptible to COVID-19?

CRD patients are more susceptible to viruses which remain a significant cause of exacerbations. COPD patients, like active smokers, demonstrate upregulated ACE-2, the SARS-CoV-2 entry point, and increased CXCL10, CCL7 and IL1-RA that promote higher viral load, poorer lung function and worse SARS-CoV-2 outcomes.5 Asthmatics have deficient interferon (IFN) production that compromises anti-viral defenses, placing them at higher risk of COVID-19.[6]

(3) Does treatment for CRDs have a protective effect on COVID-19?

Following our own systematic review, we find no evidence that inhaled steroids protect against or are suitable for use in COVID-19, and in fact may cause harm.

Update as of 27 Jan 2021: Based on an observational cohort study in England, findings do not provide any strong support for a protective effect of inhaled corticosteroids use in COPD and asthma populations.[7]

CONCLUSION

Viral infections are a common trigger for acute COPD and asthma exacerbations. Based on this review, studies suggest that patients with CRDs, particularly COPD, are at greater risk of severe illness with COVID-19. Given this, current evidence is insufficient to suggest protection for CRD patients (treated or untreated) against COVID-19. Until new evidence emerges, current treatment protocols for CRDs should be adhered to and patients should seek care at appropriate settings in the event of an exacerbation.

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BUILDING COMMUNITY RESILIENCE BEYOND COVID-19: THE SINGAPORE WAY

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HIGHLIGHTS

- Adopting a community resilience perspective can help communities and government leaders better understand a country's persistent capacity to overcome and rebound from adversities such as the COVID-19 pandemic.
- Efforts to systematically strengthen the building blocks of community resilience: social capital, social responsibility and trust among individuals, is crucial for addressing future health shocks.

COVID-19 has been one of the deadliest virus outbreaks in modern history and has affected over 215 regions/countries. The effects of COVID-19 have not been limited to healthcare, but the pandemic has also affected the global economy. The implementation of safety measures have had an impact on the mental well-being of many individuals. Singapore's experience suggests that apart from efficient healthcare systems and government, the community played crucial roles in pandemic containment, managing negative effects and support recovery.

In our viewpoint[1], we reviewed the interconnected key elements of community resilience (Figure 1) that have helped Singapore combat COVID-19 and cope with the repercussions.

Community partnerships and social responsibility to maintain physical health

Singapore was able to rapidly contain the spread by adopting a test-isolate-quarantine-contact trace approach. The role played by the community in complying with the recommended safety measures was an important part of the equation of minimising community spread. Further, partnerships with private hospitals, private organisations and government agencies to rapidly set up community care facilities prevented the tertiary systems from being overwhelmed and kept fatalities rate low.

As a hallmark of our kampung spirit, individuals and grassroots organisation came together to support and look out for each other during the pandemic. Community-based organisations also stepped up and brought medical support into the homes of the vulnerable to ensure that care is maintained.

Inclusive society and psychological health

About 90% of the local infected cases were migrant workers living in the dormitories. This is a reminder of the high risk of disease spread in a community in dense living conditions. To control the spread of virus within the dormitories, combined efforts from various government agencies as well as cooperation and patience from the migrant workers were required. Non-governmental organisations also came forward to introduce initiatives to care for the well-being of this population.

In this pandemic, mental health support for the community was not triggered in the early stages. Community-based organisations stepped up and filled the gap to provide the much needed emotional support to cope with the pandemic.

Economic well-being

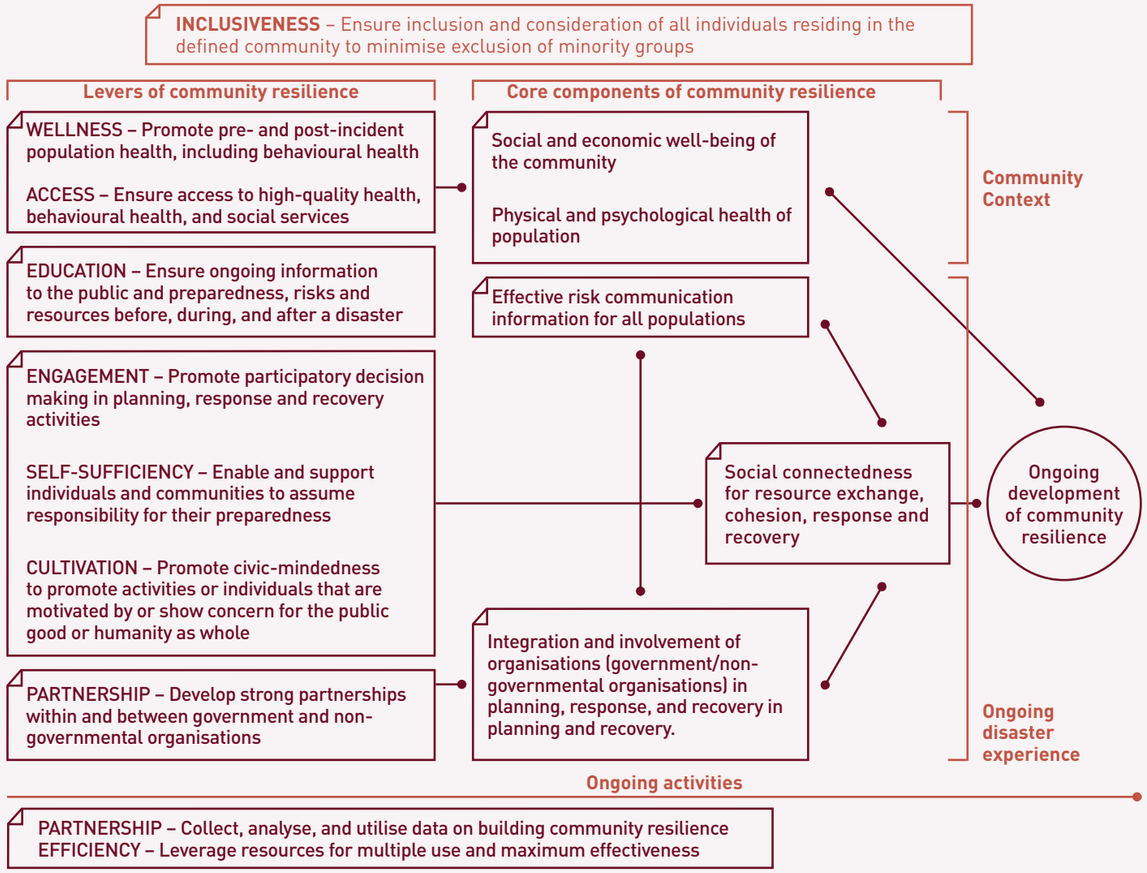
The financial support provided by the government had been crucial to protect jobs, support individuals and families and stabilise businesses. This economic support provided breathing space and reduced emotional stress for individuals and families to cope with the financial burden and adapt to the safety measures. Importantly, these financial schemes allowed safety measures to be implemented with minimal social tension and minimised fractures on social cohesiveness.

Communication to avoid confusion

Relevant, timely and accurate information from responsible sources are key to avoiding panic and confusion. In the new digital world, fake news on the pandemic can easily reach multiple individuals in a short span of time. This misinformation caused confusion within the community, and impeded policy implementation. In response, the government used various social media channels, official website and traditional media communications to disseminate timely information and provide clarifications.

These lessons are evidence that efforts to systematically strengthen the building blocks of community resilience: social capital, social responsibility and trust among individuals, will facilitate recovery efforts and be crucial for addressing future health shocks.

Figure 1. Components of community resilience (adapted from Anita Chandra and colleagues[2])



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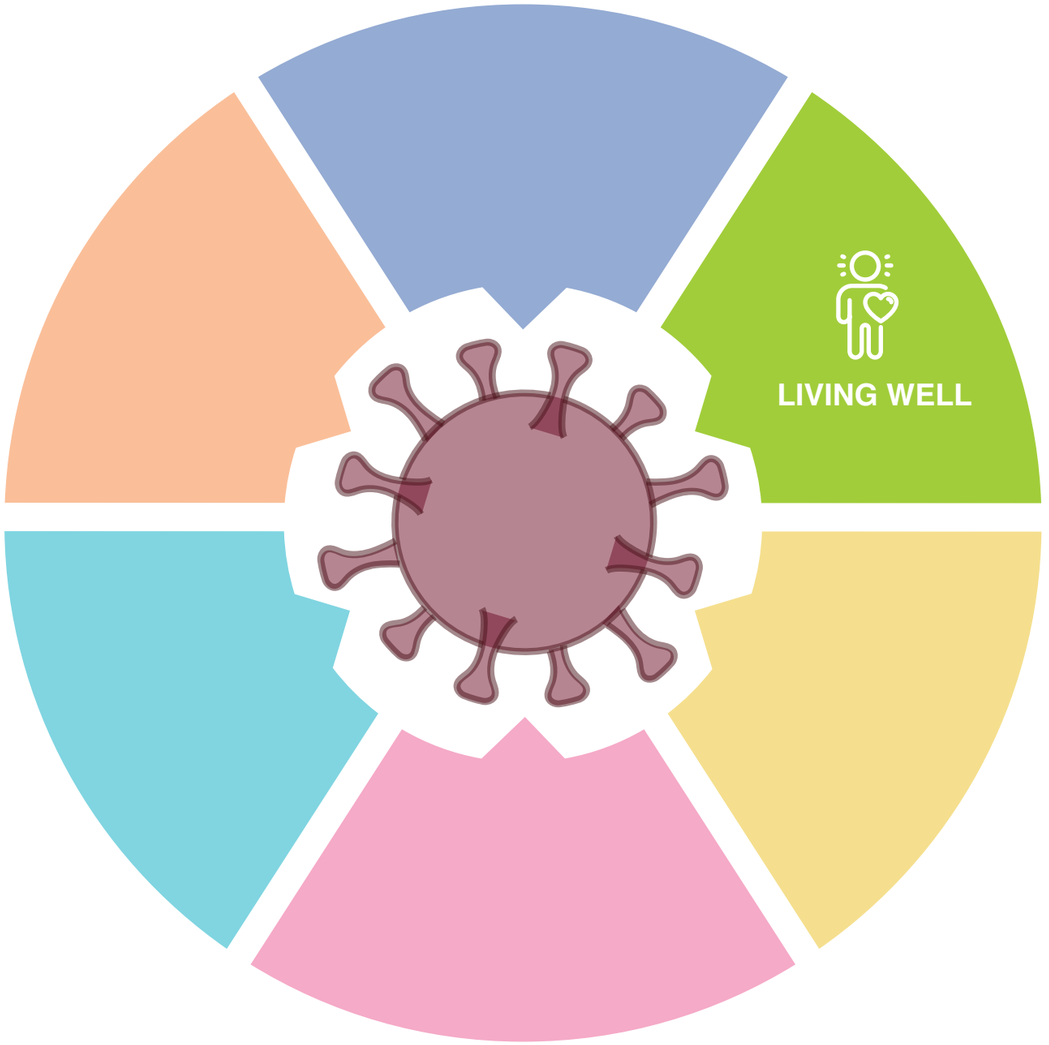
LIVING WELL

A focus on healthy individuals and population health management



EARLY DISEASE - PROGRESSION TO DISEASES, COMPLICATIONS AND DEATH, AND EVIDENCE OF INTERVENTIONS TO PREVENT PROGRESSION

Dr Yap Chun Wei, Dr Pradeep Paul George Gunapal, Dr Ang Yee Gary, Dr Aidan Lyanzhiang Tan, Teow Kiok Liang, Dr Zhu Zhecheng, Palvinder Kaur, Dr Heng Bee Hoon

HIGHLIGHTS

- Persons with early diseases are at higher risk of progression to diseases and complications, compared to those who are well.
- Interventions, such as physical activity and weight loss, can prevent progression to diseases and complications in persons with early diseases.

INTRODUCTION

Screening often classifies people as being neither diseased nor entirely risk-free of disease. These "in-between" states are sometimes designated as "early disease". The objective of this study is to determine whether persons with early diseases are at higher risk of progression to diseases and complications such as stroke, acute myocardial infarction, chronic kidney disease (CKD) stage 3A to 5, compared to well persons.

METHODS

We performed a retrospective cohort study to determine the risk of progression to diseases and complications for persons with early diseases. The inclusion criteria are Singaporeans or permanent residents living in Central or North zones, age 21 to 100 years old on study entry, who visited any National Healthcare Group (NHG) institutions between 2008 to 2019 and has at least one clinical measurement or laboratory test (blood pressure, BMI, FPG, OGTT or LDL) during that period. Persons are entered into the study on the first date of their clinical measurement or laboratory test and exited from the study on their last visit date or discharge from any NHG institutions between 2008 to 2019, or last date of clinical measurements or laboratory test, whichever is later. Persons are excluded from the study if they did not visit any NHG institutions at least once a year during their study period.

A panel data for each person, consisting of whether they were free of disease (and early disease), had early disease, or had the disease for various conditions (diabetes, hypertension, dyslipidaemia, obesity, metabolic syndrome), were determined from their clinical measurements or laboratory test results using the criteria shown in Table 1. Other than these factors, smoking status, age, gender, and ethnicity of each person was also obtained and used for the study. Logistic regression models were used to determine the 5-year risk of progression of these early diseases to diabetes, hypertension, dyslipidaemia, metabolic syndrome, stroke, acute myocardial infarction, CKD stage 3A to 5, severe frail, and all-cause mortality.

RESULTS

The increased risks of early disease progression to diseases and complications in 5 years compared to no early disease or disease are shown in Table 2. Studies have shown that weight loss is associated with a decreased risk of progression from pre-diabetes to type 2 diabetes. For every 1 kg decrease in weight, the risk of developing diabetes in future was reduced by 16%.[1] In addition, the incidence of hypertension was also reduced by 42%.[2] Physical activities showed a favourable effect on lowering blood pressure [2], improving oral glucose tolerance, fasting blood sugar and HbA1c.[3]

CONCLUSION

Persons with early diseases are at higher risk of progression to diseases and complications, compared to well persons. Interventions, such as physical activity and weight loss, can prevent progression to diseases and complications in persons with early diseases.

Table 1. Definitions of early diseases and diseases

CONDITION	NO EARLY DISEASE OR DISEASE	EARLY DISEASE	DISEASE
DIABETES	FPG <6.1 and OGTT <7.8	Impaired fasting glucose – FPG 6.1-6.9 Impaired glucose tolerance – OGTT 7.8-11.0	FPG ≥7.0 or OGTT ≥11.1 (≥2 readings)
HYPERTENSION	SBP <130 and DBP <85	High normal – SBP 130-139 or DBP 85-89 Elevated – SBP ≥140 or DBP ≥90 (single reading)	– SBP ≥140 or DBP ≥90 (≥2 readings)
DYSLIPIDAEMIA	LDL <3.4	LDL 3.4-4.0	LDL ≥ 4.1
OBESITY	BMI <25.0	BMI 25.0-29.9	BMI ≥30.0
METABOLIC SYNDROME	BMI <30.0	BMI ≥30.0 and 1 of the following: – TG ≥1.7 or known dyslipidaemia – HDL <1.03 for males or HDL <1.29 for females – SBP ≥130 or DBP ≥85 or known hypertension – FGP ≥6.1 or known diabetes	BMI ≥30.0 and ≥2 of the following: – TG ≥1.7 or known dyslipidaemia – HDL <1.03 for males or HDL <1.29 for females – SBP ≥130 or DBP ≥85 or known hypertension – FGP ≥6.1 or known diabetes

Table 2. Risks of early disease progression to diseases and complications in 5 years compared to no early disease or disease

	PRE-DIABETES		PRE-HYPERTENSION				
OUTCOMES	IFG	IGT	HIGH NORMAL BP	ELEVATED BP	PRE–DYSLIPID-AEMIA	PRE–OBESITY	PRE–METABOLIC SYNDROME
DIABETES	460%	745%	0%	10%	0%	30%	-
HYPERTENSION	20%	0%	20%	130%	0%	5%	-
DYSLIPIDAEMIA	70%	60%	0%	25%	300%	10%	-
METABOLIC SYNDROME	50%	30%	10%	30%	20%	40%	1420%
STROKE	0%	0%	0%	10%	0%	0%	40%
AMI	0%	0%	0%	15%	0%	0%	35%
CKD STAGE 3A TO 5	5%	0%	0%	20%	0%	0%	0%
SEVERE FALL	0%	0%	0%	30%	0%	0%	80%
ALL-CAUSE MORTALITY	0%	0%	0%	0%	0%	0%	60%

*FPG – Fasting plasma glucose; OGTT – 2-hr oral glucose tolerance test; SBP – Systolic blood pressure; DBP – Diastolic blood pressure; BMI – Body mass index; TG – triglycerides; LDL – Low-density lipoproteins; HDL – High density lipoproteins

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HEALTH RISK ASSESSMENT: A SCORECARD FOR OUR POPULATION

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HIGHLIGHTS

- We adjusted the Health Risk Assessment scorecard for 1-year risk of diabetes, hypertension, or dyslipidaemia in our local population, through the use of logistic regression models.

