

Early Implementation of a Patient-centered Medical Home in Singapore: a Qualitative Study Using Theories on Diffusion of Innovations

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Abstract

Background: Primary care (PC) reform is imperative to meet the demands of a rising number of chronically ill patients with complex needs. Patient-Centered Medical Home (PCMH) is a new care model that was found to improve care for complex needs patients in some countries but has not yet been widely adopted in Singapore. Guided by the PCMH principles, “ComSA-PCMH” was developed to proactively deliver integrated PC to a specific population with complex needs. This study explored the change strategies, initial experience and perception, and lessons learnt during its early implementation.

Methods: A grounded theory approach was employed. In-depth interviews were conducted for twenty-two key informants from three groups: the implementers, their implementation partners and other PC providers. The theoretical framework on diffusion of innovations by Greenhalgh and colleagues (2015) was used to determine theoretical saturation, reorganize data, and provide insights to the emerging themes.

Results: “Diffusion of innovation” emerged as an overarching theory to contextualize ComSA-PCMH and its early implementation. ComSA-PCMH was differentiated from usual PC through three innovations: i) team-based and integrated care; ii) empanelment; and iii) shared care with private general practitioners. Their corresponding change strategies were: i) repurposing pre-existing services and infrastructure; ii) partnership to create supporting infrastructure and pathways in the delivery system; and iii) targeted outreach. Initial experience of the implementers was characterized by “assimilation”, which was a cyclical process of experimentation, negotiations, and adaptations. Initial perception of the implementation partners was characterized by “adoption”, which was affected by perceived value of ComSA-PCMH and perceived burden in implementation. Initial perception of the private general practitioners was also characterized by adoption, which was affected by a lack of awareness and understanding of ComSA-PCMH. Lessons were learnt about ways to work with the complexity and novelty of the innovations.

Conclusions: ComSA-PCMH employed creative and pragmatic strategies to overcome country-specific contextual challenges and the inherent complexities of the care model. Assimilation and adoption were identified as the challenging steps, as they involve complex processes participated by multiple players who might exhibit less predictable, self-organizing behaviors.

Trial Registration: This study was retrospectively registered with ClinicalTrials.gov (Protocol ID: NCT04594967).

Contributions To Literature

- Our study is the first to link Patient-Centered Medical Home (PCMH) transformation with theories on diffusion of innovations, which provide a framework to contextualize the early implementation of a new PCMH.
- Complexity is well recognized in the implementation literature. We unpacked complexities involved in the early adoption and assimilation of a PCMH, particularly by characterizing assimilation as a cyclical process of experimentation, negotiation, and adaptations.
- We also shed light on the ground-up implementation of the PCMH where, in the absence of government-led dissemination, it had to employ creative strategies to path-find for a new model of care.

Background

A robust primary care (PC) system is the foundation to a high-functioning health system and healthy populations (1, 2). With ageing of the population, there are increasing pressures for PC to manage older chronically ill patients with complex needs such as multimorbidity, geriatric syndromes, co-existing cognitive impairments, mental illness, or psychosocial vulnerabilities (3–5). Complex chronic patients require provision of care that is person-centered, comprehensive, coordinated, and longitudinal. These requirements are often unmet by PC practices which lack adequate training, multidisciplinary care teams, appropriate practice infrastructure and payment systems (5–7). Without good-quality PC, complex chronic patients experience worse health outcomes and consume higher proportions of healthcare services and cost (8, 9). Hence, PC reforms are imperative to address the service gaps for complex chronic patients (10, 11). However, it is well known that PC reform is time-consuming, costly, and unpredictable in its outcomes. Without appropriate change strategies, the possibility of failures, burnout and financial losses are real for PC providers participating in these reforms (12, 13).

