General medicine at the frontline of acute care delivery: Comparison with family medicine hospitalist model implementation in Singapore

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Abstract
Introduction This mixed methods study seeks to assess the clinical outcomes and qualitative insights associated with the pragmatic implementation of a general medicine (GM) physician-led inpatient care model, first at Alexandra Hospital (AH) and then at Sengkang General Hospital (SKH), and to compare them with findings reported in an earlier implementation of the family medicine (FM) hospitalist model in Singapore.

Methods Anonymous quantitative demographic and clinical data including length of stay, 30-day readmission rate, inpatient mortality rate and gross cost of hospitalisation bills were extracted from the hospital information system. Comparative analyses with the FM hospitalist model and usual care were made. Secondary qualitative data that were gathered focused on increased understanding of the proposed model, its perceived challenges and future opportunities for its implementation.

Results The adapted GM care model implemented first at AH and then at SKH seemed to suggest that such a model run by physicians from various backgrounds was capable of producing similarly superior outcomes when compared with the FM hospitalist model piloted in 2011, which was juxtaposed with usual care. With regard to qualitative insights, three findings were reported: (a) perception of and mindset in relation to generalists, which illustrates the barriers to implementing GM; (b) education and training of generalists, which underlines the current lack of adequate supply of GM specialists; and (c) operational issues of care model implementation, which highlights the current mismatches between the prevailing healthcare philosophy and the requirements for successful implementation of the GM care model.

Conclusion The success of a GM care model hinges on how it is operationalised. With clear protocols, definitions, and a high level of protocol compliance by healthcare team members, the intended outcomes show promise for replication at other interested sites.

Keywords
Hospitalist, generalist, care model, integrated care, holistic care

Introduction
With life expectancy the third highest in the world, Singapore, like other developed countries, is facing an ageing population plagued with multimorbidity.1 The prevalence of chronic diseases in Singapore is something that cannot be overlooked as chronic disease management becomes more complex and threatens to fuel exponential growth in healthcare expenditure.1,2 The concept of integrated care has also gained prominence as the favoured approach for enhancing patient care through the horizontal and vertical integration of various care and service sectors.1–10

International input has been sought to develop and reform frameworks centring on the concepts of integration and holistic care delivery.11–15 In Europe, this has resulted in initiatives such as Joint Action on Chronic Diseases, which place emphasis on multidisciplinary or generalist-led teams that constantly review customised care plans for patients, the...
utilisation of self-management tools and the integration of information across different providers and settings. In Canada, as part of the PRISMA care model, case managers, whose role is to lead and coordinate care between multidisciplinary teams in the community, are assigned to patients. If integrated care is the desired outcome, the idea of family medicine (FM) physicians leading a new model of care as a patient’s principal physician and care coordinator seems promising. Strong primary care networks have been shown to deliver better population health outcomes at a lower cost. In the Netherlands, each citizen has an approved general practitioner (GP) and the providers are organised in care groups to deliver holistic, coordinated care for patients with chronic diseases. With the rise of multimorbidity, FM is well positioned to deliver holistic care that not only focuses on medical problems but also on the psychosocial needs of patients.

Singapore’s primary healthcare system operates a mixed delivery model in which private GPs constitute up to 80% of primary care capacity in the community and focus on episodic care that often only involves minor ailments. The bulk (up to 80%) of chronic disease cases are managed by public polyclinics, which make up the remaining 20% of the sector’s capacity. Because there are largely untapped GP resources in the community, there have been increased efforts towards engaging these providers meaningfully in the co-management of patients with multimorbidity and to realise a single primary physician approach to holistic care.