INTRODUCTION

The Health Risk Assessment (HRA) was developed by Bellin Health and Healics in the United States as a quick screening tool to categorize patients according to their state of health. It uses factors, such as patients' smoking status, body mass index, waist circumference, blood pressure, plasma glucose, triglycerides, low-density lipoprotein and high-density lipoprotein cholesterol levels, to classify patients into health risk categories ranging from minimal to extreme risk. However, the derivation methodology of the scorecard and specific health risks that it is based on, is unclear and not presented publicly. Therefore, to apply the HRA to our local population, we have to reassess the scoring system and base it on specific health conditions relevant to our population.

METHODS

For this study, we retrospectively used baseline screening data of 15,184 participants from the Yishun community health screening program to model for risk of diabetes, hypertension and dyslipidemia diagnoses in the following year. At the point of screening, these participants were verified to be free of these chronic conditions through self-reported information and cross-references to hospital records within NHG. Participants were followed up for 1 year from their date of screening to document if they were diagnosed with any of the 3 conditions.

For model validation, the data for 30% of the patients was set aside as a hold-out dataset. Logistic regression models were constructed to model their risk of diagnosis, using the factors from the HRA. The scoring for each variable category and of the HRA were then changed based on the odds ratios. By doing so, we were able to calibrate the HRA scorecard to reflect 1-year risk of incident diabetes, hypertension or dyslipidemia in our local population (Table 1). The calibrated scorecard was then compared to the original HRA scorecard in terms of predicting incident disease in the hold-out dataset.

RESULTS

The calibrated scorecard performed better than the original in predicting incident diabetes, hypertension or dyslipidemia, with an Area Under Curve (AUC) of 0.759 compared to an AUC of 0.665 (Table 2). The calibrated HRA also performed well in predicting incident diabetes with an AUC of 0.847.

CONCLUSION

We calibrated an overseas HRA scoring system to reflect 1-year risk of chronic disease for our local population using data from a community-based health screening program.

Table 1. Adjusted Health Risk Assessment scorecard for 1-year risk of diabetes, hypertension or dyslipidemia (scores in bold)

	MINIMAL	MODERATE	MEDIUM	HIGH	EXTREME
SMOKING	**2** No	**2** No	**2** No	**2** No	**1** Yes
BMI & WAIST CIRCUMFERENCE	**4**	**3**	**2**	**2**	**1**
MALE ⩽90CM	18.5 - 22.9	23.0 - 27.4	27.5 - 32.4	32.5 - 37.4	<18.5 or ⩾37.5
MALE >90CM	18.5 - 22.9	NA	23.0 - 27.4	27.5 - 32.4	<18.5 or ⩾37.5
FEMALE ⩽80CM	18.5 - 22.9	23.0 - 27.4	27.5 - 32.4	32.5 - 37.4	<18.5 or ⩾37.5
FEMALE >80CM	18.5 - 22.9	NA	23.0 - 27.4	27.5 - 32.4	<18.5 or ⩾37.5
BLOOD PRESSURE	**16**	**10**	**6**	**3**	**2**
SYSTOLIC	<130	130 - 139	140 - 159	160 - 179	>180
DIASTOLIC	<85	85 - 89	90 - 99	100 - 109	⩾110
GLUCOSE	**25** ⩽6.0	**15** 6.1 - 6.9	**8** 7.0 - 7.7	**5** 7.8 - 11.0	**3** ⩾11.1
TRIGLYCERIDE	**30** <1.7	**18** 1.7 - 2.2	**8** 2.3 - 4.4	**5** 4.5 - 11.0	**3** ⩾11.0
TOTAL CHOLESTEROL	**5** <4.1	**4** 4.1 - 5.1	**3** 5.2 - 6.1	**2** 6.2 - 7.2	**1** ⩾7.3
LDL CHOLESTEROL	**6** <2.6	**4** 2.6 - 3.3	**3** 3.4 - 4.0	**2** 4.1 - 4.8	**1** ⩾4.9
HDL CHOLESTEROL	**5** ⩾1.6	**4** 1.3 - 1.5	**3** 1.0 - 1.2	**2** <1.0	**NA** NA
CHOLESTEROL / HDL RATIO	**5** <3.3	**4** 3.3 - 3.4	**3** 4.5 - 5.0	**2** 5.1 - 6.0	**1** >6.1
TOTAL POINTS	**100 - 86**	**85 - 71**	**70 - 61**	**60 - 51**	**<50**

Table 2. Performance of the adjusted HRA scorecard in predicting incident disease in the next year

	AUC (95% CI)
ORIGINAL HRA	0.665 (0.637 - 0.694)
ADJUSTED HRA	0.759 (0.733 - 0.784)
ADJUSTED HRA, PREDICTING DIABETES ONLY	0.847 (0.807 - 0.887)

AUC: Area Under Curve; CI: Confidence Interval; HRA: Health Risk Assessment

A QUALITATIVE EXPLORATORY STUDY OF HEALTH RESILIENCE AMONG OLDER COMMUNITY-DWELLING ADULTS IN SINGAPORE

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HIGHLIGHTS

- Health resilience is a multi-dimensional concept.
- An older individual's level of resilience when faced with health-related adversities is influenced by one's guiding principles in life, personality, experiences across one's life course, which in turn affects the adoption of a variety of coping strategies.
- The ability to bounce back was found to be linked with these individual's health activation and social participation, as well as access to healthcare and other supporting resources.

INTRODUCTION

In Singapore, population aging is taking place at a rapid pace. With populations living longer, it is inevitable that our society will increasingly face socio-cultural challenges associated with longer exposure to age-related diseases, disabilities, dementia and dysfunction. Some individuals adjust well after a health event with a stable return to healthy functioning while others may experience significant distress after the event. This raises the question about whether we can intervene and better support these individuals at pre- and/or during event phases to strengthen their ability to cope with future stressors. Therefore, we seek to better understand resilience in the face of health-related adversities, and to identify its core processes from the perspective of the individuals – personal-level factors and how they interact with community-level resources.

METHODS

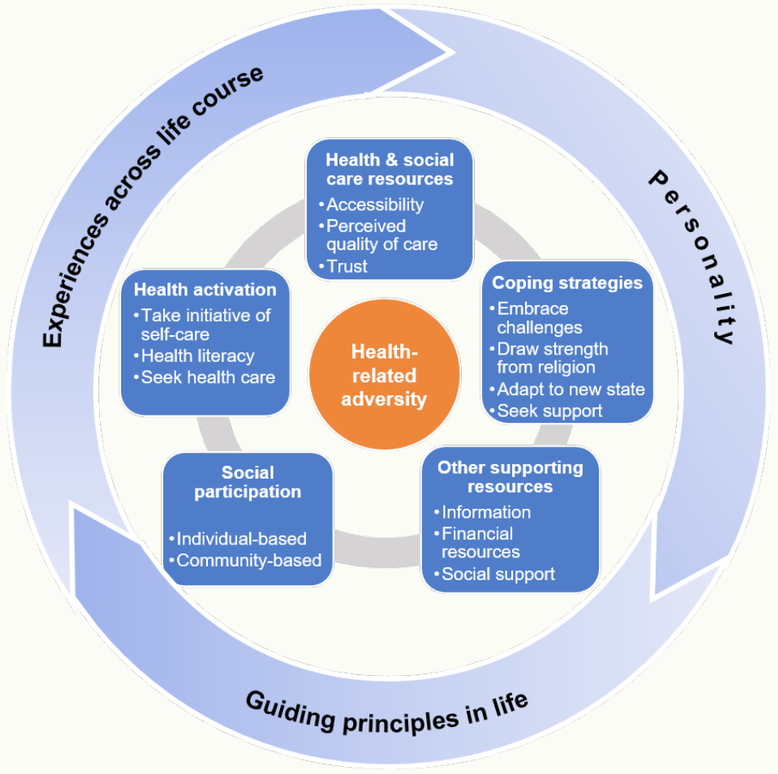
Guided by the Interpretive Systemic Framework, the sampling frame was set up to capture the perspectives of various stakeholder groups (older adults, caregivers, health and social care providers) who play critical roles in supporting the health of the community. For older adults, in-depth semi-structured interviews were conducted to obtain their views and experiences about how they prepared for, dealt with and overcame the effects of health-related adversities. All interviews were audio-recorded and then transcribed. Data were analysed thematically using both deductive and inductive approaches. QSR NVivo version 12 software was used for coding, cross-referencing, storing, and data retrieval.

RESULTS

Eight themes (Figure 1) were identified from preliminary findings based on 19 interviews of community-based dwelling adults aged 53 – 85 years old. Together with one's guiding principles in life, personality and experiences across one's life course worked to influence the adoption of various coping strategies to manage external and internal demands of health challenges. Individuals adopted different coping strategies: embracing challenges; adapting to the new state by adjusting lifestyles, maintaining order (e.g., following a daily schedule) or engaging in self-affirming thoughts and behaviours; seeking external support; or drawing strength from one's religion.

Depending on their readiness to take responsibility for their health, highly activated individuals may have sought to increase knowledge and skills to manage their health, and move towards adopting a set of health behaviours oriented towards a return to a better health state. Timely and accessible care, coupled with the ability to navigate the healthcare system to utilise appropriate healthcare resources, supported individuals to recover from their illnesses. However, participants delayed or avoided seeking medical treatment when they had little trust in the healthcare system or healthcare professionals. Other supporting resources including financial resources, information, or social networks and support also played an important role in better managing the health challenges. Having different forms of social support, especially those from immediate family or siblings, helped individuals better cope with biological, psychological and social stressors, but individuals who were highly self-reliant or did not want to affect family status quo did not tap on them. They instead participated in individual or community-based activities as a way to maintain their self-esteem through contributing to others.

Figure 1. Themes and subthemes for health resilience

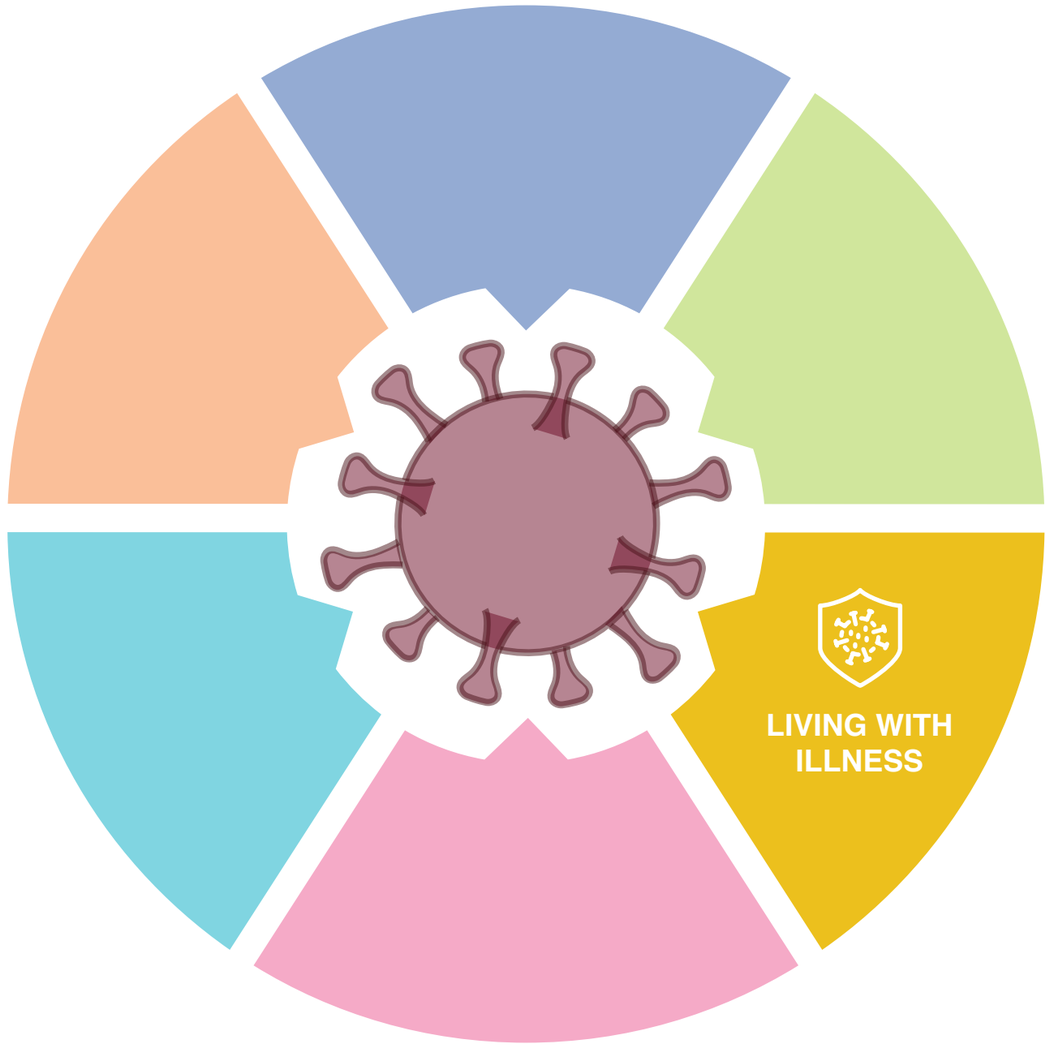


CONCLUSION

The preliminary findings of this study are indicative of individual health resilience of older adults being expressed through a dynamic interaction of individual life experiences; personal value orientation, patterns of thinking, feeling and behaving; and related to resources available socially and within the healthcare system, coping strategies and behaviours. Understanding these interactions in older people can inform the healthcare system on how to better support them to overcome the ill-effects of health challenges.

LIVING WITH ILLNESS

A focus on patients with specified diseases who do not require hospitalisation or complex medical care



BASELINE CHARACTERISTICS OF PATIENTS ENROLLED IN THE DEFINITE PROGRAMME AND DEFAULTERS

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HIGHLIGHTS

- We reported baseline characteristics of patients enrolled in the DEFINITE Programme.
- The TTSH default rate of 20.5% is relatively high and warrants further investigation.

INTRODUCTION

The Diabetic Foot in Primary and Tertiary (DEFINITE) Care Programme is funded by National Healthcare Group (NHG)'s inaugural Population Health Grant from FY2020 to FY2022. It aims to scale up existing initiatives targeted at patients with diabetic foot ulcers (DFU), to achieve coordinated primary and tertiary care for these patients. This would potentially bolster efforts to prevent diabetes-related amputations and decrease the economic and disease burden of DFU within NHG. The programme deploys coordinators to integrate patient care, ensure patient compliance and track outcomes. In addition, three new podiatry positions have been created across NHG sites to supplement existing services and allow integration of the STEP-UP (Surveillance and Treatment Escalation Programme for Ulcer Prevention) primary care services with the LEAPP (Lower Extremity Amputation Prevention Programme) rapid-access multidisciplinary clinics.

In this preliminary study, we looked at the baseline characteristics of patients enrolled in the DEFINITE programme, and compared defaulters with non-defaulters at Tan Tock Seng Hospital (TTSH).

METHODS

We obtained a list of patients who were enrolled in the programme from 1 June 2020 to 30 July 2020. Defaulters were defined as those who did not attend their scheduled follow-up visits that were tracked by coordinators. Due to the COVID-19 pandemic, there was a delay in the enrolment of patients at Khoo Teck Puat Hospital (KTPH). Thus, our defaulter analysis focused on patients enrolled at TTSH. Quantitative patient characteristics were compared as means using independent two-sample t-tests, while categorical characteristics were compared as proportions using Chi-squared tests.

RESULTS

Baseline characteristics of enrolled patients are shown in Table 1. Majority of the patients were of low socioeconomic status and had suboptimal control of systolic blood pressure (defined as exceeding the target of <130mmHg), as well as glycaemic control (defined as exceeding the target of HbA1c <8.0%). We also found that defaulters at TTSH (20.5%) were younger and were more likely to be smokers, compared to non-defaulters (Table 2).