New PC models have been trialed and one model gaining popularity in recent years is the Patient-Centered Medical Home (PCMH). PCMH is a PC redesign whereby patient care is delivered through a centralized setting to enable “care integration, family and patient partnership and engagement, and operationalization of the PC core attributes of personal, first-contact access, comprehensive, and coordinated care” (14, 15). Typically, practice transformation to a PCMH model involves the addition or modification of existing infrastructure and/or workflow (e.g., care managers, clinical information system). Furthermore, some PCMHs also integrate with the mental health or social services in the delivery system they reside (16). Practice transformation is context dependent and there is no one-size-fits-all model for PCMHs (15, 17). Nonetheless, all PCMHs share the core feature of a team-based structure (with two or more clinicians working together), and other features that operationalize the PCMH core principles of: i) enhanced access (e.g., after-hours care); ii) coordinated care (e.g., good care plan transitions); iii) comprehensiveness (e.g., integrated psychosocial care services); iv) patient-centeredness (e.g., active engagement of patients and family members); and v) quality and safety (e.g., use of clinical information technologies) (18, 19). PCMHs have demonstrated significant improvements in episodes of depression, health-related quality of life, self-management outcomes, and biomedical markers such as blood pressure and glycated hemoglobin (20). They have also improved patient experience, mitigated disparities, reduced utilisation of acute care and overall healthcare expenditure (21). PCMH has been recommended as a model for PC reforms and systematically disseminated in the US and Australia (22, 23). However, there is a paucity of evidence in implementing PCMHs in other countries.

PC reforms and early adoption of PCMHs in Singapore

In Singapore, PC reforms have been underway in response to rapid population ageing. By 2030, one in four Singaporeans will be aged 65 and above (24). In a population study conducted in 2016–2017, nearly 40% of Singaporeans aged 60 and above had three or more chronic illnesses (25). The burden of increasing chronic illness demands that chronic care be delivered in the community, in a manner that is integrated or coordinated with other service providers and able to meet comprehensive needs in a continuous and person-centered manner (26, 27).

At present, usual PC in Singapore is provided by either public polyclinics or private practices in the community (Box 1). PC providers are usually led by physicians, with very few practicing multidisciplinary team-based care. Patients may utilize more than one PC provider of their choice due to the lack of empanelment in the sector. Chronically ill patients with slightly more complex needs are usually referred to specialists based at outpatient clinics in the acute hospitals (28, 29). Shared care between PC providers and the specialists is an emerging trend but still uncommon. Meanwhile, shared care across individual PC providers is highly limited, to the best of our knowledge (30).

In more recent years, PC reforms have been initiated to improve readiness to deliver comprehensive, team-based care in the community. Singapore's health system is divided into three integrated clusters called the Regional Health Systems (RHSs), each comprising a network of public-sector healthcare providers (31). There has been an increasing trend for the various providers in the RHS to form partnerships to test out region-specific innovations for potential national-level dissemination (32). Examples of PC innovations implemented at the national level include the redesign of private practices to become team-based Family Medicine Clinics led by family physicians, creation of Community Health Centers to provide support services to private general practitioners (GPs), the introduction of team-led care in the polyclinics, development of a supportive network and shared services for GPs through the Primary Care Network, and the integration and co-location of health and social services for older adults in one-stop centers called Geriatric Service Hubs (33, 30).

Into this landscape, PCMH was initially introduced by a private GP group, two acute hospitals and a non-profit family foundation (34, 35). However, relatively little has been published about these pioneering PCMH initiatives. One study evaluated patient experience (36), while another study examined implementation challenges, which included high setting-up costs, unfamiliarity with new care models and restrictions in utilizing RHS-based health financing schemes (13).

The Innovation: ComSA-Patient Centred Medical Home

Launched in November 2016, ComSA-PCMH is a new PC model co-developed by the central-region RHS and Tsao Foundation (TF). The foundation is experienced in providing primary medical and psycho-social care for community-dwelling older adults. ComSA-PCMH is part of “ComSA” (Community for Successful Ageing), which is a community-wide ageing-in-place initiative in Whampoa, a precinct of Singapore with a relatively high proportion of older persons (18% aged 60 or above out of a population of 30,500, 2015 figure) (37). In a community needs survey conducted in 2014 among 1,325 older Whampoa residents aged 60 or above, participants reported risk of

cognitive impairment (10%), social isolation (53%) and inappropriate help-seeking behaviors (25.6%) (38). Box 1 summarizes the context-specific acronyms and terminology used in this study.

