A Qualitative Study Examining the **Unintended Consequences from** Implementing a Case Management **Team to Reduce Avoidable Hospital Readmission in Singapore**

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Abstract

Background: Countries are implementing interventions to reduce avoidable hospital readmissions. However, evaluating such interventions are potentially complex. These interventions can cause unintended consequences, and they are among the most common causes of the intervention's failure. The objective of this study was to identify the unintended consequences from implementing a pilot case management team to reduce avoidable hospital readmissions at a tertiary hospital in Singapore.

Methods: We conducted five in-depth semi-structured interviews with stakeholders who were involved in the planning, development, and implementation of the intervention in addition to analysing 12 intervention documents. Deductive thematic analysis using Rogers' diffusion of innovation theory was conducted.

Results: Data analysis generated seven subthemes: ineffective targeting of patient population, fund constraints, lack of patient ownership, limited post discharge follow up, comprehensive care approaches, role overlap and patient confusion. The absence of a readmission risk assessment tool resulted in care plan needs assessments being conducted for all admitted patients, rather than targeting those who would benefit most. This broad approach overwhelmed care coordination efforts. The initial plan to form a specialised intervention team responsible for care plan needs assessments could not be fully established due to funding constraints. As a result, the intervention team functioned more as a consulting service, providing recommendations to the primary team, which retained decision-making authority. Overlapping roles with existing case managers caused patient confusion, prompting the intervention team to step back and support care plan needs assessment remotely.

Conclusion: Overall, results suggest that intervention team recognised a problem and participated in the intervention. This became the foundation for implementing change. However, the unintended consequences undermined the intervention from achieving its objectives and as a result the intervention was stopped. Decision-makers should pay attention to these unintended consequences to inform effective implementation and refine future interventions.

Keywords

readmission, unintended consequences, qualitative research, current reality tree, discharge

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Introduction

Singapore spends only about 4% of its GDP on healthcare annually, while the United Kingdom (UK) and the United States of America (USA) spend significantly more.¹ However, Singapore's healthcare costs are rising. In 2024, healthcare expenditure is projected to reach \$18.77 billion, marking a 4.6% increase from 2023.² One of the main cost drivers for this increase, both in Singapore and globally, is inpatient care.¹ Hospital re-admissions and extended length

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of hospital stays are becoming and will become more frequent due to the country's ageing population and the growing prevalence of chronic diseases.¹

While the majority of hospital readmissions are deemed clinically necessary and unavoidable,³ there is a significant portion that can be attributed to avoidable issues.^{3,4} Some of these avoidable readmissions occur during the initial stay, while others result from inadequate post-discharge follow up.^{3,4}

Globally, best practices emphasise the importance of follow-up post discharge as a key strategy to prevent avoidable hospital readmissions. The National Institute for Health and Care Excellence⁵ guidance also recognises this. Some of the interventions aimed at reducing avoidable hospital readmissions include improving discharge planning, patient education, medication reconciliation, timely follow-ups with primary care physicians, and telephone check-ins by community nurses.⁶⁻⁹ However, evaluating these interventions is a complex task. While these interventions aim to achieve their objectives, unintended consequences can arise. The unintended consequences often stem from resistance by stakeholders involved in the intervention. Such unintended consequences can lead to intervention failure, that is, the intervention not being able to achieve its objectives.¹⁰

Recently, a tertiary hospital in Singapore implemented a case management team with the aim of reducing avoidable hospital readmission. This was a pilot intervention. Given the complexity of evaluating such interventions, our study sought to explore the unintended consequences through qualitative interviews with stakeholders.

The research objective was: To identify the unintended consequences from implementing a case management team to reduce avoidable hospital readmission. This study is important because many countries including Singapore are implementing interventions to reduce avoidable hospital readmission.¹¹⁻¹³ For example, in terms of intervention, these studies focused on anchoring chronic disease management in the primary care networks and patient-centred medical homes, which prioritise coordinated care in the primary care. Our study expands this idea by focusing on the case management team's role in reducing avoidable hospital readmissions—an extension of the same principle but tailored for a tertiary hospital environment in Singapore.

Understanding the unintended consequences of an intervention is instrumental in enabling stakeholders to assess the overall value of such interventions and make informed decisions about the future direction of their healthcare system.