CONCLUSION

Patients enrolled in the DEFINITE programme can benefit from intensive medical interventions to further optimise their risk factors to prevent diabetes-related amputations. The default rate from the programme is relatively high and more research is needed to investigate the reasons for defaulting so as to better improve compliance. Outcomes will be reported after completion of the first year of the programme.

Table 1. Baseline characteristics of enrolled patients by institution (selected)

		TTSH N=386	KTPH N=31	NHGP N=333
MEAN AGE IN YEARS (SD)		66.5 (11.9)	69.4 (9.6)	63.7 (11.7)
GENDER				
	MALE, N (%)	249 (64.5)	22 (71.0)	218 (65.7)
ETHNICITY, N (%)				
	CHINESE	247 (64.0)	20 (64.5)	180 (54.1)
	MALAY	54 (14.0)	4 (12.9)	61 (18.3)
	INDIAN	63 (16.3)	6 (19.4)	62 (18.6)
	OTHERS	22 (5.7)	1 (3.2)	30 (9.0)
SMOKING, N (%)		N = 356	N = 26	N = 306
	EX-SMOKER	113 (31.7)	129.4 (18.9)	80 (26.1)
	NON-SMOKER	175 (49.2)	11 (42.3)	175 (57.2)
	SMOKER	67 (18.8)	7 (26.9)	51 (16.7)
	SMOKING CESSATION	1 (0.28)	0 (0)	0 (0)
LOW SOCIOECONOMIC STATUS, N (%)		284 (73.6)	18 (58.1)	181 (54.4)
MEAN BMI (SD)		26.3 (5.8)	25.3 (5.2)	26.0 (4.9)
MEAN BLOOD PRESSURE IN mmHg (SD)				
	SYSTOLIC	136.7 (22.1)	129.4 (18.9)	134.6 (21.4)
	DIASTOLIC	68.7 (10.9)	67.5 (9.0)	70.5 (10.7)
MEAN HbA1c in % (SD)		8.0 (1.8)	7.3 (1.4)	8.3 (2.0)
MEAN LDL IN mmol/L (SD)		2.2 (0.9)	2.2 (1.0)	2.4 (1.1)

BMI: Body Mass Index; HbA1c: Haemoglobin A1c; LDL: Low-density Lipoprotein; SD: Standard Deviation

Table 2. Comparison of defaulters and non-defaulters in TTSH (selected)

		DEFAULTERS N = 79	NON-DEFAULTERS N = 307	P-VALUE
MEAN AGE IN YEARS (SD)		63.8 (61.5-66.1)	67.2 (65.8-68.6)	0.023
SMOKING, N (%)		N = 71	N = 285	
	EX-SMOKER	16 (22.5)	97 (34.0)	0.009
	NON-SMOKER	32 (45.1)	143 (50.2)	
	SMOKER	23 (32.4)	44 (15.4)	
	SMOKING CESSATION	0 (0)	1 (0.4)	

CI: Confidence Interval

PSYCHOSOCIAL IMPACT OF SKIN DISEASES: A POPULATION-BASED STUDY

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HIGHLIGHTS

- Debilitating symptoms of skin diseases such as intractable pruritus, pain, and disfigurement can significantly reduce quality of life.
- Participants with history of skin disease were more likely to have depressive symptoms, social isolation and loneliness

INTRODUCTION

While it is well established that skin disease places significant psychosocial burden on wellbeing, these effects have rarely been examined in Asian populations. This study aims to examine the psychosocial burden of skin diseases among a general multi-racial population cohort in Singapore, with the intent of increasing awareness on the importance of holistic management.

METHODS

This cross-sectional population health study included 1510 participants interviewed on their history of skin diseases by asking a specific question: "Have you ever had any of the following skin conditions [a list of 13 skin conditions including eczema, acne vulgaris, psoriasis, vitiligo, viral warts, scabies, fungal skin infections, chronic urticaria, bacterial skin infections, chronic ulcers or wounds, skin cancers, alopecia areata, and pruritus]?" This list was modified from the 15 categories of skin diseases included in the Global Burden of Disease Study 2010. Clinical photographs of each skin disease were used to assist the interview process.

The Patient Health Questionnaire (PHQ-9), Lubben Social Network Scale-6 (LSNS-6), University of California Los Angeles (UCLA) Loneliness Scale, and European Quality of Life-5 Dimensions-5 Levels (EQ-5D-5L) were used as measures for depressive symptoms, social isolation, loneliness and quality of life, respectively. Multiple linear regressions were conducted to examine the association of skin diseases with each of the measured outcomes, controlling for socio-demographic variables including age group, gender, marital status, employment status, highest education level, presence of self-reported financial constraints and other chronic conditions.

RESULTS

Participants with skin diseases were less likely to be married and employed, and more likely to have financial constraints, compared to their healthy counterparts ($p<0.05$). The most common skin conditions amongst our participants were eczema (8.8%), followed by bacterial skin infections (7.6%) and fungal skin infections (3.9%). Men reported higher rates of fungal skin infections (6.5%) and psoriasis (1.9%) than women. Younger adults (22-39 years) had higher incidence of acne vulgaris (7.5%), while older adults (≥75 years) had higher prevalence of bacterial skin infections (13.8%) and skin cancer (1.6%).

Participants with skin diseases reported higher PHQ-9 and UCLA Loneliness scale scores, and lower LSNS-6 and EQ-5D-5L scores when compared to their healthy counterparts (Table 2). History of skin diseases was positively associated with depressive symptoms (B = 0.40, SE = 0.11), and negatively associated with quality of life (B = -0.03, SE = 0.01), after adjusting for age group, gender, marital status, employment status, highest education level, financial constraints, and diagnosis of any chronic diseases.

Participants with history of skin diseases were also more likely to feel socially isolated (B = 0.40, SE = 0.34) and lonely (B = 0.11, SE = 0.06), although this was not statistically significant after adjusting for the same covariates. As disease severity was not evaluated in the study, we were unable to ascertain the associations between disease severity and measured outcomes.

CONCLUSION

Participants with skin diseases were more likely to be socially isolated, feel lonely, and have depressive symptoms and lower quality of life. The psychological impact of skin diseases should not be underestimated. A more holistic approach should be taken to optimise patient care and reduce the burden of skin disease. Some considerations include monitoring patients for mood-related changes regularly and implementing psychosocial interventions early.

Table 1. Comparison of PHQ-9, LSNS-6, UCLA Loneliness scale and EQ-5D-5L index scores between participants with and without skin disease, mean±SD

	ANY SKIN DISEASE IN THE LIST		P-VALUE
	NO (N=1, 163)	YES (N=347)	
PHQ-9	0.6 ± 1.7	1.3 ± 2.5	< 0.001
LSNS-6	16.6 ± 5.9	15.9 ± 6.4	0.043
UCLA LONELINESS SCALE	3.3 ± 0.8	3.5 ± 1.2	0.002
EQ-5D-5L	0.95 ± 0.12	0.89 ± 0.18	<0.001

Table 2. Associations between history of skin disease and depressive symptoms, social engagement, loneliness and quality of life

	DEPRESSIVE SYMPTOMS		SOCIAL ENGAGEMENT		LONELINESS		QUALITY OF LIFE	
	B	SE	B	SE	B	SE	B	SE
HISTORY OF ANY SKIN DISEASE (REF: NO SKIN DISEASE)	0.398**	0.114	-0.404	0.347	0.106	0.055	-0.033*	0.007
AGE GROUP (REF: 22-39)								
40 - 59	-0.025	0.136	-1.788**	0.415	<0.001	0.066	-0.009	0.009
60 - 74	-0.363*	0.165	-3.096**	0.501	-0.024	0.079	-0.016	0.010
≥ 75	-0.213	0.222	-5.023**	0.676	-0.055	0.107	-0.092**	0.014
GENDER (REF: MEN)	0.519	0.101	0.478	0.308	-0.096*	0.049	-0.015*	0.006
MARITAL STATUS (REF: SINGLE)								
MARRIED	-0.225	0.123	1.300**	0.374	-0.197**	0.059	0.015	0.008
WIDOWED / DIVORCE	0.001	0.170	0.487	0.516	-0.052*	0.082	0.003	0.011
EMPLOYMENT STATUS (REF: EMPLOYED)								
UNEMPLOYED	0.508**	0.131	-1.487**	0.400	0.251**	0.063	-0.006	0.008
RETIRED	0.440**	0.165	0.458	0.504	0.044	0.080	-0.032**	0.011
UNFIT FOR WORK	3.372**	0.385	-6.605	1.090	1.429**	0.189	-0.339**	0.023
HIGHEST EDUCATION (REF: NO FORMAL EDUCATION)								
PRIMARY	0.093	0.206	-0.069	0.626	0.088	0.099	-0.007	0.013
SECONDARY	0.080	0.172	0.386	0.524	0.128	0.083	-0.003	0.011
POST-SECONDARY	0.127	0.165	0.144	0.503	0.162	0.080	-0.009	0.011
SELF-REPORTED FINANCIAL CONSTRAINTS	0.908**	0.129	-3.244**	0.393	0.466**	0.062	-0.041**	0.008
PRESENCE OF ANY CHRONIC CONDITION	0.445	0.108	0.248	0.330	0.137**	0.052	-0.036**	0.007

*p<0.05; **p<0.01

INTERCONVERSION OF FT4 VALUES FROM DIFFERENT ASSAY PLATFORMS WITH DIFFERENT REFERENCE INTERVALS USING LINEAR TRANSFORMATION METHODS

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HIGHLIGHTS

- We established an accurate and reliable methodology of interconverting FT4 by any laboratory to an equivalent FT4 value scaled to a reference range of interest.
- Using linear and piecewise linear transformations, we produced relatively accurate FT4 inter-scale conversion.

INTRODUCTION

Clinicians managing thyroid patients serially monitor thyroid function tests (TFT), comprising serum or plasma free thyroxine (FT4) and thyroid stimulating hormone (TSH), to determine appropriate dose adjustments of thyroid medications to attain individualized therapeutic targets efficiently. Ideally, patients receiving regular follow-ups should have their blood tests done at exactly the same time of day, preferably in the fasted state and analyzed by the same clinical laboratory using identical assay platforms at every single doctor's visit. Therefore, patients are advised to repeat TFT at one single laboratory for consistency to facilitate interpretation of serial thyroid hormone changes and dose-responses to thyroid medications. However, in reality, patients may not have their TFT performed consistently at the same medical facility for various reasons. Thus, it is common to encounter patients with TFT from different laboratories, each reported under a different normal reference range due to a lack of harmonization of test platforms. Under such circumstances, physicians occasionally dismiss such TFT because they are uncomparable or confounded by inter-assay variations. This approach wastes past data records, necessitates additional time, costs, and effort of repeat tests, whilst permitting unnecessary pain of repetitive venipunctures. Discounting analytical and biological variability, most TFT assays demonstrate excellent linearity across a broad measurement range, with relatively good correlations between different TFT assay techniques. In this study, we propose two transformation methods (linear and piecewise linear) to interconvert FT4 reported by any laboratory to a specific scale of interest that permits comparisons for time or dosing trends to aid the management of thyroid patients.

METHODS

From an anonymized database of research subjects, we analyzed paired-samples of TFT measured using direct analog immunoassay (IA), tandem mass spectrometry (LC-MS/MS), and equilibrium dialysis (ED). The TFT dataset used was obtained from overtly healthy individuals without any significant past medical history, aged 18 to 65 years of both genders. None of the females included were pregnant and no subjects were sick at the time of the study. We use two transformations (linear and piecewise linear) to convert the FT4 data with the reference interval $[u, v]$ into equivalent FT4 data in the reference scale $[a, b]$ as follows:

$$x_{new} = a + \frac{b-a}{v-u}(x_{original} - u) \text{ for any raw data } x_{original}$$

$$x_{new} = \begin{cases} \frac{a}{u} x_{original}, & \text{for } x_{original} < u, \\ a + \frac{b-a}{v-u}(x_{original} - u), & \text{for } x_{original} \geq u. \end{cases}$$

$[a, b]$ denotes the reference interval of FT4 that is chosen as the scale to be mapped into; $[u, v]$ denotes the reference interval of FT4 values measured by any specific method; $x_{original}$ denotes the FT4 value measured with a specific method with the reference interval $[u, v]$; x_{new} denotes the converted FT4 value in the chosen scale with reference interval $[a, b]$.

RESULTS

We analyzed 62 paired-samples of TFT with the raw FT4 data measured with IA, LC-MS/MS, and ED from 62 healthy subjects. There were 4 outliers (2 with hyperthyroidism and 2 with hypothyroidism confirmed by the 3 assay methods). The remaining FT4 data of 58 subjects by the 3 assay methods were normally distributed (Shapiro-Wilk p-value = 0.249, 0.488, 0.294, respectively). Table 1 presents estimations of normal intervals for FT4 assays. Mean FT4 values obtained with IA were 8.3% and 6.0% lower than values measured with LC-MS/MS and ED, respectively. As shown in Table 2, mean, SD and CV are reduced after the transformation into the reference interval scale of IA. In particular, SD and CV of FT4 values are respectively reduced by over 46% and 43% when transformed from LC-MS/MS to IA. For transformation from ED to IA, the reductions in SD and CV are around 56% and 55%, respectively. Table 3 represents an illustrative example of FT4 values measured by IA and corresponding FT4 values transformed into IA from LC-MS/MS and ED scales using linear transformation.

CONCLUSION

Linear transformation performs better when FT4 values are converted from a more to a less accurate assay platform. The converse is true, whereby piecewise linear transformation is superior to linear transformation when converting values from a less accurate method to a more robust assay platform. This study aids interpretation of TFT trends while monitoring the treatment of thyroid patients.

Table 1. Description of FT4 data (pg/mL) and their reference intervals (N=64)

METHOD	LC-MS/MS		IA		ED	
MEAN (SD)	11.55 (4.55)		10.58 (3.28)		11.26 (4.57)	
CV	0.39		0.31		0.41	
95% REFERENCE LIMIT	[2.64, 20.46]		[4.16, 17]		[2.31, 20.22]	
90% CI OF LIMITS	[1.02, 4.26]	[18.84, 22.09]	[2.99, 5.33]	[15.84, 18.17]	[0.68, 3.94]	[18.59, 21.85]
REFERENCE INTERVAL	[8, 21]		[9, 16]		[7, 23]	

Table 2. Mean, SD and CV of FT4 transformations into IA scale by linear transformation

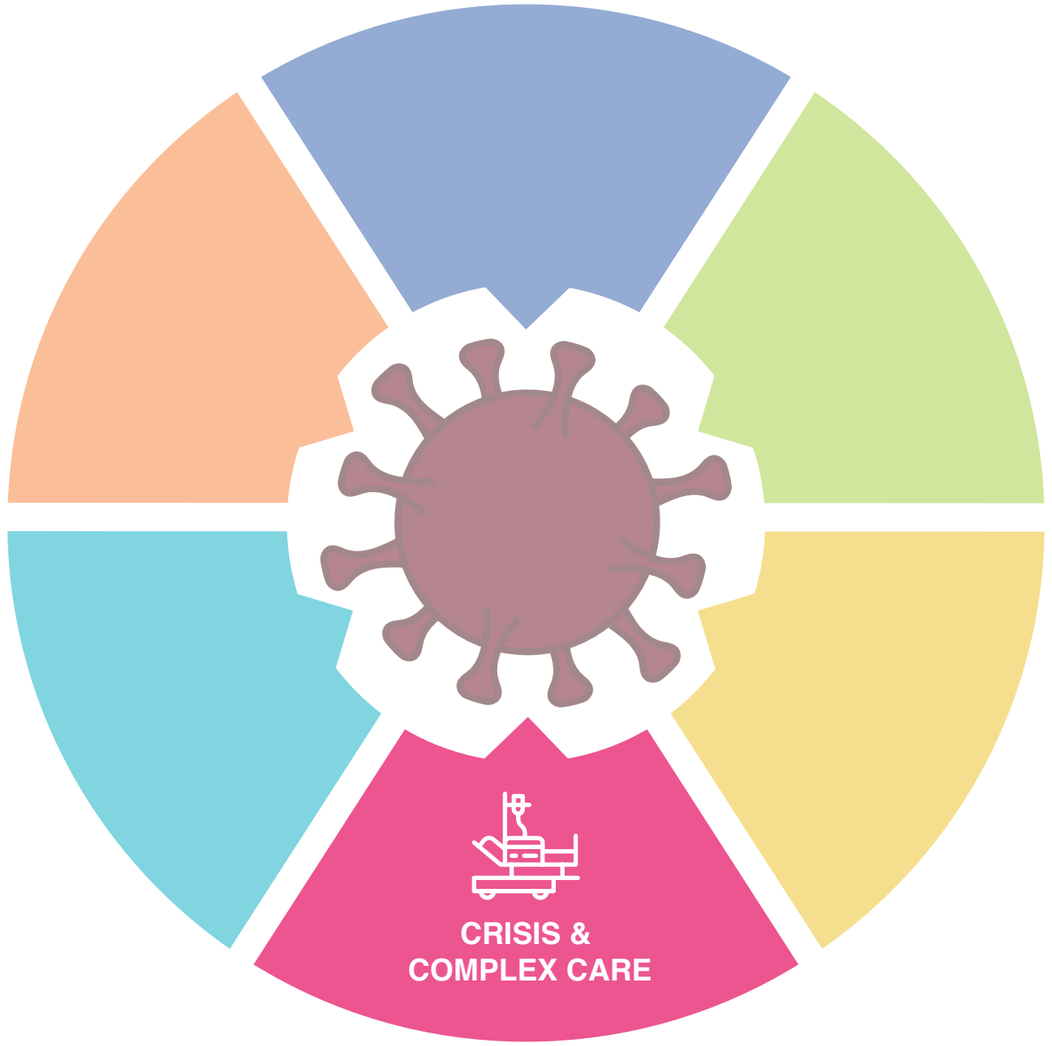
METHOD	LC-MS/MS			ED		
	ORIGINAL	NEW	CHANGE %	ORIGINAL	NEW	CHANGE %
MEAN	11.34	10.8	-4.76%	11.09	10.79	-2.71%
SD	2.61	1.41	-46.08%	2.88	1.26	-56.19%
CV	0.23	0.13	-43.34%	0.26	0.12	-55.03%