Elsewhere, many hospitals have trialled a functional model based on hospitalist care, in which GP partners spend 25%–50% of their time as ‘hospitalists’ caring for inpatients. This model of care has demonstrated that FM hospitalists may reduce the overall cost and length of stay (LOS) for patients without compromising clinical outcomes, while at the same time enabling the GPs to continue holistic care and care coordination for patients at post-discharge follow-ups. Recognising the potential, Singapore General Hospital (SGH) implemented and evaluated a FM hospitalist pilot in 2011. Since the pilot, there have been many new integrated approaches and models of care trialled at various regional general hospitals. In 2017, the MOH Office for Healthcare Transformation was set up and a partnership with Alexandra Hospital (AH) was established to implement the integrated general hospital care model. This emphasised a single generalist-led inpatient care team, the minimal transfer of care, a single outpatient principal physician and care integration with community providers. These endeavours illustrate differing interpretations and operationalisations of the overarching concept of care integration. Consequently, it becomes important for clinicians and hospital administrators to explore, study and compare implementations to arrive at an informed decision with regard to a set of elements that can be adopted for care transformation efforts in their respective institutions.

This retrospective observational study seeks to assess quantitatively a general medicine (GM) physician-led inpatient care model implementation attempt and compare the clinical outcomes with the previously reported implementation of the FM hospitalist model, which was juxtaposed with usual care. The findings from this study may reveal issues and insights that were perhaps neither anticipated nor clearly articulated during the hospitals’ earlier deliberations with regard to conceptualising their intended care models, and may serve as a useful point of reference in the future.

Method

Setting

Sengkang General Hospital’s (SKH) model of care was first implemented at AH, a 300-bed acute hospital located in a mature precinct in Western Singapore, which was SKH’s nested site between 2015 and 2018 while its new 1000-bed acute hospital was being built in a developing precinct in North-Eastern Singapore. During this interim period, the hospital treated patients who were mostly community-ambulant, requiring subacute care, or ambulance transfers from other hospitals. After the opening of SKH in July 2018, the care model was adapted for this new hospital, which serves a younger patient population with more acute issues who live close to the premises.

Implementation of care model

The care model adopted had its foundations in a generalist approach to multimorbidity. However, instead of enlisting solely FM physicians to lead the model, it was implemented with a team of physicians practising GM. The team consisted of doctors who were trained in FM, internal medicine, geriatric medicine, rehabilitation medicine and a wide array of other specialties. With defined GM protocols, the model was built on team-based integration of specialist expertise, thereby shifting organ-based diagnosis and treatment to an interactive, system-wide intervention.

At AH, a ward-based approach was adopted. The ward’s consultant and care team took on cases classified as GM. Nursing, allied health and support staff also operated largely with the same ward-based approach. Each care team member participated actively in the care management and planning processes and multidisciplinary team meetings were also held weekly on a regular basis. At SKH, the management adopted a round-robin, team-based approach, which saw GM teams managing allocated patients at various ward locations. The common feature of both sites was that the consultants, regardless of their own specialty, were required to devote a significant portion of their time practising GM and caring for patients with conditions that often did not fall within their respective specialties. When required, referrals could be made to request specialist input from one another for management of complex issues requiring advanced tertiary care. Proper discharge planning supported by a team of patient navigators (case managers), when required, was also a feature of the care model. In addition, the GM team provided support for managing chronic diseases pre- and postsurgery to selected surgical patients. Using a healthcare ecosystem approach, designated GM physicians also conducted post-discharge house visits to patients at risk of frequent readmissions (Hospital-to-Home programme) during the study period, and provided medical support to institutionalised patients in the community within the precinct.
A p-value of inflation in Singapore between 2011 and 2016, and between 1.1758 in accordance with reported health services bills in 2011 was adjusted for inflation by a factor of 1.1242.

Data collection and analysis

Anonymised quantitative demographic and clinical data including length of stay, 30-day readmission rate, inpatient mortality rate and gross cost of hospitalisation bills were extracted from the hospital information system for GM patients admitted between July 2016 and June 2017 to AH, and between October 2018 and March 2019 to SKH. There was a gap between the data extraction periods because this was the period during which SKH’s operations at AH were being scaled down in preparation for its physical relocation (July 2017–May 2018), and also the period of the initial setting-up and scaling-up phase of operations at the new site (June 2018–Sep 2018). The patient load, case mix, workflows, processes and outcome variables during the transition might not reflect the steady state of operations at both locations.