ComSA-PCMH was established to serve a target population of Whampoa residents aged 40 or above identified to have complex medical and psychosocial needs. Such targeted service is called “empanelment”, which is defined as “a continuous, iterative set of processes that identifies and assigns populations to facilities, care teams, or providers who have a responsibility to know their assigned population and to proactively deliver coordinated primary health care towards achieving universal health coverage” (39). It has two distinct but integrated care components, comprising a PC clinic and home-based care management (CM) service. The PC clinic is led by family physicians trained in geriatric medicine and care coordination. Physicians are supported by registered nurses and a clinic executive (information and referral). As patients have complex needs, the duration of consultation is typically longer with the first visits lasting up to sixty minutes, to allow sufficient time for doctor-patient communication, comprehensive medical and psychosocial assessments, and health education. Patients with higher psycho-socio-behavioural needs are referred to an integrated CM service, which is home-based. Home-based CM enables the care managers to assess patients’ home environment and to understand the patients’ broader support system. Tasks in CM include addressing financial and socio-behavioural issues, coordinating care with other providers of social services, and ensuring social support is in place. The CM service is led by social worker and nurse care managers, with the support of assistant care managers and a program coordinator.

Box 1. Terminology Used in This Study.

CM (care management): is a home-based service offered to patients with complex psychosocial needs. Integrated with a PC clinic, they formed ComSA-PCMH.

ComSA (Community for Successful Ageing): is a community-wide initiative in the Whampoa precinct, which provides an integrated system of programs and services with the aim of promoting health and wellbeing over the life course, and enabling ageing in place (40).

ComSA-BPS-RS (ComSA BioPsychoSocial Risk Screener): is a risk screening tool purpose built for ComSA and locally validated in 1,107 community-dwelling older adults aged 60 or above in Whampoa. It contains 37 questions from biological, psychological and social dimensions, with each dimension having equal weightage to a final score that stratifies older adults into four categories: i.e., “managing well” (Category 1); having “some problems” (Category 2); “many problems” (Category 3); “overwhelming problems” (Category 4) in managing their health (41).

ComSA-PCMH (ComSA-Patient Centered Medical Home): is the integrated service of two key services (i.e., PC clinic and home-based CM service). It is the PC innovation under investigation by this study.

Polyclinics: are the public-sector PC providers in Singapore. They provide medical treatment, preventive healthcare, and health education at a subsidized cost. There were about twenty Polyclinics which catered for 20% (2014 figure) of PC clinic attendances in the country (42).

Private GPs (General Practitioners): are the private-sector PC providers in Singapore, who work in either solo or group practices. Services offered vary according to the strengths of GPs and local needs. There were about 2,000 Private GPs which catered for 80% (2014 figure) of PC clinic attendances in the country (42).

RHS (Regional Health System): is an integrated cluster of public healthcare providers including acute hospitals, polyclinics, and community hospitals. There are currently three RHSs (Central, Eastern and Western regions) in Singapore.

TF (Tsao Foundation): is the non-profit family foundation who initiated ComSA-PCMH, in partnership with the central-region RHS. The foundation had more than 25 years of experience serving community-dwelling older persons in Singapore.

Study aims and objectives

This qualitative study explored the early implementation of ComSA-PCMH. The objectives of this study were threefold:

1. To explore and describe the change strategies employed in implementing a new PCMH care model in Singapore;
2. To examine the initial experience and perception toward ComSA-PCMH and its change strategies; and
3. To propose lessons learnt from the early implementation of ComSA-PCMH.

Methods

An interpretivist approach was used to explore multiple perspectives, unpack complexities and conceptualize under-defined areas (43). Semi-structured, in-depth interviews were conducted in three groups of key informants: i) *“implementers”* from the TF; ii)

"implementation partners" from the RHS; and iii) other PC providers, predominantly the *private GPs*. Key informants were purposively sampled to give a diverse range of organizational and individual perspectives. An initial interview topic guide was developed using PCMH principles defined by the Agency for Healthcare Research and Quality (19), with additional topics on practice transformation and perceived outcomes (Additional File 1). IDIs were between 45–60 minutes, audio recorded and transcribed verbatim. Key informants were interviewed only once within the initial 3.5 years of the innovation.