Table 3. An example of FT4 values by IA and transformations to LC-MS/MS and ED scales

SUBJECT S/N	ORIGINAL IA	LC-MS/MS TO IA	ED TO IA	ORIGINAL LC-MS/MS	ORIGINAL ED
2	6.4	8.4	9.42	6.89	7.97
58	7.8	8.97	9.42	7.94	7.97
59	8.24	8.64	8.55	7.33	5.96
22	8.3	8.57	9.12	7.21	7.29
20	8.4	8.56	9.82	7.19	8.88
23	8.9	8.22	8.71	6.55	6.35
1	9.65	8.9	8.92	7.81	6.82
52	10.1	11.75	10.34	13.1	10.7
42	11.4	8.34	9.59	6.77	8.35
60	14.9	8.32	8.9	6.75	6.77

CRISIS & COMPLEX CARE

A focus on patients who require hospitalisation and complex medical care



EFFECTIVENESS OF A MULTIDISCIPLINARY ACUTE CARE MODEL IN REDUCING EXCESS LENGTH OF STAY FOR PATIENTS WITH SELECTED MEDICAL CONDITIONS

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HIGHLIGHTS

- Patients admitted to the AIMS unit stay 1.5 days shorter than similar patients admitted to the general wards.
- The 8 beds at the AIMS unit currently may save the hospital more than 800 bed-days per year.

INTRODUCTION

The Acute Internal Medicine Service (AIMS) of Tan Tock Seng Hospital (TTSH) has been operational since November 2016. This multi-disciplinary service involves expedited access to specialist care for patients in the appropriate setting, as well as front loading of investigations to shorten time-to-intervention. The AIMS team consists of the head of service, nurse manager, advance practice nurse, consultant, registrar and medical officers, registered and enrolled nurses, as well as representatives of ancillary services including diagnostic radiology, laboratory medicine, allied health and pharmacy. Patients may be admitted to AIMS if they require up to 72 hours of in-hospital care for conditions which include (but are not limited to) infections such as cellulitis, gastroenteritis, pneumonia, viral illness; cardiac conditions such as acute heart failure, atypical chest pain; endocrine conditions such as hypo- or hyper-glycaemia, hypo- or hyper-thyroidism; vascular conditions such as venous thrombosis, stable pulmonary embolism; respiratory conditions such as asthma, COPD and other conditions such as giddiness and syncope. The unit currently operates with 8 beds.

This evaluation aimed to assess the effectiveness of AIMS in reducing hospital average length of stay (ALOS), as well as its impact on total patient bed-days saved for the hospital.

METHODS

The evaluation utilised a retrospective cohort of patients admitted to TTSH from August 2016 to March 2018, and compared outcomes between patients admitted to the AIMS unit and controls. Selection of controls involved a review of electronic medical records by AIMS consultants. Patients who met the AIMS criteria for admission based on clinical data from their medical records, but who were admitted to the general wards comprised the control group. For both groups, only patients admitted for any of the 10 most common emergency department (ED) diagnosis of AIMS patients during the period were included in the analysis. Outcomes included hospital ALOS, hospital bed-days saved, time-to-consultant review, mortality, and 7- and 30-day re-admission rates. Analysis involved univariate and multivariate statistics.

RESULTS

AIMS patients with the 10 most common ED diagnoses comprised 66% of all AIMS admissions. Using these 10 diagnoses, there were 718 AIMS and 134 control patients included in the study (Table 1). AIMS patients admitted for cellulitis, the most common diagnosis for both groups, stayed 6 days shorter than Controls. On the other hand, AIMS patients admitted for sepsis stayed almost 1 day longer than Controls. AIMS patients were seen by the consultant 2.8 hours earlier than Controls (95% CI = 2.0, 3.6). There was one death (0.1%) in the AIMS group, a patient who was transferred from AIMS to the general wards on the 2nd hospital day. There were no deaths in the Control group. Controlling for ED diagnosis, ALOS for patients admitted to AIMS was 25% shorter than for Controls (RR; 95%CI = 0.74; 0.64, 0.85).

There were no significant differences in 7- and 30-day readmission rates after adjusting for ED diagnosis (RR; 95%CI for 7 days = 1.40; 0.29, 6.66; for 30 days = 1.43; 0.59, 3.50).

Total bed-days saved over the 17-month study period was 1,180 days (@ 830 days per year) (Figure 1). 6 of the 10 included diagnoses were bed-day saving.

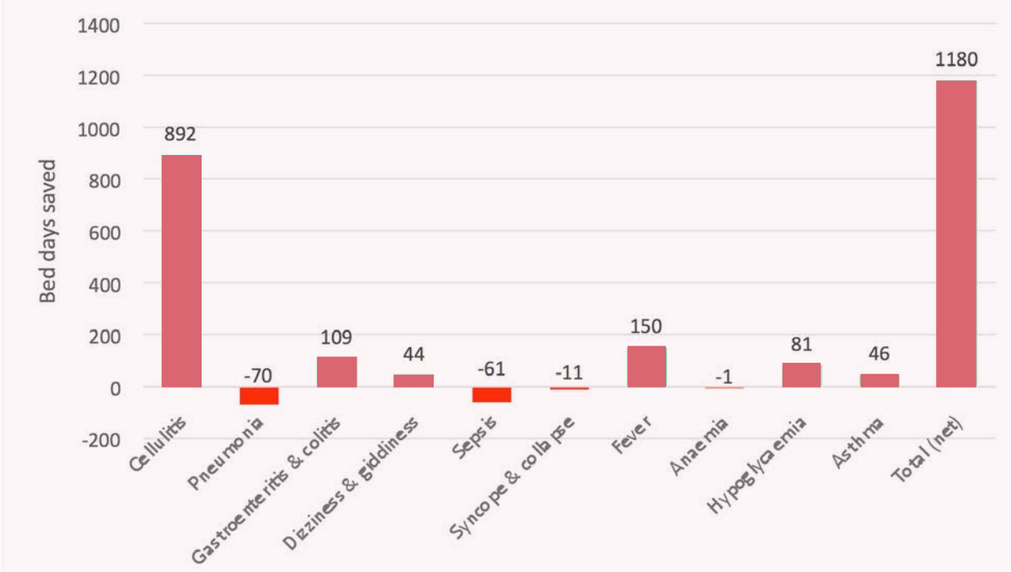
CONCLUSION

AIMS patients have a significantly shorter ALOS than Controls. This shorter ALOS for AIMS patients translates to a total bed-day savings of more than 830 bed-days per year accruing from 8 AIMS beds. Compared to controls, AIMS patients are seen almost 3 hours earlier by consultants. Although no differences in mortality, 7- and 30-day readmission rates were detected, an adequately powered study may be useful to confirm this.

Table 1. Average Length of Stay of AIMS and Control Patients by ED Diagnosis

PRIMARY ED DIAGNOSIS	AIMS		CONTROL		DIFFERENCE IN ALOS
	NO. OF PATIENTS	ALOS	NO. OF PATIENTS	ALOS	
CELLULITIS, UNSPECIFIED	147	5.18	20	11.25	6.07
PNEUMONIA, UNSPECIFIED	125	4.98	12	4.42	-0.56
GASTROENTERITIS & COLITIS	102	3.75	17	4.82	1.07
DIZZINESS & GIDDINESS	91	3.46	18	3.94	0.48
SEPSIS, UNSPECIFIED	77	6.22	7	5.43	-0.79
SYNCOPE AND COLLAPSE	58	2.88	16	2.69	-0.19
FEVER, UNSPECIFIED	34	3.38	5	7.80	4.42
ANAEMIA, UNSPECIFIED	33	2.15	16	2.12	-0.03
HYPOGOLYCAEMIA, UNSPECIFIED	29	3.55	14	6.36	2.81
ASTHMA, UNSPECIFIED	22	3.68	9	5.78	2.1

Figure 1. Bed-day Savings for the Study Period, Total and by ED Diagnosis



BUNDLED PAYMENTS FOR SURGICALLY MANAGED HIP FRACTURES IN SINGAPORE

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HIGHLIGHTS

- Bundled payments for surgically managed hip fractures can potentially lead to improvements in care access, care quality and service utilisation.

INTRODUCTION

Bundled payment is a financial reform proposed to reduce healthcare costs by giving a single payment to providers in different settings to increase coordination of care and efficiency. Bundled payments for hip fractures have shown benefit in countries like Taiwan and US to some extent. However, little is known about the impact of bundled payments for surgically managed hip fractures across outcomes of care access, care quality, healthcare resource utilisation, clinical impact and acute care cost.

METHODS

Patients who received subsidised care for surgery at Tan Tock Seng Hospital for an isolated unilateral hip fracture from 2014 – first quarter of 2019 (diagnosis-related group [DRG] codes: I03A, I03B, I08A, and I08B) and transferred to designated post-acute rehabilitation partner institutions were studied [Ren Ci Community Hospital (RCCH) or Ang Mo Kio Community Hospital (AMKCH)]. Patients with multiple fractures or multiple care episodes were excluded. An observational cohort study using available information from a standing database was conducted.

A quasi-experimental design comparing pre- and post- bundled payments was performed through interrupted time series analysis, with multiple logistic regressions that were segmented by calendar quarters. This methodology allows the measurement of the presence of immediate changes in outcomes examined (Table 1) after the implementation of bundle payments to infer potential attribution.

RESULTS

A total of 1477 patients were studied. 811 were assigned to pre- bundled payments, and 666 to post- bundled payments. Patients were predominantly aged between 70 – 89 years (80.1%) and mostly female (70.5%). No individual-based differences between patients across calendar years were detected for demographics, hip fracture diagnosis, medical complexity, and premorbid functional independence.

Graphical results from individual models for selected outcomes are presented in Figures 1 – 4. During post-bundled payments, trend of ward admission waiting times improved (OR=1.14; p=0.020), rates of 30-day all-cause readmissions were lower (OR=0.08; p=0.019) and decreasing trends of inpatient rehabilitation and overall length of stay (OR=1.26; p<0.000 and OR=1.17; p<0.000, respectively) were demonstrated. However, ward admission waiting times were longer (OR=0.45; p=0.015) and inpatient acute care cost for complex cases (DRGs: I03A and I08A) were higher (OR=0.49; p=0.028) when bundled payments were in place, compared to pre- bundled payments. Waiting times for surgery, time to inpatient post-operative physiotherapy, 30-day all-cause mortality, functional outcomes, and inpatient acute care cost for simple cases were unaffected.

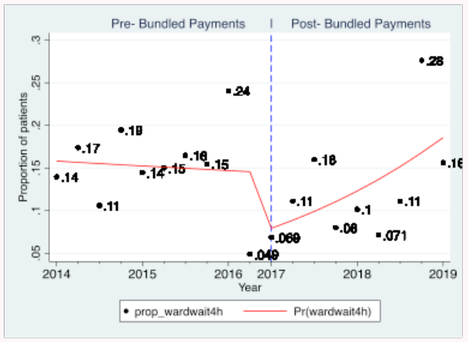
CONCLUSION

Bundled payments for surgically managed hip fractures can potentially lead to benefits across several outcomes pertinent to clinical improvement initiatives. These benefits were likely a result of earlier management of acute medical needs and care coordination to facilitate discharge planning, and closer collaboration between acute care and inpatient rehabilitation partners. More work, especially in the area of cost-effective surgical implants, is critically needed to contain the growth of acute medical care cost for these patients.

Table 1. List of outcomes examined according to type

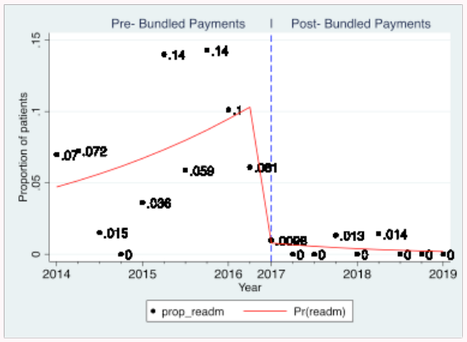
OUTCOME TYPE	SPECIFIC OUTCOMES
CARE ACCESS	1. Proportion of patients who waited at ED ⩽4 hours for their ward admission 2. Proportion of patients who waited ⩽48 hours for their hip fracture surgery after ward admission 3. Proprtion of patients who commenced inpatients physiotherapy on post-operative day 1 or earlier
CARE QUALITY	1. Proportion of patients with 30-day all-cause readmission after CH discharge 2. Proportion of patients with 30-day all-cause mortality after CH discharge
HEALTHCARE RESOURCE UTILISATION	1. Proportion of patients TTSH LOS ⩽12 days 2. Proportion of patients CH LOS ⩽32 days 3. Proprtion of patients overall episodic LOS ⩽44 days
CLINICAL IMPACT	1. Proportion of patients with functional independence at inpatient rehabilitation discharge among those with functional independence pre-morbidly 2. Proportion of patients with functional independence at 6-month follow-up among those with functional independence pre-morbidly 3. Proprtion of patients discharged to nursing home post-inpatients rehabilitation
ACUTE CARE COST	1. Proportion of patients whose inpatient acute care cost was ⩽$SGD12, 805 for simple cases 2. Proportion of patients whose inpatient acute care cost was ⩽$SGD18, 130 for complex cases

Figure 1. Care access:
Proportion ward admission ⩽4 hours



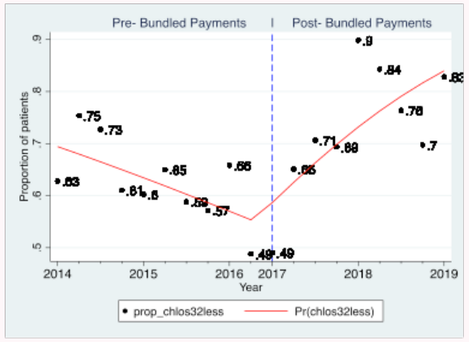
*p<0.05 compared to Pre-Bundled Payments period
**p<0.05 for trend during Post-Bundled Payments period

Figure 2: Care quality:
Proportion readmitted within 30 days (all-cause)



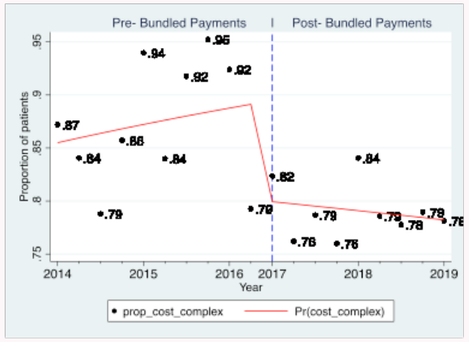
*p<0.05 compared to Pre-Bundled Payments period

Figure 3. Service utilisation:
Proportion CH LOS ⩽32 days



*p<0.05 for trend during Post-Bundled Payments period

Figure 4. Acute care cost:
Proportion cost ⩽ $SGD18, 130 for complex cases



*p<0.05 compared to Pre-Bundled Payments period

EVALUATION OF TTSH'S COMMUNITY HEALTH TEAM: TRENDS IN ACTIVATION, QUALITY OF LIFE AND CAREGIVER BURDEN OVER ONE YEAR

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HIGHLIGHTS

- Activation scores of Community Health Team patients improved by 7 points within the first 3 months and these levels maintained till the end of the one-year follow-up.
- Their quality of life improved from baseline till the 6-month time point.