Demographic data were presented using measures of central tendency and proportions. Because length of stay and gross hospitalisation cost data had skewed distributions, geometric mean and 95% confidence intervals were used to summarise the variables. Readmissions and inpatient mortality were presented as proportions. Outcome variables were compared with the corresponding results from an earlier local study reported by Lee, et al. in 2011 that used parametric tests for continuous variables and non-parametric tests for categorical variables. The gross cost of hospitalisation bills in 2011 was adjusted for inflation by a factor of 1.1242 and 1.1758 in accordance with reported health services inflation in Singapore between 2011 and 2016, and between 2011 and 2018, respectively. A p-value of <0.05 was considered statistically significant. All statistical analyses were performed with STATA version 13.1.

Secondary qualitative data were gathered over a period of six weeks from March 2019 to April 2019. In the development of a guide to subjects that could be discussed at interview, there was a focus on three domains: (a) understanding of the SKH care model; (b) perception of the current state of care model implementation and associated challenges; (c) lessons learned from implementation and future opportunities.

Interview participants were key stakeholders responsible for the planning, implementation and scaling of care model initiatives at both AH and SKH. They were recruited from a variety of departments including medical, nursing, allied health and administration (e.g. clinical governance and strategic planning). Audio recordings were transcribed, coded and categorised inductively before thematic analysis was carried out. The qualitative data management efforts were supported by ATLAS.TI version 8. Concepts and themes were mapped based on the aspects and levels of integration described, and subsequently reported and discussed based on the objectives of the study.

The study protocol was reviewed and approved by the hospital’s medical board and senior management.

Results

Quantitative findings

Approximately 66.3% (3495 out of 5270 episodes) and 58.2% (9981 out of 17,148 episodes) of all patients admitted to AH and SKH, respectively, were treated under a single GM team, without any transfer of care to other disciplines. Other demographic information about the patients are presented in Table 1.

At AH, a patient’s average length of stay (ALOS) was 4.0 days, the 30-day readmission rate was 8.1%, the inpatient mortality rate was 1.4% and patients incurred an average cost of $3662.60 for their hospitalisation episodes. Although ALOS and the readmission rate were similar to the FM hospitalist model in 2011, the inpatient mortality rate was significantly lower, whereas the hospitalisation cost was higher (Table 2).

At SKH, a patient’s ALOS was 2.6 days, the 30-day readmission rate was 15%, the inpatient mortality rate was 2.8% and patients incurred an average cost of $3085.30 for their hospitalisation episodes. Inpatient mortality was similar to the FM hospitalist model in 2011. However, it was noted that the ALOS was significantly lower, whereas the readmission rate and the hospitalisation costs were significantly higher in this comparison (Table 3).

Qualitative insights

A total of 20 semi-structured interviews were conducted with 24 individuals. The characteristics of participants are summarised in Table 4.

The findings revealed a diversity in opinions with regard to the challenges faced by staff working on the frontline as well as those encountered by management. These findings can be grouped into three main themes: (a) perception of and mindset in relation to generalists, which illustrates the barriers to implementing GM in a general hospital with multiple GM-like specialties; (b) education and training of generalists, which underlines the current lack of adequate supply of GM

| Table 1. Demographic and clinical characteristics of patients cared for by AH and SKH. |
|---------------------------------------------------------------|
| | AH (n=3495) | SKH (n=9981) |
|---------------------------------------------------------------|
| Median age (year (IQR)) | 68 (52–79) | 67 (52–79) |
| Ethnicity (%) | | |
| Chinese | 68.7 | 70.1 |
| Malay | 10.6 | 13.7 |
| Indian | 13.5 | 9.9 |
| Others | 7.2 | 6.3 |
| Within hospital catchment area (%) | 29.4 | 70.5 |
| Charlson Comorbidity Index (%) | | |
| None (0) | 76.3 | 60.8 |
| Low (1–2) | 23.7 | 18.2 |
| Moderate (3–4) | 0 | 6.7 |
| High (⩾5) | 0 | 14.3 |

through a hub-and-spoke approach. These included the destinations, inpatients at the Institute of Mental Health and residents in nursing homes within the hospital’s catchment area.