Methods

Intervention—A Case Management Team

A pilot case management team was set up in the internal medicine department of a tertiary hospital in Singapore in 2021. The team comprised of two care coordinators, five consultants and an administrative lead. The main objectives of the case management team were to (1) reduce total number of inpatient days per year; and (2) reduce avoidable hospital readmission rate. This case management team is no longer in operation. The case management team was considered an active intervention due to modifications in operation compared to usual care. In usual care when a patient is admitted to the internal medicine department, the primary team's case manager directly interacts with the patient and develops a post discharge care plan using a specific care needs assessment tool. Primary team refers to the team under which the patient gets admitted. The case manager of the primary team also has nursing duties to undertake.

As part of the intervention, when a patient gets admitted under the primary team, the care coordinator of the case management team also develops a post discharge care plan using an assessment tool known as the 4M framework. The care coordinator of the case management team only undertakes care planning activities. The 4M framework focuses on Mind, Mobility, Medication, and Matters Most.14 However, the care coordinator develops the care plan solely based on patient information available in the electronic medical record and does not directly interact with the patient. The care plan is then reviewed by the consultants of the case management team. Once the care plan is developed, the care coordinators enter it into the patient's electronic medical record. They then communicate this information to the primary team through messaging. Additionally, the care coordinator takes on the responsibility of ensuring that referrals to community services and primary care providers are followed through. The detailed workflow of the case management team is presented in Figure 1 below.

Conceptual Framework

We used Rogers¹⁰ diffusion of innovations theory to study the unintended consequences. According to Rogers diffusion of innovation theory, four dimensions influence the emergence of unintended consequences: (1) the characteristics of members of social system, such as their perceptions and interests; (2) the nature of the social system, including norms, culture, and organisational capacity; (3) the attributes of the innovations themselves, such as their compatibility, complexity, observability, and relative advantage; and (4) how the innovations are used, including aspects like reinvention. These dimensions interact to shape the resulting consequences.

Roger classified consequences into three categories: (1) desirable versus undesirable, (2) anticipated versus unanticipated, and (3) direct versus indirect. We used Ash et al's¹⁵ method to operationalise direct and indirect consequences. Direct consequences are those related to processes and indirect consequences are those related to outcomes. We considered anticipated consequences as those which are addressed in intervention guidelines.

We further refined Rogers categorisation of consequences by using Bloomrosen et al's¹⁶ approach. Consequences that are desirable and anticipated are called intended



Figure 1. Workflow process of the intervention.

consequences. Whereas consequences that are undesirable and/or unanticipated are called unintended consequences.

Study Design

We conducted a cross-sectional qualitative study and incorporated two essential data collection techniques: (i) indepth semi-structured interviews and (ii) a review of documents. This combination of data collection techniques was used to triangulate the findings.

Sampling Strategy, Data Collection and Data Analysis In-Depth Semi-Structured Interviews (IDIs). In qualitative research, sample size is not determined through computations or power analyses; rather, it is guided by the principle of saturation. At the time of data collection, only five stakeholders were actively involved in the intervention, as three of the original eight stakeholders had left. These five stakeholders, who were directly involved in the planning, development, and implementation of the intervention, formed the study's sample. The goal of our study was to identify the unintended consequences of the intervention, making these stakeholders the most relevant participants. Given that we can only include the only five stakeholders, we applied the concept of "pragmatic saturation," an interpretive judgment made to determine the adequacy of the sample size based on the study's purpose and analytical goals. Since we interviewed all five stakeholders involved, the sample is saturated.^{17,18}

Data was collected between March and October 2023. The inclusion criteria comprised stakeholders who were actively involved in the planning, development, and implementation of the intervention. Conversely, individuals not involved in these aspects of the intervention were excluded from the study. Stakeholders, that is, doctors, care coordinators and administrator were recruited using convenience sampling. We obtained a contact list of the stakeholders from the programme manager and sent stakeholders the participant information sheet and consent form. Only five stakeholders were still part of the case management team, and all five of them agreed to participate.

IDIs were conducted after obtaining written informed consent from the participants. The first author (SS) conducted the IDIs in English, and each IDI lasted between 60 and 90 minutes. An interview guide developed based on a priori themes from Rogers diffusion of innovation framework was used to guide the interviews. The interview guide explored the following key topics: (1) characteristics about members and their perception about the intervention; (2) nature and use of the intervention; (3) barriers and facilitators of implementing the intervention and (4) perceived consequences of the intervention which are aligned with the core component of Rogers diffusion of innovation framework. See supplementary file 1 for the full interview guide.

Document Review. We analysed 12 documents. The documents were annual monitoring reports, half-yearly steering committee reports, and its meeting minutes. These documents were developed from the start of the intervention. Specifically, we analysed five steering committee reports, five meeting minutes, and two monitoring reports. The documents were purposively selected since it contained information about the intervention.