IDIs were initially coded deductively based on the PCMH related topics in the interview guide. However, this approach was found to be inadequate to explain the emerging patterns in the inductively derived codes. Analysis then shifted to a grounded theory approach to construct theories based on these emerging patterns in the data (44). This involved three iterative steps: inductively detecting new patterns from the data, finding suitable theoretical frameworks in the literature, and in-depth discussion between two analysts who are experienced in qualitative analysis (ZZBL and MMK). After multiple rounds of data-framework-discussion process, analysis arrived at the theoretical framework on the diffusion of innovation by Greenhalgh and colleagues (45). Constructs in the framework (Fig. 1) were used to re-organize inductively derived codes, explain the relationship between categories (i.e., clusters of related codes), and provide complex insight into the emerging themes (46, 47). Figure 3 is an example showing the relationship between inductively derived codes, categories, and themes, with supporting theories. To ensure theoretical saturation, all transcripts were re-coded based on this new theoretical framework and two additional interviews were conducted. About a third of the transcripts were double coded to ensure intercoder reliability. Both analysts were also in a unique position of having worked in the TF prior to data analysis, with the exposure to the organizational culture and the day-to-day implementation of the innovation. The additional ethnography-like experience offered a depth of tacit knowledge about the innovation, which was used for elucidating the nuances in implementation. Potential implicit biases were uncovered through reflexivity and mutually challenging each other's views (48, 49). Using Nvivo (v.12) and the comment function in Microsoft Word, an audit trail was kept for codes, categories, and emerging themes, as well as discussions made to resolve differences in interpretations. Findings were also presented to other members of the study team, advisors, implementers, and implementation partners for enhancement of interpretations. The Standards for Reporting Qualitative Research (SRQR) was used to guide the reporting of findings (Additional File 2).

Results

Fifteen implementers, seven implementation partners and two private GPs were interviewed between November 2017 and July 2020. A three-pronged strategy for transformation into a PCMH care model was identified, corresponding to the creation of three "innovations" which differentiated the ComSA-PCMH from usual PC. "Innovations" were identified from inductively derived codes which matched the five defining characteristics of an innovation in health service organizations: i.e., healthcare services or support that are differentiated from previous practice, perceived as new by key stakeholders, aim to improve certain outcomes related to patient care, and led by strategized implementation (Fig. 1). Initial experience and perception from key informants had emerging themes predominantly related to "adoption" or "assimilation" of the innovations. Figure 2 summarizes the key themes for change strategies, initial experience and perception, and lessons learnt during early implementation of ComSA-PCMH.

Innovation I. Team-based care delivering integrated medical and psychosocial services

The first innovation that differentiates ComSA-PCMH from usual PC is team-based care (vs. solo physicians in usual PC) that delivers integrated medical and psychosocial services (vs. medical care only).

Change strategy: repurposing TF's pre-existing services and infrastructure based on PCMH principles and local needs

The TF had pre-existing services which cared for older patients with complex chronic needs, hence ComSA-PCMH was not entirely new to the implementers (Quote 1, see Table 1). Two services (i.e., a PC clinic and home-based CM service) were repurposed to become one integrated team. Strategies supporting the integration between these services included: i) co-location of PC clinic and CM workspace; ii) redesign of roles and workflow toward team-based care; iii) communication to facilitate team building or team-based decision-making (e.g., interdisciplinary meetings, team huddles) (Quote 2). Services were also redesigned to suit local needs. For example, more clinical time was spent on managing family dynamics as most older persons in Whampoa are living with families, in comparison to pre-existing services which addressed the needs of clients who were predominantly older persons living alone (Quote 3). In addition, clinical

information systems were enhanced to remove the need for double entries of health records and billing information, facilitate team-based communication and patient tracking. Implementers were upskilled in the provision of aged care, care coordination, patient-centered and team-based care, through on-the-job training by experienced peer implementers and sharing from external experts.

Initial experience of TF implementers: characterized by “assimilation”

TF implementers experienced their new or redesigned roles and workflow in a complex, non-linear and iterative manner, best described as a cyclical process of “experimentation”, “negotiation” and “adaptation” (Fig. 3).

Example 1: defining “complex needs”

Context: ComSA-PCMH needed to develop a new set of eligibility criteria because previous criteria did not target complex needs patients. The ComSA BioPsychoSocial Risk Screener (ComSA-BPS-RS) was developed to provide operational definitions for complex needs (Box 1).

Negotiation: Initially, only patients in the two highest risk categories (i.e., having “many problems” or “overwhelming problems” in managing their health risk) were eligible for receiving care from ComSA-PCMH, because ComSA-PCMH was perceived to be a resource-intensive model best reserved for patients with the highest needs (Quote 4). However, some implementers advocated for patients in the next category of having “some problems” to start receiving care to prevent their deterioration to the highest risk category.

Experimentation: Some patients from the “some problems” category started to receive care from ComSA-PCMH.