The study protocol was reviewed and approved by the hospital’s medical board and senior management.
specialists; and (c) operational issues in relation to care model implementation, which highlight the current mismatches between the prevailing healthcare philosophy and requirements for the successful implementation of the GM care model. These reported themes seek to increase understanding with regard to the proposed care model, look at the challenges associated with its implementation and consider the system-level changes, including medical training, that may be needed for the meaningful and scalable transformation of GM-led care in the future.

Perception of and mindset in relation to generalists. Many participants viewed FM doctors favourably and agreed they are better at discharge planning because they are more connected with community providers and, thus, play an important role as a bridge between hospital and community.

| SGH (2011) | AH (2016–2017) | Difference (SGH–AH) | P |
|------------|---------------|---------------------|---|
| Non-hospitalist, n=2892 | Hospitalist, n=601 | 3495 | | |
| Length of stay (days) (95% CI)* | 5.7 (5.4, 5.9) | 4.0 (3.9, 4.2) | 1.7 | <0.001 |
| Readmission (%)* | 7.5 | 8.1 | -0.6 | 0.617 |
| Hospital mortality (%)* | 5.3 | 4.0 | 1.4 | 3.9 | <0.001 |
| Total hospitalisation cost ($) (95% CI)* | 2986.5 (2889.0, 3087.5) | 3662.6 (3545.5, 3781.4) | -676.1 | <0.001 |

SGH: Sengkang General Hospital; AH: Alexandra Hospital; CI: confidence interval; P: p-value at alpha 0.05.

*p-value calculated using chi-square test.
* Geometric mean (95% CI); the p-value for an unadjusted mean length of stay and the cost of hospitalisation was calculated using Welch’s t-test with equality of variance not assumed.

Table 3. Summary of quantitative findings from implementation in SKH (October 2018–March 2019) and comparison with findings reported by Lee et al.29

| SGH (2011) | SKH (2018–2019), n=9981 | Difference (SGH–SKH) | P |
|------------|--------------------------|-----------------------|---|
| Non-hospitalist, n=2892 | Hospitalist, n=601 | 9776 | | |
| Length of stay (days) (95% CI)* | 5.7 (5.4, 5.9) | 2.6 (2.6, 2.7) | 3.1 | <0.001 |
| Readmission (%)* | 7.5 | 15 | -7.5 | <0.001 |
| Hospital mortality (%)* | 5.3 | 2.8 | 2.5 | 0.005 |
| Total hospitalisation cost ($) (95% CI)* | 3123.6 (3021.6, 3229.2) | 3085.3 (3038.3, 3133.0) | -38.3 | 0.511 |

SGH: Singapore General Hospital; SKH: Senkang General Hospital; CI: confidence interval; P: p-value at alpha 0.05.

*p-value calculated using chi-square test.
* Geometric mean (95% CI); the p-value for the unadjusted mean length of stay and cost of hospitalisation was calculated using Welch’s t-test with equality of variance not assumed.

FM does a very important role in terms of continuing care, because they know the community and they know what patients might need in the community, and how to facilitate that. . . . there are a lot of hospitals that have strong fam med departments also have very strong discharge planning programme. SF15

On the other hand, some participants were concerned that FM physicians may not be able to handle complex acute cases competently compared with specialists or other hospital-based generalists because they still face systemic limitations, for example, they lack exposure to complex cases.

If the patients are not referred there for whatever reason, or patients don’t want to go there for whatever reason . . . cost subsidies and all those things, and then the GPs don’t see these cases, they get rusty, and patients don’t have confidence. SM05
Finally, participants raised the point that patients’ mindsets and their perceptions of receiving care from a generalist need to be changed to take advantage of the benefits of a generalist-led model; currently, patients still prefer to receive treatment from an expert in a specific field.