We selected the documents based on the factors outlined by Flick.¹⁹ Flick¹⁹ outlined fours factors to use when deciding which documents to include. The four factors are authenticity, credibility, representativeness, and meaning.

We assessed authenticity by verifying the primary source, that is, ensuring that members of the intervention team had prepared the documents, their names appeared on document and the documents were officially signed off. Next, to assess credibility, we examined whether the documents presented both positive and negative aspects of the intervention. This approach ensured a balanced perspective and helped verify that any potential challenges were transparently documented. We evaluated the meaning of each document during selection by quickly reviewing its content for relevance. During coding, we analysed the documents in greater detail, focusing on extracting information that addressed our research question. Since members of the intervention team provided these documents, they had the discretion to grant access only to those documents they chose. Consequently, we did not assess representativeness.

Data Analysis: IDIs. IDIs were audio-recorded, transcribed verbatim and analysed using Lumivero NVivo 14 software deductively using the conceptual framework.^{20,21} Authors (SS) and (DBM) led the analysis. Herein, we will summarise our data analysis procedure based on a five-step approach proposed by Bingham.²²

- (1) Organising data: First, we developed attribute codes that identify data type, location, source, and time. Then we tagged the data associated with each of these attribute codes to categorise the data. For example, codes for a piece of data might include "interview" (data type), "2023" (time period).
- (2) Sorting data into relevant topical categories: Second, we developed topical codes, for example, unanticipated consequences, undesirable and process driven based on the conceptual framework. We categorised the different types of consequences using the previously defined criteria of anticipated/ unanticipated, desirable/undesirable, and direct/ indirect. Consequences were classified as direct or indirect based on whether they were associated with changes in processes or outcomes. After that we re-read the transcripts and categorised the data under the topical categories.
- (3) Initial coding: Third, we coded the data under the topical categories. The developed codes were applied to similar data across the topical categories or new codes were developed.
- (4) *Identifying themes*: Fourth, we reviewed the codes and organised them into subthemes and themes.
- (5) *Explaining the findings*: Last we used the conceptual framework to interpret and explain the findings.

See Supplementary file 2 for COREQ checklist.

To enhance the rigour of the analytical process, we discussed the codes and themes in regular team meetings. This approach aimed to foster reflexivity and challenge potential interpretations. Quotes are identified by a participant label (P) followed by a unique participant number (eg, P01).

To enhance the trustworthiness of the study, we implemented several measures. Firstly, the interviewer transparently acknowledged her role as a research team member to the participants, thereby mitigating any potential preconceived bias.¹⁸ Secondly, the interviewer wrote memos to record her reflections and capture a priori themes, which were subsequently used to characterise the various types of consequences.²³ Lastly, member checking was performed with selected participants to confirm the accurate representation of their perspectives and validate our interpretations of the data.¹⁸

Document Analysis. In the preliminary phases of the study, the documents provided basic knowledge about the case management team's workflow process and the types of resources and materials available. Documents were analysed using Lumivero NVivo 14 software deductively using the conceptual framework.^{20,24} Authors (SS) and (DBM) led the analysis. Herein, we will summarise our data analysis procedure based on a five-step approach proposed by Bingham.^{22,23}

- (1) Organising data: First, we developed attribute codes that identify data type, source, and time. Then we tagged the data associated with each of these attribute codes to categorise the data. For example, codes for a piece of data might include "document" (data type), "steering committee report" (source), "2022" (time period).
- (2) Sorting data into relevant topical categories: Second, we developed topical codes, for example, unanticipated consequences, undesirable and process driven based on the conceptual framework. We categorised the different types of consequences using the previously defined criteria of anticipated/ unanticipated, desirable/undesirable, and direct/ indirect. Consequences were classified as direct or indirect based on whether they were associated with changes in processes or outcomes. The document review allowed us to compare the intended processes and outcomes envisioned by programme implementers with those that emerged in practice. After that we re-read the documents and categorised the data under the topical categories.
- (3) Initial coding: Third, we coded the data under the topical categories. The developed codes were applied to similar data across the topical categories or new codes were developed.
- (4) *Identifying themes*: Fourth, we reviewed the codes and organised them into subthemes and themes.
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Data Integration. We employed data triangulation, as outlined by Denzin.²⁵ We used IDIs and document analysis as our primary data sources. Each data source was analysed independently as explained above. Data from both sources were given equal weightage and merged at the analysis stage by (SS) using the Rogers¹⁰ diffusion of innovations theory. Following independent analyses, we compared the findings from both sources. This comparison aimed to identify areas of agreement (convergence), additional insights (complementarity), and any inconsistencies (divergence). The integration of data from IDIs and documents was conducted through a systematic comparison. We identified themes consistently present in both data sources. For instance, both IDIs and documents highlighted the addition of new screening questions into enrolment criteria to address ineffective targeting of patient population. Additionally, documents provided detailed information that complemented insights from the interviews. For instance, there was quantitative data in the documents which showed that there was an improvement in targeting patient population after introducing new screening questions into enrolment criteria. While our analysis was attentive to potential discrepancies, we did not identify any contradictions between the data sources.