INTRODUCTION

Serving the central zone of Singapore, Tan Tock Seng Hospital (TTSH)'s Community Health Team (CHT) aims to assist the successful transition of patients with complex needs from hospital to the community within three to six months. Based on the program's inclusion criteria, eligible patients were tiered into either L1 (has social issues), L2 (has functional & active medical issues) or L3 (requires complex nursing needs). Through multidisciplinary teams, the CHT delivers holistic community-based care to these patients to ensure continued recovery post-discharge and to prevent unplanned readmissions.

The aim of this evaluation was to assess if there was an improvement in (1) the level of patient activation, (2) health related quality of life (QoL) and (3) caregiver burden over a period of one year among patients enrolled with the CHT.

METHODS

A prospective single arm, pre-post study design was employed for this evaluation. Patients who were enrolled with the CHT and: (1) could speak English, Malay, Mandarin, Hokkien or Cantonese, (2) had a contact number, (3) were cognitively sound and (4) had no hearing impairment were included in the analysis. Through telephonic surveys, the patient activation measure (PAM-13), and EuroQOL 5 Dimension (EQ5D) were administered to patients at baseline (up to two weeks post-discharge, before intervention by the CHT), 3-, 6- and 12-month intervals. The Zarit Burden Interview (ZBI-12) was administered to family members who were primary caregivers to the enrolled patients.

RESULTS

Patient recruitment

Between June 2017 and April 2019, 1,370 patients were enrolled with the CHT, of whom 814 (59.4%) participated in the surveys. Of these participants, 444 (58.3%) completed telephonic surveys with valid scores before receiving any CHT interventions and were included in the final analysis (Figure 1). There was a high dropout rate at each time point. They either withdrew from the CHT, refused to participate in follow-up surveys, provided insufficient information to compute a survey score, were institutionalised or were excluded due to hearing and/or cognitive impairment.

Survey Respondents (n=814) (SR) vs Non-Respondents (n=556) (NR)

Overall, the mean age of CHT patients included in the evaluation was 79.7 (SD 10.8). 55% were female and 83.1% were of Chinese ethnicity. There were no significant differences in demographics between SR and NR. However, NR were frailer and had more comorbidities. In terms of healthcare utilization one year prior to CHT enrolment, NR had more inpatient admissions, longer length of stay, more ED visits, as well as lower SOC and polyclinic visits. There were more deaths among NR (44.4% vs 31.6%). About 60% and 23% of patients in SR and NR groups respectively had caregivers present at baseline.

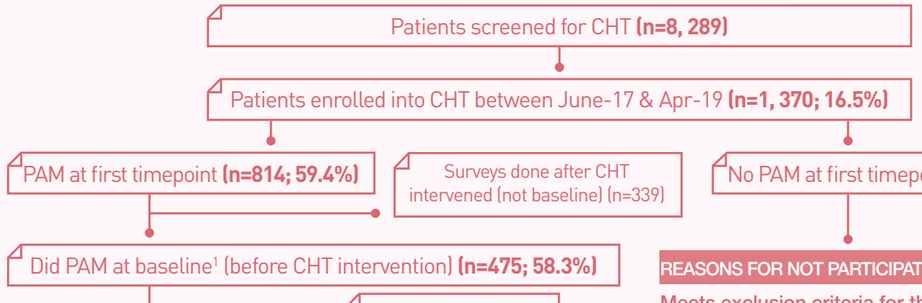
Trends in activation, QoL and Caregiver burden over 12 months (longitudinal cohort)

For patients with PAM-13 surveys done at all time points (n=83), mean PAM-13 scores significantly increased from baseline to 3-month follow-up by 7 points (Figure 2). Scores were maintained till end of the follow-up period. At each time point, about 40% of patients transited to a higher PAM-13 level (i.e., higher activation) from baseline. Similarly, longitudinal analysis showed an increase in mean EQ5D utility scores from baseline till 6 months' follow up (Figure 2). At baseline, 251/444 (56.5%) patients included in the analysis had a caregiver present. Of these, 228 caregivers did the ZBI-12, and they reported relatively low overall mean score (=10.3, SD=10.8). Of caregivers who had a ZBI-12 done at all time points, there was a slight increase in ZBI scores from baseline (Figure 2).

CONCLUSION

To the best of our knowledge, this is the first study in Singapore which assessed patient activation in the community. Survey respondents were generally healthier than non-respondents. There were high dropout rates at each time point, affecting sample size. Activation and QoL significantly improved from baseline, with activation remaining relatively stable from the 3rd month. Caregiver burden was relatively low in this group.

Figure 1. Recruitment flowchart



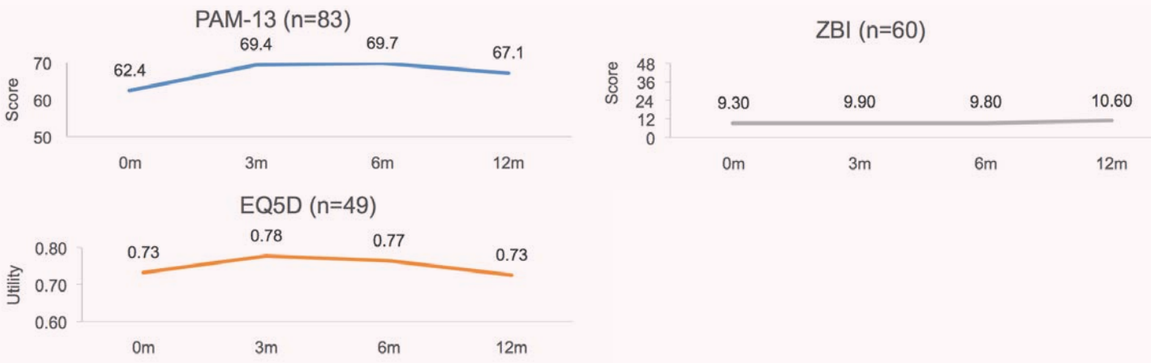
	BASELINE	3 MONTHS	6 MONTHS	12 MONTHS
VALID PAM ONLY	444	236	136	83
VALID EQ5D ONLY	326	150	81	49
ZBI-12 ONLY	250	132	80	60
VALID PAM + EQ5D	305	142	74	44
ZBI-12 (WITH VALID PAM + EQ5D)	99	26	7	4

[1] Baseline refers to administration of surveys before CHT intervened.

[2] Invalid refers to PAM-13 and EQ5D responses that were insufficient to compute a score

REASONS FOR NOT PARTICIPATING IN SURVEYS	N	%
Meets exclusion criteria for the surveys	249	44.8
Patient rejected CHT	125	22.5
Deceased	48	8.6
Institutionalised	43	7.7
Patient/Caregiver refused to participate in survey	35	6.3
Handover to community with health partner/hospital health programme	22	4.0
Withdraw from CHT (stop CHT interventions)	17	3.1
Patient/Caregiver unreachable	10	1.8
Patient/Caregiver not in condition to participate in surveys (e.g. admitted, sick)	7	1.3
TOTAL	556	100

Figure 2. Trend of activation, QoL and caregiver burden over 12 months [longitudinal cohort]



CROSS-CULTURAL ADAPTATION OF THE MALAY VERSION OF THE SEVERE RESPIRATORY INSUFFICIENCY TOOL FOR PATIENTS WITH RESPIRATORY FAILURE

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HIGHLIGHTS

- A pre-final version of the Severe Respiratory Insufficiency (SRI) questionnaire was developed for local Malay-speaking ventilator-assisted individuals, whilst adhering to cross-cultural adaptation and translation process guidelines

INTRODUCTION

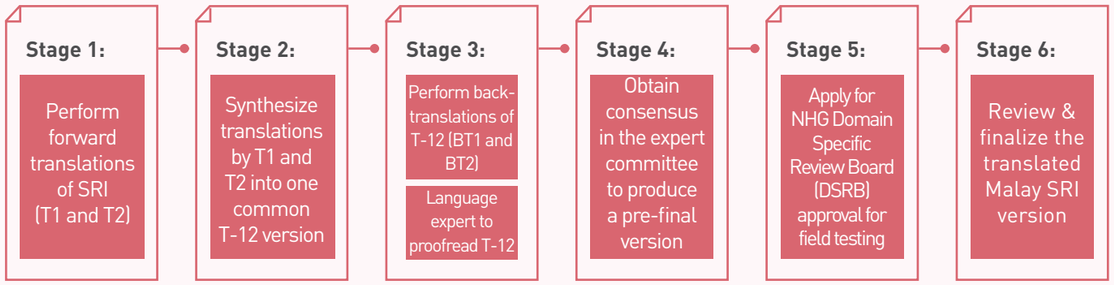
Ventilator-assisted individuals (VAIs) are individuals who suffer from severe chronic respiratory failure and require respiratory support. In Singapore, these patients can be referred to the Home Ventilation and Respiratory Support Service (HVRSS) based at Tan Tock Seng Hospital. It has been reported that quality of life of VAIs improved after receiving home ventilation support. The Severe Respiratory Insufficiency (SRI) questionnaire is a disease-specific, multi-dimensional, self-administrated health-related quality-of-life (HRQoL) instrument developed for VAIs with respiratory failure from a variety of underlying diseases. The SRI originally published in German [1], has been validated and consists of 49 questions across 7 domains. To date, there are other published translations of the SRI tool in several languages (Chinese, Greek, Hungarian, Japanese, Spanish), and these have been administrated on patients with chronic obstructive pulmonary disease (COPD), chronic hypercapnic respiratory failure (CHRF) and patients with other health conditions who were receiving HMV services. In multi-cultural Singapore, approximately one-fifth of local VAIs are of minority ethnicities. However, there is no Malay language version of SRI available for use. Thus, we conducted a cross cultural adaptation (CCA) translation process of the SRI into Malay language.

METHODS

We translated the SRI using the translation-back translation method. This method has been used in numerous CCAs of outcome measures. The process consisted of 6 stages (Figure 1), and required the formation of an expert committee. Each committee member's role was based on the criteria set in the CCA's guidelines [2], [3]. Details of the roles in the CCA process are stated in Table 1 below.

The CCA process started off with two forward translators, one who was aware of the purpose of the SRI to provide a clinical perspective of translation (T1). The other translator was clinically uninformed and unaware of the SRI tool, and thus could provide a translation more reflective of the language used in the community (T2). Consensus was obtained to produce one common translation, T-12, which was then used in the next back-translating step. The back translators were without any medical background and were unaware of the concepts underlying the SRI tool. This avoided bias in the back-translation of the T-12 version. An external language expert was hired to proofread the T-12 version compared to the original English version. All translations, proofreading reports and feedbacks were discussed in meetings with the expert committee. After extensive discussion, the committee achieved semantic, idiomatic, experiential and conceptual equivalence for every item in the pre-final version of the Malay-translated SRI. Semantic equivalence means items or word that has multiple meanings, causing difficulties in translations. Idiomatic equivalence would be colloquialisms or idioms that are difficult to translate. Experiential equivalence refers to daily tasks which may not be easily experienced in a different culture. Lastly, conceptual equivalence concerns words that holds different conceptual meaning in different cultures.

Figure 1. Translation-back translation method steps in cross cultural adaptation (CCA)



*Currently in progress

Table 1. Expert committee members' background and roles held

MEMBER	BACKGROUND	ROLES
A	Lecturer at the Faculty of Health Sciences, National University of Malaysia, with experience in CCA of HRQoL tools into Malay language	Methodologist
B	No clinical background, and fluent in Malay language as a mother tongue	Forward Translator 1 (T1)
C	No clinical background, and fluent in Malay language as a mother tongue	Back-translator 1 (BT1)
D	No clinical background, and fluent in Malay language as a mother tongue	Back-translator 2 (BT2)
E	Consultant in Respiratory & Critical Care Medicine, and fluent in Malay language from secondary education	Healthcare professional
F	Health services researcher	Study lead
G	Research assistant, and fluent in Malay language from secondary education	Forward Translator 2 (T2)
Company X Pte Ltd	Accredited language organisation: ISO 9001:2015	Language professional

CONCLUSION

A pre-final Malay language version of the SRI was created using cross-cultural adaptation and translation process guidelines. Future plans include ethical approval to conduct field-testing to finalize the Malay language SRI version. There are further plans to conduct reliability testing after finalisation.

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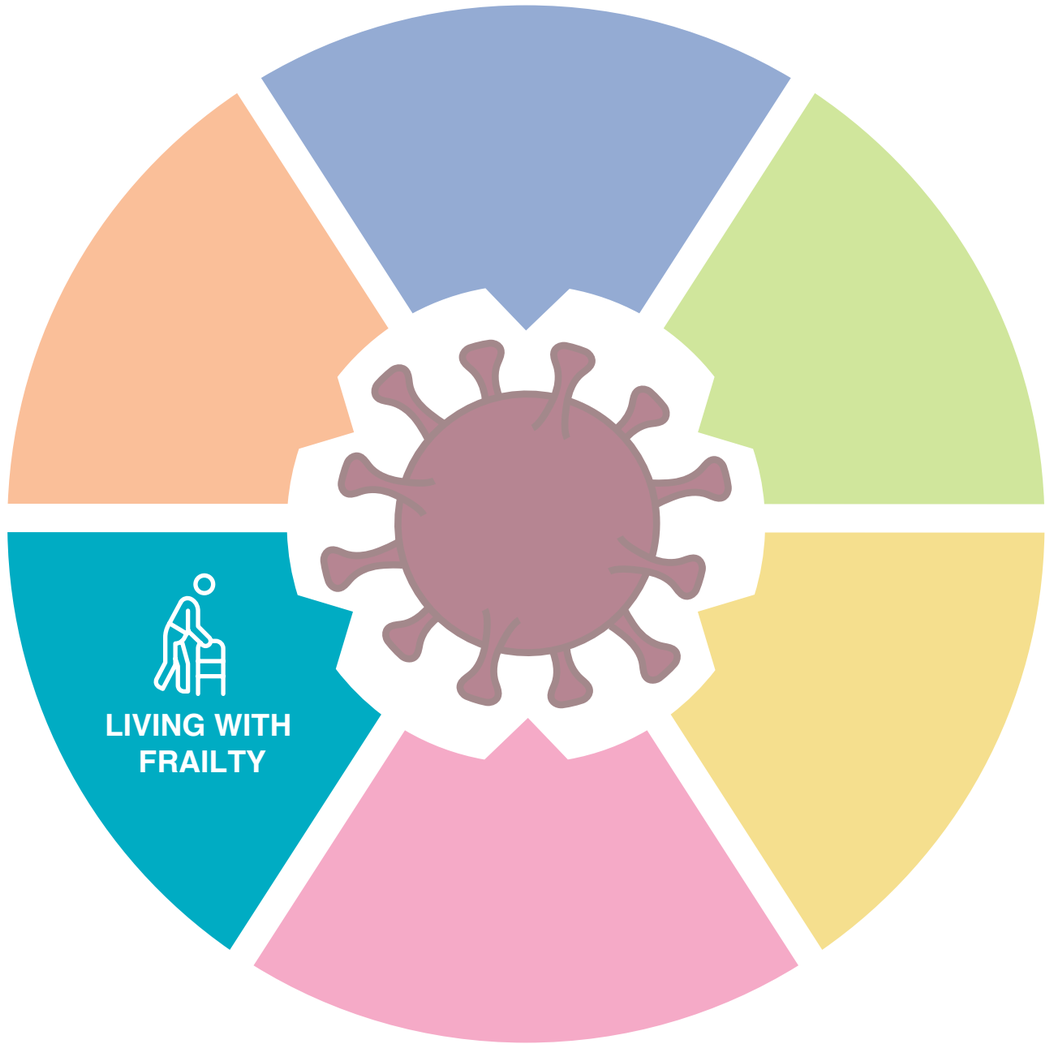
LIVING WITH FRAILTY

A focus on ageing
and frail patients



OUTCOMES FOR FRAILTY-RELATED INTERVENTIONS

Dr Yip Wan Fen, Dr Tan Woan Shin

HIGHLIGHTS

- **An appropriate set of outcomes will allow accurate tracking of frailty progression and measure the effectiveness of a set of frailty-related interventions.**
- **Data availability in the electronic medical record system will reduce the potential of missing data, minimise the burden of data collection and streamline the evaluation process.**

Frailty is an age-related syndrome with multiple causes and contributors, and is characterised by diminished strength, endurance, and reduced physiologic function. At-risk or frail individuals are at an increased risk of adverse health outcomes such as falls, poor mobility, and mortality, and unplanned hospital utilisation. To prevent and address the ill-effects of frailty, a consolidated framework that matches services to the needs of the population as persons transverse the frailty trajectory is being developed in the National Healthcare Group (NHG). In this study, we propose an outcomes framework to monitor changes in health behaviour, health status, caregiver burden, social connectedness, and health-related quality of life, that are attributable to services designed to address care needs by frailty levels (**Figure 1-2**).