So the public mindset is I want to see specialist. Why would I want to see (family medicine) doctor? They don’t know anything one! You know. Then I have problem I have to . . . I got cardio problem I will go and see heart doctor. GP don’t know one.

**SM04**

**Operational issues in relation to care model implementation.** Some participants mentioned that the clinical boundaries within GM disciplines (FM, internal medicine, and geriatric medicine) are often blurred. If this is the case, then deliberate segregation of specialties within GM practice may create more problems for staff than it might solve.

where do you draw the line to say, okay these conditions and above with this level of acuity, complexity, you can go back to your specialist; And this one don’t need; this one comes to me. **SF06**

The next challenge is the lack of precise and reproducible patient characterisation and segmentation data during admission and referrals, so that patients suitable for a specific generalist’s care can be identified.

now it’s (patient assessment) not very standardised . . . what the patient gets referred to depends a lot on the individual who’s doing the assessment . . . based on their expertise and their knowledge. **SF18**
Another challenge mentioned was the need for better patient characterisation. If a comprehensive assessment is to be performed at the point of admission, patients’ medical conditions and psychosocial profiles need to be documented objectively with accurate and up-to-date information. Individualised care plans could then be compiled.

Discussion

Healthcare delivery in Singapore has focused historically on episodic acute care in hospitals. Although acute care remains important, the growing demands of an ageing population have made the hospital-centric model unsustainable. Inspiration for this study was drawn from the pilot implementation of the FM hospitalist model by SGH in 2011; subsequent adaptations culminated in the SKH model centred around GM practice.

The adapted care model implemented in AH seemed to suggest that the GM model run by physicians from various backgrounds was able to produce similarly superior outcomes when compared with the FM hospitalist model piloted in 2011 that was juxtaposed with usual care. The ALOS and inpatient mortality of patients treated under the AH and FM hospitalist models were significantly lower compared with non-hospitalist care, whereas 30-day readmission rates were similar across the patient groups. Collectively, these findings may suggest that the generalist model could be applied effectively to patients requiring care at a lower acuity level because patients treated at AH were mostly stable with less complex acute needs.

The model was adopted at SKH in a higher acuity setting when the hospital opened in July 2018. Results of the implementation showed a significantly lower ALOS compared with both the FM hospitalist and non-hospitalist models described in 2011. However, the benefit was negated by the higher 30-day readmission rate observed. From qualitative insights elicited subsequently, the lower observed ALOS among patients treated in SKH could be due to bed crunch experienced during the phased opening of the hospital and, consequently, higher pressure to discharge patients, which, in turn, might have contributed to the statistically higher readmission rates. Nonetheless, as both studies could only track readmissions to their respective hospitals and the vast majority of the patients treated by SKH were residents who stayed nearby within its catchment area (Table 1), compared with other hospitals such as SGH and AH, it might have inadvertently contributed to its own higher-than-expected readmission rate. The hospitalisation costs were similar to those for usual care, whereas inpatient mortality was significantly lower. These results may further attest to the notion that the generalist model may not only be able to produce comparable results when compared with the FM hospitalist model, but may also be suitable for patients across a wide range of acuity levels.

From the qualitative interviews, three findings may be inferred.

First, physicians with different backgrounds have slightly different strengths and weaknesses. For example, although FM physicians may not be able to take on more complex cases, their knowledge and awareness of community services could allow them to be more effective in discharge planning.

In the same vein, physicians trained in internal medicine or geriatric medicine may be better at handling other subtypes of inpatients. However, regardless of background training, any physician will likely be able to acquire the skillset needed to perform GM work effectively given sufficient exposure to it.