Rationale for equal weightage of both data sources^{19,24-27}:

- The document analysis, offered complementary evidence that validated and expanded upon the interview findings. Furthermore, it corroborated the interview narratives.
- (2) No discrepancies across data sources.
- (3) Analytical approach ensured equal treatment of both data sources.

Results

Five IDIs were conducted with a wide range of participants such as doctors, care coordinators and administrator and twelve documents were analysed. Among these participants, two were females and three were males.

The conceptual framework guided the structure and organisation of the result section. The results section is laid out in a hierarchical structure with themes followed by subthemes. In qualitative research, a theme represents a central concept of meaning derived from the data, while a subtheme elaborates on specific aspects of the theme, providing a finer granularity of understanding. The themes are introduced in the subheadings (eg, theme 1). It represents an outcome-related desirable or undesirable unintended consequence. The subthemes, presented as sub-subheadings (eg, subtheme 1.1), detail the process-related desirable or undesirable unintended consequences that contributed to the respective outcome-related unintended consequence, that is, the theme.

For each of the themes described below we explain how the interactions between the characteristics of members, attributes and use of intervention and the nature of the healthcare system led to the emergence of the unintended consequences. This is summarised in Figure 2 below. The intervention was not able to achieve its objectives due to the unintended consequences and as a result the intervention was stopped.

Theme 1: Unable to Decrease Avoidable Hospital Readmissions

Subtheme 1.1: Ineffective Targeting of Patient Population. All participants shared that when forming the case management team, they believed it would benefit patients. The primary medical team would address acute conditions, while the case management team would handle post-discharge follow-ups, aiming to prevent avoidable readmissions. However, they noted that a readmission risk assessment tool was not used to accurately identify the appropriate patient population for care needs assessments. As a result, they conducted assessments for all admitted patients rather than focusing on those who would benefit most. This broad approach led to a higher number of patients requiring follow-up than the care coordinators could manage. One participant mentioned:

. . .we struggled to come up with the correct algorithm. . .we had high-cost people are those that get admitted, so don't have to be selective about who you intervene. . .actually maybe out of 5 patients 4 might be straightforward. . .we might have to focus only on the 5th patient. . . nature of the work became diffuse. . .had limited overall effectiveness. . .So on looking back was the initial design to help us find the right patient correct one? Difficult to say. . . (P03)

To address this issue, the case management team introduced new screening questions into the enrolment criteria. Document analysis also confirmed, addition of new screening questions into enrolment criteria. The first step in this revised process involved an eligibility check using inclusion and exclusion criteria. If the patient passed this initial check, a second set of screening questions was administered. Only patients who passed both steps received a care needs assessment. This streamlined approach helped exclude cases that did not require assessment, optimising the care coordinators' time. However, this process improvement was only implemented toward the end of the programme.

According to the document analysis, in July 2022 before adding new screening questions into enrolment criteria, out of the 154 patients admitted, 66% underwent care plan needs assessment. However, after adding new screening questions into enrolment criteria, in July 2023, out of 150 patients admitted, only 34% had to undergo care plans needs assessment. One participant said:

To make it more concise, because in the past we included cases that did not need case management, for example, youngsters coming in with gastritis which is a one-time acute medical issue, we solve and they well, so, there's no need for case management. We wanted to be concise in finding out those patients that need case management. (P02)



Figure 2. Interaction of four dimensions leading to unintended consequences.