We first conducted a literature review of frailty prevention and management interventions, study end-points, and outcome measurement tools. A list of compiled outcomes and tools were presented for discussion with an expert workgroup comprising geriatricians, operations and finance managers and administrators for comment on their relevancy and practicality for implementation. A catalogue of frailty-related outcomes is presented below (**Figure 1**).

To slow down the progression of frailty and improve frailty-related health outcomes, multiple interventions such as exercises, nutrition, multi-component interventions and individually-tailored geriatric care model may be initiated. These interventions may influence either composite measures of frailty (e.g. frailty status), a specific dimension of frailty (e.g. physical functional status) or adverse outcomes (e.g. falls, mortality). To accurately track the progression of the population and to evaluate the effectiveness of a chosen intervention, an appropriate set of outcomes attributable to the intervention has to be chosen. For example, for an intervention aimed at improving an individual's mobility to reduce risk of falls, we would include functional mobility assessment tools (e.g. berg balance scale, timed up-and-go test) and the number of incident falls.

To be able to track the outcomes, it is essential to ensure that the required data are readily available. Hence, to reduce the burden of data collection and missing data, building in these requirements in the electronic medical record system is extremely important. Otherwise, a separate data collection system may need to be set up to ensure an efficient data collection process.

In conclusion, it is important that collective agreement on the set of frailty outcomes designed to measure the outcomes of care attributable to the interventions has been achieved. In this framework, we have considered the objective of intervention, target population and the availability of information. An appropriate set of outcomes will allow an accurate tracking of frailty progression and measure the effects of the complex suite of interventions to be implemented. In addition, data availability within the electronic health record system will minimise the chance of incomplete data, reduce the burden of data collection, thus, streamlining the evaluation process.

Figure 1. Recruitment flowchart

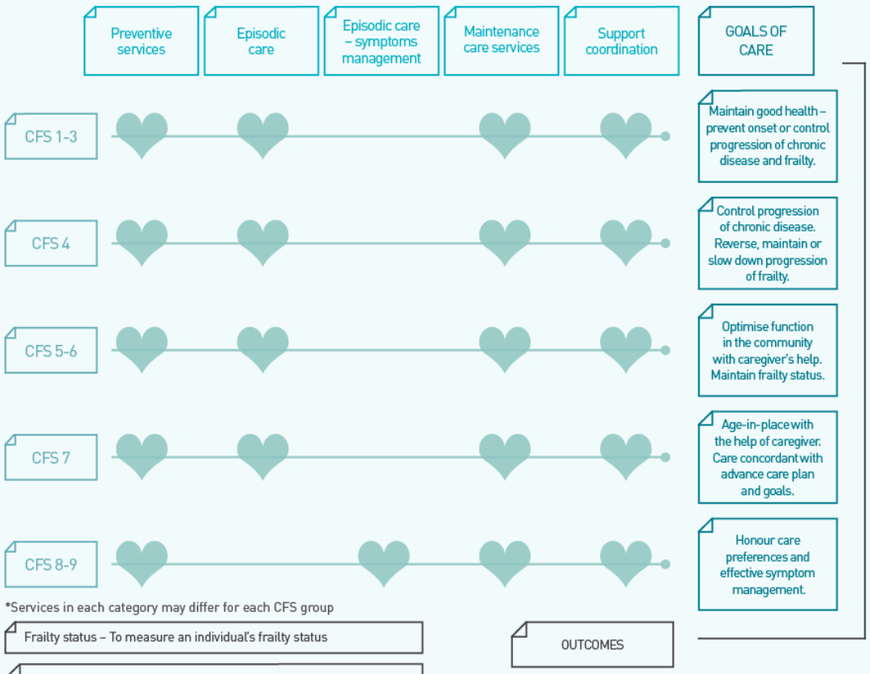


Figure 2. Frailty-related outcomes and the suggested tool or unit of measurement

OUTCOMES	SUGGESTED TOOL/UNIT OF MEASUREMENT
FRAILTY STATUS	CLINICAL FRAILTY SCALE (CFS)
HEALTH BEHAVIOURS, RISK	
ACTIVATION LEVEL	Patient activation measure
	FUNCTIONAL MOBILITY ASSESSMENT TOOLS Berg balance scale, Timed up-and-go test, Single leg stand
FALL RISK	**MULTI-FACTORIAL ASSESSMENT TOOLS** Fall risk assessment tool
	SELF-REPORTED PHYSICAL ACTIVITY QUESTIONNAIRE Global physical activity Questionnaire
PHYSICAL ACTIVITY LEVELS	**PHYSIOLOGICAL MEASURES** Heart rate measure, Accelerometer
CLINICAL HEALTH OUTCOMES	
SYMPTOM MANAGEMENT	Palliative outcome scale (POS), Edmonton symptom assessment scale (ESAS),Palliative performance scale (PPS)
	ACTIVITIES OF DAILY LIVING Barthel index, Katz activities of daily living
PHYSICAL FUNCTIONAL STATUS	**PERFORMANCE-BASED MEASURES** Gait speed, Timed up-and-go test (TUG), Grip strength, Short physical performance battery (SPPB)
	CHAS CARD CONDITIONS Anxiety, Bipolar disorder, Dementia, Major depression, Parkinson's disease, Schizophrenia
COGNITIVE FUNCTIONAL STATUS	**COGNITIVE IMPAIRMENT SCREENING TEST** Abbreviated mental test score (AMT), Montreal cognitive assessment (MoCA), Mini-mental state exam (MMSE)
NUTRITIONAL STATUS	Mini-nutritional assessment (MNA)
INCIDENCE OF FALLS	Number of falls
SEVERITY OF DIABETES COMPLICATIONS	Diabetes complications severity index (DCSI)
ADVANCE CARE PLAN (ACP)	
COMPLETION OF ACP	General ACP/Disease specific ACP/Preferred plan of care
CPR ADMINISTRATION	Yes/No
MEDICAL TREATMENT	Full treatment/Limited additional intervention/Comfort care
SEVERITY OF DIABETES COMPLICATIONS	Home/Hospital/Hospice/Nursing Home
AGGREGATE HEALTH OUTCOMES	
HEALTH-RELATED QUALITY OF LIFE	EuroQol-5 Dimension (EQ-5D)
QUALITY OF LIFE IN LATER LIFE	Control, Autonomy, Self-Realisation and Pleasure (CASP)-19
CAREGIVER BURDEN	Zarit burden interview
SOCIAL FRAILTY	
SOCIOECONOMIC STATUS	Dwelling type, Medifund status, CHAS status
	SOCIAL ISOLATION 6-item Lubben social network scale
SOCIAL ISOLATION	**LONELINESS** UCLA loneliness scale

EVALUATION OF EARLY GERIATRIC SPECIALIST INTERVENTIONS AT THE EMERGENCY DEPARTMENT

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HIGHLIGHTS

- Early geriatric assessment at the emergency department and discharge to home or subacute care with follow up appears to maintain outcomes similar to that of standard care.
- Progression of frailty category may be slowed among patients receiving the interventions, compared to those receiving standard care.

INTRODUCTION

The Emergency Department Interventions for the Frail Elderly (EDIFY) program was developed to provide early geriatric specialist interventions at the ED. The primary objective of the program is to reduce the number of potentially avoidable acute admissions in older persons who may be discharged back to the community safely through early review from geriatric care experts. The EDIFY team consists of healthcare professionals trained in specialized geriatric care, including a geriatrician, senior resident, advanced practice nurse (APN), pharmacist, and physiotherapist. Secondary objectives of the program are to perform comprehensive geriatric assessments on frail older persons at the ED, and follow up with appropriate interventions early to maximize and sustain their functional and frailty status in the community, as well as to provide awareness and education on frailty and related health outcomes.

In this study, we evaluated the effectiveness of the EDIFY program in its primary objective of reducing potentially avoidable acute hospitalizations, as well as ensuring health outcomes remain comparable to that of standard care.

METHODS

We performed a quasi-experimental study to evaluate outcomes of older patients under the EDIFY program versus standard care between July 2018 to August 2019. Participants aged 85 years and older who presented to the ED and were recommended by the ED consultant for admission were assessed for eligibility into the study. Recruitment of eligible patients for the intervention and control arms of the study was done in alternating weekly blocks. Written informed consent was obtained from patients or their legally acceptable representatives if they lacked mental capacity. Participants in the intervention arm received EDIFY program components at the ED (Table 1), whilst those receiving standard care were seen by the geriatric team only after admission to an acute ward or if their waiting time at the ED exceeded 4 hours.

The primary outcome was measured as the number of successful avoidances of admission to acute care. This was defined as no ED attendance within 72 hours of discharge from ED, no transfer to an acute ward from subacute care units within 72 hours, or no transfer to an acute ward from the short-stay unit (SSU). Secondary outcomes assessed included rate of readmission and ED reattendance, as well as institutionalization, functional decline, mortality, and frailty transitions within 1, 3 and 6 months. Bivariate analyses comparing differences between the intervention and control arms were conducted using Fisher's tests for categorical variables and unpaired t-tests for continuous variables. For multivariable analyses, linear and generalized linear models were built for normally and non-normally distributed outcomes respectively, and adjusted for demographics and baseline Modified Barthel Index scores.

RESULTS

A total of 100 patients were recruited for the study, with 43 receiving EDIFY and 57 receiving standard care. Among the 43 patients who received EDIFY, 35 (81%) successfully avoided an acute admission. Of the 8 patients who did not, 5 (63%) were admitted to the acute wards, 2 (5%) were transferred to the acute ward from the SSU, and 1 (2%) was discharged from ED but re-attended ED within 72 hours. Patients were generally similar across arms in baseline characteristics, other than patients in the intervention arm reporting slightly higher Modified Barthel Index scores (Table 2).

Comparing the patients in the intervention and control arms, there were no significant differences in rates of hospitalization or ED-reattendance, as well as other secondary outcomes such as mortality or institutionalization, or functional ability. However, a lower proportion of patients from the intervention arm progressed in their Clinical Frailty Scale (CFS) categorization over follow-up, compared to that of the control arm (intervention: 17%, control: 42%; p=0.02). Adjusted analyses revealed that patients who received EDIFY were less likely to progress to a higher CFS category at 6 months follow-up, compared to the control patients (odds ratio = 0.28, 95% confidence interval = 0.10-0.85).

CONCLUSION

EDIFY facilitates discharge of patients from the ED after a detailed geriatric assessment, to home or subacute care, avoiding admission to acute care. The program averted acute admissions for 81% of the enrolled patients. Additionally, the program did not appear to worsen outcomes of hospitalization or attendance in subsequent months, as well as other secondary outcomes such as mortality, institutionalization or functional ability. Instead, frailty progression appeared to be slower in patients under the program compared to those under standard care.

Table 1. Description of EDIFY interventions

EDIFY COMPONENT	INTERVENTION
MULTIDISCIPLINARY ASSESSMENTS	- Comprehensive Geriatric Assessment with Geriatric Medicine consultant review - Assessments by Physiotherapist (PT), Occupational Therapist (OT) and other Allied Health professionals as necessary
TRANSITIONAL CARE PACKAGE	- Transitional care specialist referral - Transportation fee waiver and mobility aids as necessary - Outpatient PT sessions and home OT visits
FOLLOW-UP CARE PLANNING	- Geriatric Medicine follow-up clinic appointment as necessary - Phone follow-up from EDIFY care coordinator/Advanced Practice Nurse
COUNSELLING AND EDUCATION PACKAGE ON FRAILTY	- Counselling and provision of educational material on diet and exercise - Dietician referral if required

Table 2. Baseline characteristics of patients (selected)

CHARACTERISTIC	CONTROL (N=57)	INTERVENTION (N=43)	P-VALUE OR DIFFERENCE (95% CI)
AGE, MEAN (SD)	90.4 (4.2)	89.4 (4.0)	0.9 (-0.7, 2.6)
MALE GENDER, NO. (%)	21 (36.8)	13 (30.2)	0.53
CFS CATEGORY, NO. (%)			0.11
ROBUST (CFS 1-3)	6 (10.5)	1 (2.3)	
PREFRAIL (CFS 4)	13 (22.8)	6 (14.0)	
FRAIL (CFS 5-8)	38 (66.7)	36 (83.7)	
MODIFIED BARTHEL INDEX, MEAN (SD)	42.3 (26.7)	57.4 (31.3)	-15.2 (-26.7, -3.7)

CFS: Clinical Frailty Scale; CI: Confidence Interval; SD: Standard Deviation

FRAILTY AND HEALTHCARE UTILISATION ACROSS CARE SETTINGS AMONG COMMUNITY-DWELLING OLDER ADULTS IN SINGAPORE

Ge Lixia, Dr Yap Chun Wei, Dr Heng Bee Hoon, Dr Tan Woan Shin

HIGHLIGHTS

- Frail elderly in the community had higher specialist and emergency department visits, day surgery attendances and hospitalisations in the 6-month period prior to and after baseline, but lower polyclinic visits compared to their pre-frail or robust peers.
- An increase in the severity of frailty among older adults corresponds with a greater need for comprehensive and specialised health care services.

INTRODUCTION

Frailty, a common phenomenon among older adults, is frequently found to be associated with increased healthcare utilisation in western countries, but little is known about this relationship in the Asian population. Innovative projects have been implemented to address the needs of the frail elderly in Singapore, but a deeper understanding of the frail older population and their patterns of healthcare utilisation using local data is necessary for better resource planning and intervention prioritisation in public healthcare. This study was conducted to investigate the association between frailty and healthcare utilisation in different care settings among community-dwelling older adults in Singapore.

METHODS

A population-based health survey dataset from community-dwelling older adults (60 years and over) was linked with an administrative database to retrieve healthcare utilisation data: polyclinic visits, specialised outpatient clinic (SOC) visits, emergency department (ED) visits, day surgery (DS) attendances and hospitalisations during a six-month period pre- and post-baseline. Baseline frailty status was measured using the revised five-item FRAIL scale (Fatigue, Resistance, Ambulation, Illnesses, & Malnutrition) with each item scored either 0 or 1. The revised FRAIL scale is scored from 0 (best) to 5 (worst) and is translated into three categories: robust (0), pre-frail (1–2), and frail (3–5).

Negative binomial regression was applied to examine the association between frailty and healthcare utilisation for each care setting, adjusting for confounder variables of age, gender, Chinese ethnicity (yes/no), marital status, living arrangement (alone/with others), smoking status (non-smoker/past/ current), highest education level (no formal education/primary/secondary or above) and self-perceived money sufficiency for basic living needs (sufficient/insufficient). Multimorbidity and disability, which are related to but distinct from frailty, were also adjusted for. A p-value of 0.05 was deemed significant.

RESULTS

In our sample of 701 older adults, 64.8% were of robust health, 27.7% were pre-frail, and 7.6% were frail. Compared to the robust group, frail individuals had a higher rate of SOC visits (IRR: 2.8, 95% CI: 1.2-6.5), ED visits (IRR: 3.1, 95% CI: 1.1-8.1), DS attendances (IRR: 6.4, 95%; CI: 1.3-30.9), and hospitalisations (IRR: 6.7, 95% CI: 2.1-21.1) in the six-month period prior to the baseline (Table 1) and in the subsequent six months (IRR: 3.3, 95% CI: 1.6-7.1; 6.4, 2.4-17.2; 5.8, 1.3-25.8; 13.1, 4.9-35.0; respectively), controlling for covariates (Table 2).