Second, the GM agenda should be deliberately incorporated into the medical training curriculum. For existing physicians practising GM, a clearer training roadmap may be required to guide them in acquiring the necessary skillset and experience to perform their medical duties. GM needs to adapt as it continues to struggle to deal with patients who have increasingly complex needs and multiple comorbidities. Retaining medical specialties in a consultative role with inpatient medical care managed by a new future model of GM hospitalists could improve efficiency while maintaining the quality of care. Training reforms need to address the training–practice gap in GM by extending postgraduate training to provide sufficient opportunities for mastery of core skills. In addition, an outcomes-driven training process may be useful in the future. However, efforts to reform medical training must be done with the deliberate intention of revising the training content to suit future practice models, addressing issues such as service obligation, and experimenting with the best possible solutions.

Finally, better patient characterisation and segmentation will help clinicians and administrators allocate resources to patients more appropriately. At the same time, other non-medical information will be useful in discharge and shared care planning.

One interesting finding was in relation to the observation that many hospitals today have succeeded in delivering high-quality specialist care at affordable subsidised prices. An unintended consequence of this is an induced perception among patients that if admitted to hospital they will see multiple specialists for multiple conditions rather than seeing a good generalist. Such a mindset needs to be corrected so that care can be sited in the appropriate care setting with the corresponding amount of resource utilisation, especially healthcare manpower. This further emphasised the importance of strengthening the existing generalist care model to better tackle immediate healthcare challenges in many mature healthcare systems caring for multimorbid, aging populations.

Strengths and limitations

The quantitative data collection for this study mirrored that described in the article by Lee et al. In both studies, only readmissions back to the respective hospitals were assessed as hospitalisation data because other hospitals were not available to the study teams. Although this is an inherent limitation of data availability, it also allowed a fair statistical comparison to be made with the original article. Comparisons between the current and original study were made without statistical adjustment because this could not be performed without the full dataset from the original study. As such, unadjusted analyses were presented so that readers could make an informed interpretation of the outcomes of the chosen pragmatic implementation, which was based on the demographic
characteristics of the study populations, rather than providing a false sense of security by attempting potentially improper statistical adjustment.

In this study, interviews were semi-structured and, therefore, the investigators had sufficient time to develop and frame a series of questions, or at least prompts, beforehand. This paved the way for discussion flow, but at the same time also gave participants leeway to form their own interpretations and opinions. Overall, this provided a systematic, standardised basis for comparison of opinions across interviews, thus enabling effective organisation of recurring themes and associated ideas. However, the results gathered may lack balance and generalisability by not adequately or comprehensively reflecting the sentiments of all segments of frontline personnel in SKH as a whole, given that data collection was done only through 20 mostly senior participants. It should be acknowledged, however, that interviews were only carried out with middle and senior management staff so that higher-level insights into care model planning and execution could be gathered. Additionally, the utilisation of snowball sampling may have led to premature data saturation. Nevertheless, we attempted to mitigate this limitation by carrying out stratified sampling based on professions to ensure a varied and balanced perspective across the pool of interviewees. Moreover, even though data saturation had already started at around the 14th interview, data collection only ceased after the 20th interview.

Conclusion

Given established strong clinical governance in addition to a comprehensive training regime and accreditation process for generalists, the success of a generalist care model hinges on how it is operationalised. With clear support protocols, definitions and sufficiently high protocol compliance by physicians alongside other healthcare team members, the intended outcomes of lower ALOS, readmission rate and inpatient mortality and a reduction in the hospitalisation cost may be easily replicated regardless of the background specialty training of the physicians leading the teams. In line with this ideal, SKH protocolised their care model, in which even the specialists could function as effectively as any well-trained generalist.

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Authors’ contributions

All listed authors contributed significantly to the planning, execution, analysis and interpretation of the findings in this study.

Availability of data and materials

Aggregated data can be shared if requested.

Ethical approval

None required. The study was carried out as a clinical audit/quality improvement and the protocol was approved by the hospital management and its medical board.

Informed consent

Not applicable.

Trial registration (where applicable)

Not applicable.

Declaration of conflicting interests

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