Subtheme 1.2: Fund Constraints in Team Formation. According to many participants (3/5, 60%), the initial plan was to establish the case management team as a specialised group responsible for conducting care needs assessments, and post-discharge follow-ups for patients enrolled in the intervention. However, they were not sure if the funding projected would be sufficient to form a specialised team. But it later turned out that the funding was insufficient and hence they could not form a specialised team of doctors and hire more care coordinators. Document analysis showed that with regards to the unplanned emergency readmissions to the same hospital cluster within 30 days between July 2021 and March 2022, the intervention group had a numerically higher proportion of readmissions at 18% compared to 12% in the control group. One participant stated:

...We could only hire who we could afford right? If funding was unlimited, and we hired 10... a delegated full time equivalent for sure would have an account. So if on the roster there, there's general medicine, team one to 12 and team 13 is high touch case management team. Something like that. So team 13 consultant will only see patients under high touch case management team. It could have helped. But we couldn't afford. (P03)

Subtheme 1.3: Lack of Patient Ownership. All participants reported that the case management team operated more as a

consulting service because they were unable to establish a specialised team. Because of this, their role was limited to recommending necessary care services to the primary team after conducting the care plan needs assessments remotely. The primary team, possessing patient ownership, held decision-making power, and only implemented approximately half of the case management team's recommendations. Many participants (4/5, 80%) mentioned that, due to a lack in patient ownership, they refrained from probing the primary team regarding unimplemented care plan recommendations. One participant stated:

 \dots we are a consult service. That in itself landed some challenges because the primary team is the one making the decisions and having the final say since they are physically seeing the patient. . . (P01)

we also never seek an answer from them (primary team) why they didn't proceed to give some of our recommendations (P04)

...we are not the primary providers for the patients, so sometimes the recommendations that we will make, even if they (primary team) see they don't actually take our recommendations, so this is definitely one of the challenges that we are facing. (P05)

Subtheme 1.4: Limited Post-Discharge Follow Ups. Some participants mentioned that care coordinators selectively followed up on certain post-discharge service needs, such as those for patients empanelled to a polyclinic or requiring hospital care services. However, they omitted others, like services from the Agency for Integrated Care, because these had to be initiated by the primary team doctor. However, the primary team either did not refer the patients for these services or did not inform the case management team. As a result, the care coordinators had to check the electronic medical records to confirm if services were arranged, which was often unfeasible due to time constraints.

Theme 2: Unable to Decrease Length of Hospital Stay

Subtheme 2.1: Comprehensive Care Approaches. Some participants noted that when a patient is admitted to the hospital, tests are conducted to determine the cause of their symptoms. These tests may also reveal other issues that may require attention. Consequently, the increased scope of tests inadvertently prolonged the patients' hospital stay. Document analysis showed that the patients managed by the case management team had a longer average length of stay by 2 weeks compared to the control group, between July 2021 and March 2022. This excess length of stay of patients in the high touch case management group was mainly contributed by the subacute length of stay. One participant mentioned:

what I wanted us to do was provide thorough and good care as possible, in what I call the index admission, meaning settle everything then. . .in order to do that I'll be doing more tests, finding out more things that are bad. But that's only good right, then I know more, I can tell the family more, as well. So maybe I think average length of stay increased. (P01)

Theme 3: Shift in Care Planning Approach

Subtheme 3.1: Care Coordinator and Case Manager Role Overlap. One participant noted that there are already case managers in the wards who conducts care needs assessment, and bringing in care coordinators from the case management team to also conduct care needs assessment might be seen by the primary team as duplicating their efforts. However, another participant added that while both teams are involved in care needs assessment and care coordination, care coordinators' work is more specific, while the case managers have a broader range of responsibilities and did not always document their coordination efforts. One participant stated:

case managers at the ward have other work to do as well not just care coordination. So they don't document whatever coordination works they have done. So I feel ours is more very specific compared to theirs. (P05)

Subtheme 3.2: Patient Confusion. One job scope of the care coordinators in the case management team was to offer fundamental education about care plans to the patients, which all participants mentioned fulfilling. However, upon admission, the case managers of the primary team also provided

education about care plans to the patients. Consequently, some patients experienced confusion due to the multitude of individuals involved in care, according to most participants (3/5, 60%). In response, care coordinators of the case management team opted to step back, allowing case managers of the primary team to lead the care plan needs assessment and its education for patients, while they supported care plan needs assessment from behind the scenes. All participants reported that this compromise was deemed acceptable by the case management team. One participant mentioned:

we don't see it (not able to see patient) as an issue because we have consensus that we don't stand in front of patient unnecessarily, they (primary team) be the first contact person, we will give backend support. . .this action avoid confusion for the patient. (P02)

Theme 4: Integration of Care Needs Assessment Tool

Subtheme 4.1: Adoption of 4M Framework as Care Needs Assessment Tool

Subtheme 4.1.1: Vision. All participants highlighted that they were successful in persuading every case manager within the tertiary hospital to adopt the 4M framework. According to all participants, case managers and the case management team members shared a similar vision for a need to use a standardised care plan needs assessment tool and this vision became a pivotal factor for the adoption of 4M framework. Until then a universal care plan needs assessment tool was not used. One participant stated:

... there is no gold standard... I know that there was variability in practice... some people do it very well, and others do it very poorly... person in this ward, in other words should get the same similar care... they (case managers) agreed to that... we want to make our standards a bit higher. That was the selling factor, the uniformity aspect of it. (P01)

All participants mentioned that initially the case managers within the tertiary hospital were reluctant to adopt the 4M framework because the case managers perceived the requirement implied that their current evaluations were inadequate. In response, all the participants mentioned using real cases to explain to case managers how they developed care plans using the 4M framework. This involved conducting discussions on the needs assessment between the consultants and care coordinators, fine-tuning the care plan, and writing detailed notes in electronic medical records to prevent the requirement for multiple references to disparate documents. One participant mentioned:

I don't think they (case managers) were very keen to adopt it. . .Probably for them felt like an attack upon their work. It could have been interpreted that I'm accusing them of not performing adequately, which I tell them I know you do work, I know you have outcomes also. But what I'm proposing is a unified framework. So I think that's what also led them to agree that we do need a unified framework, because we love uniform care in the hospital right? (P01) Subtheme 4.1.2: Attributes of 4M Framework. Participants mentioned that case managers of the primary team perceived 4M framework's relative advantage over using InterRAI another care needs assessment tool which was available in the tertiary hospital. The InterRAI was found to be impractical for operational use, taking approximately 1 to 1.5 hours per patient for completion, including both interview and documentation. Additionally, it was unsuitable for patients with dementia or those who were uncommunicative, as it required next-of-kin input, potentially causing inconvenience. As such they deemed InterRAI was most effective for patients in community settings who were stable or at their best functional state.

In contrast, the 4M framework identified the same care needs as InterRAI but was significantly faster, taking only about 20 minutes per patient. Its design allowed for holistic care, particularly for elderly patients, addressing cognitive, functional, and social aspects. The framework's simplicity—with only four categories (Mind, Mobility, Medication, and Matters Most) and a maximum of three questions under each—made it easy to administer. Additionally, the care plans developed using the 4M framework were found to align well with patient needs. One participant stated:

...our tool also picked up what InterRAI output gave... InterRAI is taking more than one hour for a patient...ours in 20 minutes only...P05.

Subtheme 4.2: Flexible Implementation. While the case managers at tertiary hospital have embraced the 4M framework, they retain the autonomy to structure questions within each domain of the 4M framework according to their preferences. Most participants (3/5, 60%) stated that they deliberately refrained from establishing rigid guidelines for 4M framework implementation to prevent an increase in the workload of case managers (it takes 20-30 minutes per patient to administer 4M framework) and to facilitate a smoother adoption process of the 4M framework. The majority of participants (3/5, 60%) also noted that case managers had informed them that evaluating mentation and medication is not within the scope of case management duties, and as a result, they were not trained in these areas. One participant mentioned:

we didn't set any rules for them how they want to use 4M framework. . .they can use the 4M to guide their thoughts in terms of developing a new set of criteria, or maybe a new set of way to look into case management. . .we didn't want to add upon workload to them. . .made selling point harder (P02)

Mapping the Intervention to the Five-Step Adoption Process

Awareness and Interest. The intervention was initially introduced to the members of the case management team and the primary team through team meetings. All of them recognised the importance of doing care needs assessment to prevent avoidable hospital readmissions. As a result, the case management team participated in the intervention and the primary team accepted most of the care plan recommendations provided by the case management team.

Evaluation and Adoption. In this stage, the intervention's compatibility with existing workflow is evaluated. The case management team's role in conducting care needs assessments, alongside the primary team, was not seen as a relative advantage due to duplication of work and causing patient confusion. This misalignment with established operations may have influenced the decision to discontinue the case management team. The 4M framework aligned well with the existing responsibilities of the case managers, who were already tasked with conducting care needs assessments. This alignment likely facilitated its adoption.

Trial and Adoption. The care coordinators of the case management team introduced the 4M framework for care needs assessment to the case managers. They facilitated learning through demonstrations using real-life cases. Initially, the case managers were hesitant to adopt the 4M framework. However, the care management team effectively persuaded them to adopt it into their routine practice. The adoption was driven by three factors. One, having a shared vision to use a unified care needs assessments tool. Two, by providing case managers with the flexibility to determine how best to apply the 4M framework in their individual practice. Three, its simplicity. With just four categories-Mind, Mobility, Medication, and Matters Most-and a maximum of three questions per category, the framework was straightforward and easy to adopt. Its adoption demonstrates the intervention's perceived value and compatibility with the healthcare system.