CONCLUSION

Frailty was positively associated with the number of specialised outpatient clinic visits, emergency department visits, day surgery attendances and hospitalisations six months prior to and after baseline. As frailty is a potentially reversible health state with early screening and intervention, providing preventive activities that delay the onset or progression of frailty can potentially reduce secondary and tertiary healthcare utilisation.

Table 1. Associations between frailty and healthcare utilisation within 6 months pre-baseline

HEALTHCARE SETTING	FRAILTY	YES, N (%)	MEAN±SD	ADJUSTED IRR[c] (95% CI)
POLYCLINICS				
	ROBUST (N=454)	148 (32.6)	0.95±1.96	1.00
	PRE-FRAIL (N=194)	82 (42.3)	1.47±2.69	1.35 (0.96, 1.91)
	FRAIL (N=53)	20 (37.7)	1.26±2.03	1.11 (0.58, 2.10)
	P-VALUE	0.060[a]	0.024[b]	
SPECIALIST OUTPATIENT CLINICS				
	ROBUST (N=454)	126 (27.8)	1.22±2.93	1.00
	PRE-FRAIL (N=194)	79 (40.7)	2.40±5.83	1.65 (1.04, 2.63)
	FRAIL (N=53)	27 (50.9)	3.92±5.39	1.11 (1.22, 6.50)
	P-VALUE	<0.001	<0.001	
EMERGENCY DEPARTMENTS				
	ROBUST (N=454)	28 (6.2)	0.09±0.41	1.00
	PRE-FRAIL (N=194)	22 (11.3)	0.18±0.63	1.10 (0.55, 2.21)
	FRAIL (N=53)	16 (30.2)	0.57±1.01	3.05 (1.14, 8.12)
	P-VALUE	<0.001	<0.001	
DAY SURGERY				
	ROBUST (N=454)	18 (4.0)	0.06±0.37	1.00
	PRE-FRAIL (N=194)	10 (5.2)	0.09±0.61	2.02 (0.77, 5.27)
	FRAIL (N=53)	6 (11.3)	0.13±0.39	6.41 (1.33, 30.92)
	P-VALUE	0.060	0.062	
HOSPITALISATIONS				
	ROBUST (N=454)	13 (2.9)	0.04±0.27	1.00
	PRE-FRAIL (N=194)	20 (10.3)	0.14±0.47	2.06 (0.91, 4.67)
	FRAIL (N=53)	15 (28.3)	0.51±0.95	6.72 (2.14, 21.11)
	P-VALUE	<0.001	<0.001	

[a] p-values were obtained by chi-squared tests.
[b] p-values were obtained by Kruskal-Wallis H tests.
[c] IRR: Incidence rate ratio. Adjusted for age, female, Chinese ethnicity, marital status, highest education level, living alone, self-reported money insufficiency, smoking status, multimorbidity, and assistance required in ADLs.

Table 2. Associations between frailty and healthcare utilisation within 6 months after baseline

HEALTHCARE SETTING	FRAILTY	YES, N (%)	MEAN±SD	ADJUSTED IRR[c] (95% CI)
POLYCLINICS				
	ROBUST (N=454)	153 (33.7)	0.96±2.3	1.00
	PRE-FRAIL (N=194)	82 (42.3)	1.64±4.18	1.54 (1.08, 2.19)
	FRAIL (N=53)	20 (37.7)	1.1±1.82	1.17 (0.60, 2.29)
	P-VALUE	0.113[a]	0.080[b]	
SPECIALIST OUTPATIENT CLINICS				
	ROBUST (N=454)	139 (30.6)	1.21±2.61	1.00
	PRE-FRAIL (N=194)	70 (36.1)	2.03±4.13	1.48 (0.96, 2.27)
	FRAIL (N=53)	31 (58.5)	5.08±7.32	3.31 (2.38, 17.24)
	P-VALUE	<0.001	<0.001	
EMERGENCY DEPARTMENTS				
	ROBUST (N=454)	20 (4.4)	0.05±0.25	1.00
	PRE-FRAIL (N=194)	20 (10.3)	0.19±0.73	2.55 (1.25, 5.20)
	FRAIL (N=53)	16 (30.2)	0.47±0.82	6.40 (2.38, 17.24)
	P-VALUE	<0.001	<0.001	
DAY SURGERY				
	ROBUST (N=454)	20 (4.4)	0.05±0.25	1.00
	PRE-FRAIL (N=194)	11 (5.7)	0.19±0.73	1.77 (0.77, 4.06)
	FRAIL (N=53)	5 (9.4)	0.47±0.82	6.40 (2.38, 25.78)
	P-VALUE	0.468	<0.001	
HOSPITALISATIONS				
	ROBUST (N=454)	11 (2.4)	0.03±0.17	1.00
	PRE-FRAIL (N=194)	19 (9.8)	0.12±0.41	2.06 (0.91, 4.67)
	FRAIL (N=53)	16 (30.2)	0.53±0.97	6.72 (2.14, 21.11)
	P-VALUE	<0.001	<0.001	

[a] p-values were obtained by chi-squared tests.
[b] p-values were obtained by Kruskal-Wallis H tests.
[c] IRR: Incidence rate ratio. Adjusted for age, female, Chinese ethnicity, marital status, highest education level, living alone, self-reported money insufficiency, smoking status, multimorbidity, and assistance required in ADLs.

DERIVING NET TRANSITION PROBABILITIES OF CLINICAL FRAILTY SCALE GROUPS IN EMERGENCY PATIENTS USING CROSS-SECTIONAL DATA

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[1]Tan Tock Seng Hospital

HIGHLIGHTS

- The estimation of state transition probabilities from longitudinal data of sufficient quality is useful to reflect the effects of interventions in slowing disease progression.
- This study presents age-specific net transition probabilities of Clinical Frailty Scale groups derived from cross-sectional data of patients presenting to an emergency department.

INTRODUCTION

In epidemiological studies, we are often interested in age-specific transition probabilities. These probabilities can be obtained from a cohort study if data is available. However, there are few of such studies, and are often subject to issues such as small sample sizes and high drop-out rates. On the other hand, large cross-sectional surveys are often conducted, but these lack longitudinal information to generate transition probabilities.

Frailty is a concept that is gaining traction. The Clinical Frailty Scale (CFS) is a frailty measurement tool with a 9-point scale and is often further grouped into 5 tiers. Those most robust in health are the lowest tier, and the terminally ill are categorized in the last tier. Due to the relatively recent development of the CFS, there are few papers published on its age-specific transition probabilities.

The emergency department (ED) of Tan Tock Seng Hospital (TTSH) collects CFS data routinely, providing a source of cross-sectional CFS data. In this study, we used data from TTSH ED to derive transition probabilities of CFS.

METHODS

Cross-sectional CFS scores of 69,000 patients seen at TTSH-ED in 2019 were analysed. We categorised CFS scores into 3 groups (CFS 1-3: Group 1, CFS 4-5: Group 2, and CFS 6-9: Group 3).

We referenced methods used by van de Kassteele ***et al*** (1), adjusting the approach by including a component of outflow due to death. In brief, we viewed a cross-sectional survey being as equivalent to a longitudinal survey with two waves of data collection in two consecutive years, for participants aged a at the first and aged $a+1$ at the subsequent year. The a ***priori*** assumption was that age and the current state were the drivers of the next state. We first smoothed the prevalence of CFS groups by age, and subsequently modelled the transitions of people moving across groups from year y to year $y+1$ as a classical transport model. The model was tasked to find the "most likely transitions" that resulted in the observed states in year y and year $y+1$. We ran this approach through the ages of 50 to 90 years.

RESULTS

The distribution of CFS grouping by age is shown in Figure 1. Using Excel Solver, we solved for the transitions from age 50 onwards. The non-zero age-specific transitions between CFS groups are shown in Figure 2. The graphs showed that progression from Group 1 to Group 2 became more rapid after age 80, and those in Group 3 had a steady increase in the risk of death.

CONCLUSION

We estimated the transition probabilities between 3 CFS groups in patients who presented to an emergency department, using cross-sectional data. The approach of using cross-sectional data would admittedly not reflect "real" transitions, as the latter would likely include two-way transitions, i.e. a "reversal" to a previous state. However, this methodology would be an efficient and simple method to provide a basis for comparing the rates between two populations, or the effects on an intervention in circumstances where only cross-sectional data would be available.

Figure 1. Distribution of CFS groups by age

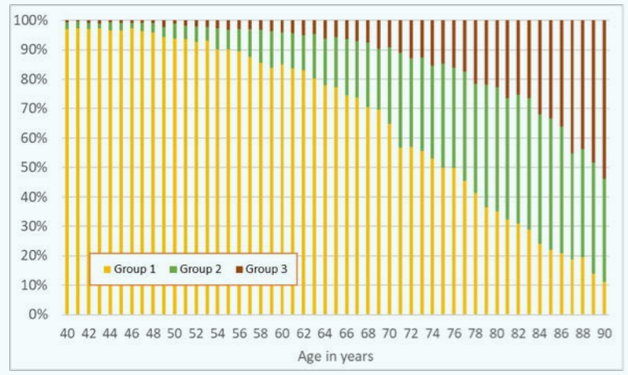
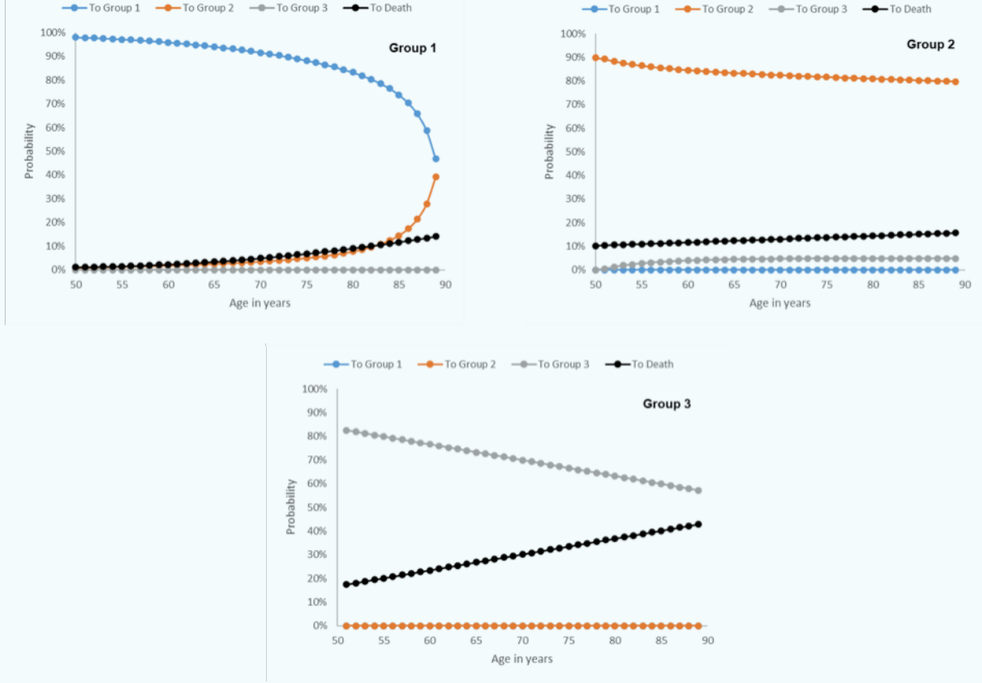


Figure 2. Net transition probabilities across groups



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LEAVING WELL

A focus on end-of-life care and considerations

PROGNOSIS FACTORS FOR END STAGE ORGAN FAILURE – A PROTOCOL FOR A SCOPING REVIEW

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HIGHLIGHTS

- A structured procedure on conducting a scoping review to identify prognostic factors for end stage organ failure was outlined in detail.
- Prognostic factors identified from the scoping review will be used to guide future development of prognostic models for end stage organ diseases.

INTRODUCTION

People with end stage organ failure (ESOF) have an unpredictable and fluctuating illness trajectory, characterised by either slow physiological deterioration with worsening symptoms, or rapid deterioration prompting swift changes in treatment goals from curative to palliative care, or periods of relative stability interspersed with episodes of acute and often severe exacerbations. They frequently encounter multiple hospitalizations and may be prescribed with intensive treatments. The gradual and prolonged decline with moments of stabilization (entry-and-re-entry phase) makes it difficult for clinicians to recognise the terminal phase of this illness, and to initiate palliative care interventions and end-of-life care. Prognostic tools to accurately identify factors associated with mortality are important for clinicians, patients, and their caregivers as it facilitates patient-centred care and shared decision making.

A prognostic factor is any measure associated with a subsequent outcome, such as survival. To improve the accuracy of prognosis, several prognostic factors can be combined to form a prognostic model, from which a survival probability can be computed. To facilitate the development of prognostic prediction models for patients with ESOF, we must first identify factors associated with mortality.

The primary objective of this scoping review is to provide an overview of factors associated with mortality for patients diagnosed with:

(1) End stage lung disease (ESLD) (defined as chronic lung conditions other than chronic obstructive pulmonary disorder)
(2) End stage heart failure (ESHF) (defined NYHA III/IV or AAC/AHA stage C/D)
(3) End stage renal disease (ESRD) (defined as Chronic Kidney Disease Stage 5)

As secondary objectives, we aim to identify variables that were included in multivariable models to account for multimorbidity and to appraise the performance of predictive models for each ESOF.

METHODS

Arksey and O'Malley's framework with advancements made by Levac et al will be adopted for this review[1]. Scoping reviews for each ESOF will be conducted separately using the same methodology (Figure 1). Study objectives were broadly guided by the Population, Index prognostic factor, Comparator prognostic factor, Outcome, Timing, Setting (PICOTS) framework[2]. The Preferred Reporting Items for Systematic Reviews (PRISMA) guidelines will be used to summarize the flow of information in identifying, screening, and selecting studies. Data extraction specific to our objectives will be guided by the Critical Appraisal and Data Extraction for Systematic Reviews of Prediction Modelling Studies (CHARMS-PF) checklist[2].

Multidisciplinary teams of palliative care clinicians, organ specialists, researchers and librarians refined the research questions and co-developed the search strategy (Figure 2). Briefly, any peer-reviewed articles or PhD thesis written in English, that investigated factors associated with all-cause mortality using multivariable analysis, amongst the specified adult end-stage organ failure populations will be included. To identify relevant articles, medical librarians will execute the search strategy across six databases (Medline, EMBASE, PubMed, CINAHL, Cochrane Library and Web of Science). Title and abstract screening will be carried out by four main reviewers with clinicians acting as arbitrators to resolve any disagreements. Studies screened and included at this stage will then proceed on to full-text screening and incorporated into the final analysis if they meet the eligibility criteria. Relevant studies will be appraised using the Quality in Prognostic Factor Studies (QUIPS) tool, and relevant data will be extracted. Bibliographic information, study design, sample size information, missing outcome data, ESOF and multimorbidity, statistical information, variables assessed and included in the final model, predictive model or clinical assessment tools used, proportion of deaths, mortality risk period assessed, validation of the models and research gaps will be tabled for each article.

RESULTS

An overview of study characteristics, design and quality of the included literature will be synthesized. Factors associated with mortality for each ESOF will be summarized. If the number of variables identified is too large, we will summarize the data based on categories (e.g., demographic, haemodynamic variables). We will report the frequencies of each factor or category that was investigated and included in the final multivariable model across all studies. Prognostic effect of variables may be influenced by proximity to death or by setting, therefore subgroup analysis by mortality risk periods and settings will be performed. Details on the type of comorbidities accounted for will be reported. Predictive accuracy of prediction models specific to each disease will be summarised.

CONCLUSION

The results from this study can potentially facilitate the development of prognostic models for patients diagnosed with end-stage lung, heart, and renal failure.