Discussion

This is one of the rare studies that identified unintended consequences of an intervention designed to reduce avoidable hospital readmissions through the lens of Rogers diffusion of innovation theory. We also found that one part of the intervention was adopted into routine clinical practice and the other part was discontinued. Below we apply Rogers diffusion of innovation theory to analyse the adoption of the 4M framework. To do so we apply the adopter categories aspect of the theory.

Innovators: The care coordinators and doctors of the case management team are identified as innovators. They pilot-tested the 4M framework, comparing it to the InterRAI tool, and demonstrated its relative advantage, including faster assessment times and holistic focus on elderly care. Innovators played a key role in advocating for the framework's adoption through team discussions and showcasing its operational practicality.

Early adopters: The case managers of the tertiary hospital represent early adopters. Initially resistant, they were persuaded by demonstrating the 4M framework's advantages and its alignment with patient needs. *Early majority*: The doctors within the tertiary hospital form the early majority. They received feedback from case managers regarding the effectiveness and alignment of care plans developed using the 4M framework with patient needs.

The adoption of the 4M framework was facilitated by its perceived relative advantage, compatibility with existing workflows and low complexity.

Undesirable consequences can vary significantly in the severity of their negative impact. Therefore, classifying consequences dichotomously as desirable or undesirable oversimplifies their significance. For example, some undesirable consequences, such as patient confusion or role overlap may disrupt the intervention's functionality without immediately jeopardising the patient's health. In contrast, other undesirable consequences, such as ineffective targeting of the patient population or limited post-discharge follow-ups, may pose a more significant threat to patient's health.

Several unintended consequences uncovered could potentially be improved upon in the next cycle of intervention. The healthcare system is inherently complex, with numerous interconnected factors that can lead to unintended consequences. Most of the time, an intervention will fail to achieve its objectives when implemented in a learning environment. Our qualitative study found that the case management team was not able to achieve its objectives due to multiple factors. We developed a causal structure, that is, a current reality tree (CRT), as shown in Figure 3 below which serves as a visual representation of the logical explanation for why the case management team was not able to achieve their objective.²⁸ We used the objective-to reduce avoidable hospital readmission rates as an example for this exercise. The CRT is developed based on what we heard from the participants and hypothesis based on the authors' experience in clinical care. The CRT was validated by a independent reviewer who is familiar with systems thinking methodologies and who interviewed the case management team. The reviewer focused on improving the clarity and accuracy of the tree's structure, ensuring that the cause-and-effect relationships identified because of the undesired consequences were well-defined, are logically connected, and consistent. With regards to the overall structure of the CRT, the reviewer ensured consistency, and that the root causes and contributing factors were sufficiently comprehensive. The reviewer considered whether the identified causes were truly driving the observed effects, or if alternative explanations should be considered. These considerations were made following the logical tests laid out by Dettmer.29

The hypotheses are represented by yellow boxes and findings from our IDIs are depicted in blue boxes. This approach aims to uncover missing causes and perceptions within the intervention. The CRT is read from bottom to top. Locate the entity at the tail of the arrow and read it preceded by the word "If." After that, read the entity at the head of the arrow, preceded by the word "then." For example, *If care planning process is time consuming, then care planners become inefficient.*

Our CRT analysis has identified three primary root causes. Addressing these root causes is crucial, as their elimination can prevent the objective from not being achieved. However, only one root cause is within the control of healthcare providers: the lack of a consistent care planning needs assessment tool. Implementing a consistent care planning needs assessment tool for healthcare providers to use is vital because it will allow healthcare providers to identify actionable patient needs, which, when addressed, can prevent the progression to more severe health outcomes. Before implementing the care planning needs assessment tool, training sessions should be conducted for healthcare providers to ensure familiarity with the tool. Additionally, feedback loops should be established to refine the tool based on practical use. Additionally, this tool should exhibit high inter-rater reliability, ensuring that the same care plan is produced regardless of which healthcare provider uses it.

The other two root causes do not directly fall within the sphere of control of healthcare providers. Instead, they fall within the authority of the senior management of the hospital. These root causes could potentially stem from the current fee-for-service funding mechanism prevalent in hospitals across Singapore. Under this funding mechanism, hospitals are reimbursed based on the number of visits, investigations, and medications provided, which does not incentivise healthcare providers to manage the overall health of their patient population.³⁰ As a result, healthcare providers focus more on the quantity of services rather than their effectiveness.³⁰

Transitioning to a capitation funding mechanism can potentially eliminate these root causes. Under capitation, healthcare providers are incentivised to manage the overall health of their patient population within a fixed budget.³¹ This shift can force healthcare providers to align their goals and be accountable for the overall health outcomes of their patients.³¹ Moreover, a capitation funding mechanism encourages the use of a consistent care planning needs assessment tool, further supporting the delivery of uniform and effective care.³¹ By addressing these root causes through the proposed changes, we can reduce the incidence of avoidable hospital readmissions. However, eliminating these root causes is easier said than done.

This model encourages consistent care planning and reduces avoidable readmissions. However, transitioning to capitation would require a major overhaul of financial structures, performance metrics, and operations, making it a challenging and complex process. Achieving buy-in from all management levels adds to the difficulty. These complexities make the task of addressing these root causes much more difficult than it might appear.

Relevance to Healthcare Practice and Policy

Targeted Approach

The study findings underscore the importance of accurately identifying patients who are at high risk of



Figure 3. Current reality tree.

avoidable hospital readmission. In the USA, the challenge of effectively targeting patient populations for readmission reduction interventions is well-documented. Studies have shown that without precise risk assessment tools, interventions may fail to identify patients who would benefit most, leading to resource strain and suboptimal outcomes. This is also particularly relevant to the UK, where the National Health Service (NHS) is often stretched thin. The use of predictive analytics and machine learning models or validated tools such as HOSPITAL Score and LACE Index to identify high-risk patients for readmissions can be helpful.^{32,33}

Funding

The NHS and healthcare systems of other countries can explore collaborative funding models, such as public-private partnerships, to ensure sufficient resources for forming teams for care coordination efforts. This approach can help leverage additional funding sources and ensure that critical healthcare services are adequately supported. Countries can also consider implementing financial penalties for avoidable readmission rates, encouraging hospitals to allocate resources towards effective avoidable readmission reduction strategies.³⁴

Strengthening Multi-Disciplinary Teams

Enhancing patient ownership can lead to better care coordination efforts. For that, there is a need to strengthen multidisciplinary teams by ensuring that all team members have a clear understanding of their roles and responsibilities. This can be achieved through better training and clearer communication channels. Additionally, countries can consider implementing more robust systems for tracking and managing post-discharge care. This can include ensuring that all relevant healthcare providers are informed about the patient's care plan as well as integrating telehealth services to reach patients who may face barriers to in-person visits.³⁵

Limitations

First, constraints related to time, financial resources, and manpower limited us to examine how cultural stigma and the social context surrounding the intervention contributed to the emergence of unintended consequences. Future studies should prioritise the integration of these elements. This can be achieved through close collaboration with intervention implementers to ensure that relevant contextual data are collected alongside intervention-level data. Securing adequate funding support will also be critical to address these challenges and enable comprehensive exploration of these elements. Last, there is a possibility the intervention team may have provided us with only a selected subset of documents, a situation that could introduce a bias known as "biased selectivity."24 This might have limited the depth of insights derived from our analytical approach, constraining our comprehensive understanding of how the unintended consequences resulted.

Conclusion

Countries are implementing interventions to reduce avoidable hospital readmission. At a tertiary hospital in Singapore, one such intervention was the creation of a case management team. Applying the Rogers diffusion of innovations theory, we discovered that the unintended consequences undermined the intervention from achieving its objectives. Decision-makers and implementers should pay attention to these unintended consequences as well as the missing causes within the intervention as depicted in the current reality tree to inform effective implementation and refine future interventions.

Abbreviations

CRT: current reality tree IDI: Semi-structured in-depth interview NHS: National Health Service UK: United Kingdom USA: United States of America

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Ethical Considerations

This study was approved by the National University of Singapore Institutional Review Board (NUS-IRB) [Ref No.: 2022-378].

Consent to Participate

Written informed consent was obtained from all participants before commencing data collection.

Author Contributions

SS, DBM, conceptualised and designed the study. SS developed the interview guide, conducted qualitative interviews, and analysis of qualitative data and documents. SS wrote the first draft of the manuscript. SS, SS, LTW, DBM contributed to refining the codes and themes. DBM made substantial contributions to revisions of the manuscript. All authors contributed to the revision of the manuscript and approved the final manuscript.

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Data Availability Statement

The data analysed during the current study are not publicly available due privacy and confidentiality reasons but are available from the corresponding author on reasonable request.

Supplemental Material

Supplemental material for this article is available online.

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