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Figure 1. Scoping review framework

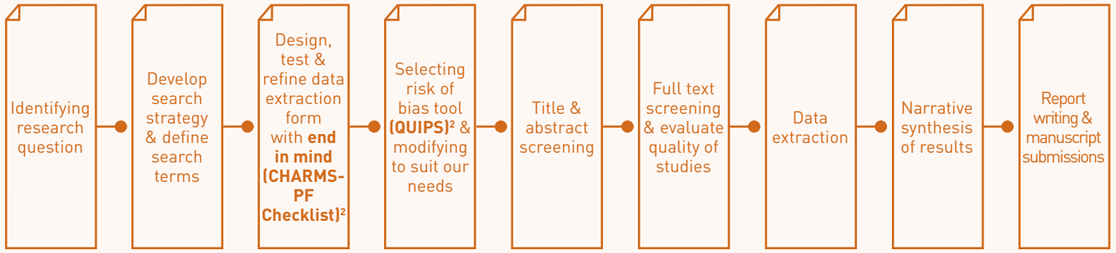

Figure 2. Search strategy

Databases: Medicine, EMBASE, PubMed, CINAHL, Cochrane Library, Web of Science

POPULATION	ESLD	ESHF	ESRD
DISEASE & TREATMENT TERMS	Interstitial lung disease, Pulmonary fibrosis, Pulmonary hypertension with chronic lung disease, Bronchiectasis, Lung diseases associated with connective tissue disease, Non-COPD	Acute heart failure, end stage heart failure, severe heart failure, diastolic, systolic heart failure, advanced heart failure, acute decompensated heart failure, NYHA III/IV AHA/AAC C/D	Kidney failure, chronic/renal insufficiency, chronic kidney failure, decreased renal function, end stage kidney disease, renal failure, chronic renal disease, stage 5 chronic kidney disease or CKD5, dialysis, hemodiafiltration, nondialytic therapy*
ANALYSIS & OUTCOME TERMS	Survival analysis, Kaplan Meier, Proportional Hazard Models, logistic model, logistic regression, prediction model, survival model, survival analysis, survival rate, life expectancy, mortality, death, death rate, death risk, prognosis, prognostic factor,		
TIME FRAME	2000-2020	2010-2020	2000-2020
STUDY DESIGNS TERMS	Epidemiological studies, case control, cohort, longitudinal, prospective, retrospective, RCT		

PROGNOSTICATION IN HOME-DWELLING PATIENTS WITH ADVANCED DEMENTIA: THE PALLIATIVE SUPPORT DEMENTIA MODEL (PalS-DEM)

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HIGHLIGHTS

- Identification of patients with advanced dementia with poor prognosis provides healthcare professionals an opportunity to evaluate goals of care, re-examine the benefit of interventions and engage surrogate decision makers in care plan discussions.
- We have developed and validated PalS-DEM, which incorporates clinician impression of patients' needs with known advanced dementia prognostic factors.
- Continued evaluation of Pals-DEM in homecare settings is needed to further assess its utility.

INTRODUCTION

Difficulties with prognostication prevent many patients with advanced dementia from receiving timely palliative support. The aim of this study was to develop and validate a prognostic model for 1-year mortality in home-dwelling patients with advanced dementia.

METHODS

This was a prospective cohort study. Cox proportional hazards regression was used to model survival in the derivation cohort using significant prognostic variables identified in univariate analysis. The final model was identified by removing variables that were no longer statistically significant in multivariate analysis. A risk score was computed by taking the logarithm of the hazard ratio of each variable, multiplying them by 10 and rounding to the nearest integer. The reference level was assigned zero points. The model was validated using 10-fold cross-validation. The area under the receiver operating characteristic (AUROC) was used to measure the accuracy of the final model, with the mean and bootstrapped 95% confidence interval reported.

RESULTS

Of the 555 home-dwelling patients with dementia at Functional Assessment Staging Test (FAST) stage 7, 419 (75.5%) patients died with a median follow-up of 47 days [interquartile range (IQR) 161]. The cohort was split into derivation (n = 275) and validation (n = 280) cohorts, with patient characteristics reported in Table 1. The model was refined into a parsimonious 6-variable model [Palliative Support DEMentia Model (PalS-DEM)] consisting of age, dementia etiology, FAST stage, Charlson Comorbidity Index scores, Australian National Sub-acute and Non-acute Patient Casemix Classification (AN-SNAP) palliative care phase, and 30-day readmission frequency for the prediction of 1-year mortality (Table 2). The AUROC was 0.65 (95% confidence interval 0.59–0.70). Risk scores categorized patients into 3 prognostic groups, with a median survival of 175 days (IQR 365), 104 days (IQR 246), and 19 days (IQR 88) for the low-risk (0-1 points), moderate-risk (2-4), and high-risk (≥5) groups, respectively.

CONCLUSION

The PalS-DEM identified patients at high risk of death in the next 1 year. The model produced consistent survival results across the derivation, validation, and cross-validation cohorts and will help healthcare providers identify patients with advanced dementia earlier for palliative care.

LEAVING WELL

Table 1. Characteristics of patients in the derivation and validation cohorts

VARIABLES		DERIVATION COHORT	VALIDATION COHORT	P VALUE
NO. OF PATIENTS		275	280	
MEAN AGE±SD		88.3 ± 7.8	88.0 ± 7.4	0.56
GENDER				0.851
	MALE	78 (28.4)	82 (29.3)	
	FEMALE	197 (71.6)	198 (70.7)	
RACE				0.343
	CHINESE	232 (84.4)	246 (87.9)	
	MALAY	12 (4.4)	5 (1.7)	
	INDIAN	24 (8.7)	22 (7.9)	
	OTHERS	7 (2.5)	7 (2.5)	
MEAN SERUM ALBUMIN ±SD		28.6 ± 5.7	28.2 ± 5.0	0.37
FAST STAGE				0.373
	7A	1 (0.4)	0 (0.0)	
	7C	36 (13.1)	36 (12.9)	
	7D	97 (35.3)	115 (41.1)	
	7E	141 (51.3)	129 (46.1)	
MEAN DURATION OF DEMENTIA (MONTHS) ±SD		80.6 ± 54.5	72.5 ± 46.0	0.07
MODERATE TO SEVERE CHRONIC KIDNEY DISEASE		84 (30.5)	86 (30.7)	1.000
PNEUMONIA IN THE PAST 12 MONTHS		195 (70.9)	213 (76.1)	0.179
PERIPHERAL VASCULAR DISEASE		9 (3.3)	22 (7.9)	0.025
AN-SNAP PHASE CATEGORY				0.701
	PHASE 1	158 (57.5)	165 (58.9)	
	PHASE 2 & 3	94 (34.2)	97 (34.6)	
	PHASE 4	23 (8.4)	18 (6.5)	

AN-SNAP: Australian National Sub-acute and Non -acute Patient; FAST: Functional Assessment Staging Test; SD: Standard Deviation

Table 2. Model for estimating risk score at one year

VARIABLES	HR	LOG HR	P-VALUE	95% CI		RISK SCORE
AGE > 85 YEARS	1.29	0.11	0.029	1.03	1.62	1
ALZHEIMER'S DISEASE	REF					
VASCULAR DEMENTIA	0.92	-0.04	0.563	0.69	1.22	0
MIXED DEMENTIA	1.16	0.06	0.287	0.88	1.52	1
LEWY BODY DEMENTIA	0.94	-0.03	0.953	0.13	6.85	0
PARKINSON'S DISEASE	0.60	-0.22	0.163	0.29	1.23	-2
OTHER TYPE OF DEMENTIA	0.99	-0.01	0.939	0.68	1.43	0
FAST 7A-7D	REF					
FAST 7E	1.26	0.10	0.049	1.00	1.58	1
CCI SCORE ≥ 8	1.14	0.06	0.232	0.92	1.43	1
AN-SNAP PHASE 1	REF					
AN-SNAP PHASES 2-3	1.98	0.30	0.000	1.57	2.50	3
AN-SNAP PHASE 4	10.96	1.04	0.000	7.26	16.54	10
READMISSION WITHIN 30 DAYS (YES)	1.16	0.06	0.182	0.93	1.45	1
AUC, LOGISTIC REGRESSION			0.66			
CROSS-VALIDATED MEAN AUC[t]			0.65			
BOOTSTRAP BIAS CORRECTED 95% CI			0.59-0.70			

AN-SNAP: Australian National Sub-acute and Non -acute Patient; AUROC: Area Under the Receiver Operating Characteristics; CCI: Charlson Comorbidity Index; CI: Confidence Interval; FAST: Functional Assessment Staging Test; HR: Hazard Ratio

END-OF-LIFE OUTCOMES OF END-STAGE ORGAN FAILURE PATIENTS: AN EXPLORATORY STUDY OF POTENTIAL HISTORICAL COMPARATORS

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HIGHLIGHTS

- Assembling a historical retrospective comparator group of end-stage organ failure patients using administrative databases is possible.
- The majority of end-stage organ failure patients passed away in government hospital.

INTRODUCTION

Acute healthcare utilisation during terminal stages of disease and hospital deaths are potentially measurable population-based end-of-life quality indicators. These outcomes can be extracted from administrative databases and may have potential use in comparative studies of palliative care interventions for end-stage organ failure patients. An exploratory study using information from administrative databases was undertaken with several aims. The first aim was to determine if potential controls for a palliative home care programme could be assembled from administrative databases of national-level healthcare data. The second aim was to examine outcomes of acute healthcare utilisation and place of death among a retrospective cohort of deceased end-stage organ failure patients (consisting of heart failure [HF], lung failure [LF] and renal failure [RF] patients). The third aim was to investigate if variations in these outcomes existed between patients of different organ failures, to determine if adjustments for potential differences in the underlying distribution between subgroups of these patients are necessary for future work.

METHODS

A retrospective cohort study was performed. Deaths recorded in Singapore on the national death registry during calendar years 2016 and 2017 were screened. The following inclusion criteria were used to select decedents as potential controls for the study: (i) had an address registered in the central region of Singapore; (ii) incurred 2 or more admissions in the last year of life, with at least 1 in Tan Tock Seng Hospital; (iii) had a principal, final or secondary diagnosis of any final year admission from a pre-specified list of International Classification of Disease (ICD10) codes (Table 1). Decedents who had utilised day hospice, inpatient hospice or home palliative care services during the last year of life, or who had cancer as a cause of death or co-morbidity, were excluded from the study. Admissions, cumulative length of stay (LOS), emergency department (ED) visits, and specialist outpatient clinic (SOC) visits during the last 6-, 3-, and 1-month of life, as well as place of death, were extracted and compared between subgroups of controls.

Table 1. ICD10 codes used to determine study eligibility

GROUP	ICD10 CODES
HEART FAILURE	- I50: Heart failure - I11.0: Hypertensive heart disease with (congestive) heart failure - I13.0: Hypertensive heart and renal disease with (congestive) heart failure - I13.2: Hypertensive heart and renal disease with both (congestive) heart failure and renal failure
LUNG FAILURE	- J44: Chronic obstructive pulmonary disease - J96.1: Chronic respiratory failure
RENAL FAILURE	- N18.5: Chronic kidney disease, stage 5

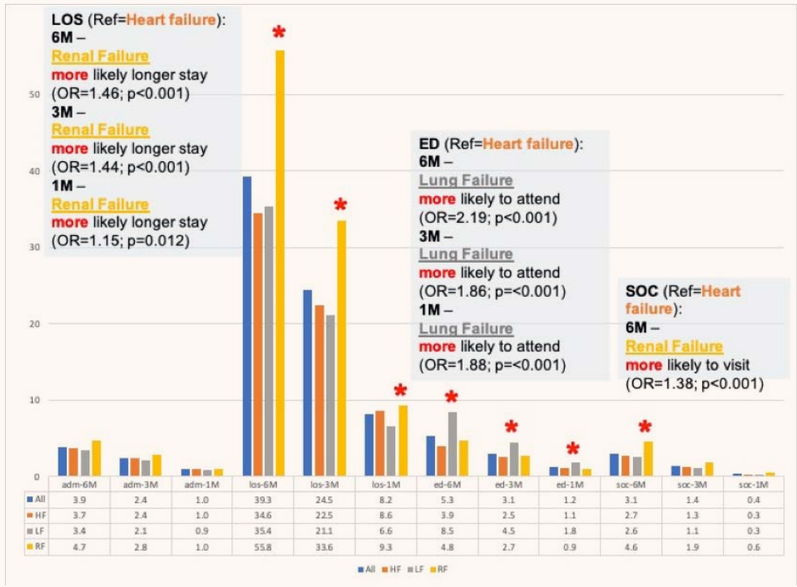
RESULTS

A total of 297 decedents with end-stage organ failure (HF=159 [53.5%], LF=75 [25.3%] and RF=63 [21.2%]) were included. Patients with RF were younger at their demise (mean age=67.0, SD=10.7; versus HF: mean=74.0, SD12.6; and LF: mean=77.7, SD=9.7 [p<0.001]). More LF patients were male (80.0%), compared to HF (61.6%) and RF (57.1%) (p=0.007).

Acute healthcare utilisation

Unadjusted means of acute healthcare utilisation results are presented in Figure 1. RF patients had higher cumulative LOS across all time-points before death examined (Odds ratios (ORs): 6-month =1.46, 3-month=1.44,1-month=1.15; p≤0.012), compared to HF patients. LF patients were more likely to visit ED across all time-points (ORs: 6-month=2.19, 3-month=1.86,1-month=1.88; all p<0.001), compared to HF patients. RF patients were more likely to visit SOC during last 6-months prior to death (OR=1.38; p<0.001), compared to HF patients. There were no between-group differences in the number of admissions.

Figure 1. Acute healthcare utilisation, by groups, across time-points [a,b]



[a] Admissions (adm), emergency department (ed) and specialist outpatient clinic (soc) visits measured in number of visits.
[b] Length of stay (los) measured in number of days.
6M: 6-month, 3M: 3-month, 1M: 1-month.

Place of death

82.2% of decedents had a government hospital death recorded. More RF patients passed away in government hospitals (92.1%), versus 81.8% for HF and 74.7% for LF patients (p=0.029).

CONCLUSION

A retrospective cohort of end-stage organ failure control patients using national-level administrative databases can be assembled. Many end-stage organ failure patients died in government hospitals. Patients with end-stage organ failure are a heterogenous population with different acute healthcare resource utilisation patterns at end-of-life and this should be considered in future studies. The methodology used in this study can potentially support new prospective studies of palliative care interventions and their impact on terminal healthcare utilisation and place of death.

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RESEARCH GRANTS

National Medical Research Council Health Services Research Grant- New Investigator Grant	2020-2022 $100,000

The CONNACT programme for knee osteoarthritis: Preventing replacement surgery, healthcare utilisation and cost, with a lifetime perspective"

Dr Michelle Jessica Pereira (PI)
Dr Bryan Tan (Co-I)
Dr Heng Bee Hoon (Co-I)
Prof Julian Thumboo (Co-I)
Dr Pua Yong Hao (Co-I)
Dr Ganga Ganesan (Collaborator)
Dr Zhu Zhecheng (Mentor)

Palliative Care Centre for Excellence in Research and Education: Research Grant	2020-2022 $50,000

End-of-life outcomes of patients on home ventilation and respiratory support

Dr Michelle Jessica Pereira (PI)
Dr Joseph Antonio D. Molina (Co-I)
Tay Riyin (Co-I)
Dr Lee Rui Min (Co-I)
Assoc Prof Konstadina Griva (Co-I)
Sun Tao (Collaborator)
Dr Yee Choon Meng (Collaborator)
Dr Tan Woan Shin (Mentor)

National Health Group: Population Health Grant	2020-2022 $1,000,000

Collaborative Model of Care between Orthopaedics and Allied healthcare professionals Trial (CONNACT Plus)

Dr Bryan Tan (PI)
Dr Michelle Jessica Pereira (Co-I)
Ngo Xueting (Co-I)
Dr Yang Su-Yin (Co-i)
Ng Lih Yen (Site PI)
Ong Pei Gin (Site PI)

National Health Group: Population Health Grant	2020-2022 $200,000

Total Knee Replacement (TKR) One-Rehab Plan: Innovative Care Model From Pre to Post-operative

Ashton Neoh Eng Chuan (PI)
Adj Assoc Prof Kelvin Tan Guoping (Co-I)
Dr Michelle Jessica Pereira (Co-I)
Melissa Chong (Co-I)
Vanessa Ho Yi Ki (Co-I)
Wong Jiayen (Co-I)

TRAINING AWARDS

NHG-LEARN Fund	2020-2022

NHG HQ sponsorship for formal qualification (L.E.A.R.N. scheme)

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A/Prof Ding Yew Yong

MBBS, FRCP, FAMS, MPH, PhD
Visiting Consultant (Senior Consultant & Clinical Associate Professor, Geriatric Medicine, TTSH)

Mr Eric Chua Siang Seng

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Senior Executive

Ms Ge Lixia

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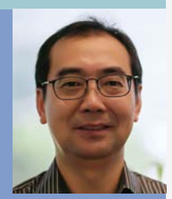
Senior Research Analyst

Mr Li Ruijie

MSc (Occupational Therapy)
Principal Research Analyst



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