Adaptations: Eligibility criteria were revised to include patients in the “some problems” category, in alignment with the philosophy to provide care in a proactive manner (Quote 5).

Example 2: introducing home medical service for homebound patients

Context: There was a lack of home medical service to meet the demand of a rising number of homebound patients in Whampoa. However, funding for ComSA-PCMH did not account for this service.

Experimentation: ComSA-PCMH physicians conducted home visits to provide home-based care in the absence of supporting funding (Quote 6)

Negotiation: There were two emergent perspectives: while one perspective thought that ComSA-PCMH (as a patient-centered care model) should prioritize meeting all patients’ needs, the other perspective argued that it was financially unsustainable for physicians to provide home-based care (Quote 7).

Adaptations: A new home medical program was introduced and workflow in ComSA-PCMH redesigned for coordinated care with this new program (Quote 8). For patients not enrolled to the new program, team-based care was still led by physicians, but direct patient care was delivered by nurse care managers whose roles were adapted to provide nursing care during home visits.

Negotiations, experimentation, and adaptations pointed to an emerging theme of “assimilation” (Fig. 3), which characterizes the complexities experienced in the process of implementers *collectively* adopting new or redesigned roles and workflow (Quote 9). Assimilation was perceived as challenging because of i) multiple perspectives carried by implementers who came from different service orientations; and ii) high number of “soft peripheries”, or less clear and adaptable components in the innovation (Fig. 4) (Quote 10), as shown in the two examples above. Assimilation was also hindered in cases of perceived lack of leadership in decision-making (Quote 11) and slow progress in transforming the clinical information systems (Quote 12). On the other hand, implementers’ capacity for assimilation was facilitated by their intrinsic motivation to contribute to aged care (Quote 13), relevant competencies and/or training in patient-centred and integrated care (Quote 14), willingness to experiment, and observability of the impacts from their invested efforts (Quote 15).

Innovation II. Empanelment of a specific population

ComSA-PCMH practices empanelment to proactively deliver integrated PC services to a target population, i.e., those aged 40 or above, living in Whampoa precinct, and needing complex care as determined by the ComSA-BPS-RS and/or clinical assessment. The aim is to

fill in the service gaps for patients in this risk stratum who require a higher level of care than usual PC but less than specialist care (Quote 16).

Change strategy: partnering with RHS to create supporting infrastructure and pathways in the delivery system

To improve compatibility between the innovation with the delivery system, ComSA-PCMH partnered with an RHS to create supporting infrastructures and pathways in the delivery system (Quote 17). Four areas of support were identified. First, the RHS hosted a site for ComSA-PCMH in the community of Whampoa. Second, dedicated referral management team was introduced for case finding (based on age and postcodes) and risk screening patients in the RHS who might be eligible for ComSA-PCMH (Quote 18). Third, RHS clinicians needed to assess patients and initiate referral of eligible patients to ComSA-PCMH. For those needing continual specialist care after referral, RHS offered shared care with ComSA-PCMH, facilitated by teleconsultations, shared health records and clinical governance meetings. For patients who had their care transferred to ComSA-PCMH, there was also an option to return to their medical specialist(s) if necessary (Quote 19). Fourth, adaptations made to RHS-based health financing schemes (e.g., subsidized medications) to ensure their transferability to ComSA-PCMH patients in the community.

Initial perception of RHS implementation partners: characterized by “adoption”

Two key themes describe the initial perception of RHS implementation partners: i) perceived value of the innovation; and ii) perceived burden in implementing change strategies. Both affected the adoption process of the innovation, including formation of favorable or unfavorable attitudes towards the innovation, experimentation with and/or adaptation of the change strategies.

Implementation partners perceived ComSA-PCMH by comparing it to usual PC, based on costs to patients, convenience, and quality of service. Costs to patients were perceived to be higher than usual PC. Nonetheless, ComSA-PCMH had the relative advantages of better geographical accessibility (specifically in comparison to polyclinics), the availability of an integrated CM service, experience in aged care (Quote 20), options to have shared care with specialists, access to RHS-based health financing schemes in the community (Quote 21), and an appointment-based system. Perceived value could have been influenced by the way implementation partners initially learnt about ComSA-PCMH. Those who have had direct contact with implementers through outreach sessions were more likely to believe in the value of this care model and subsequently refer patients. Otherwise, busy clinicians tended to regard ComSA-PCMH as “just another collaboration” and lacked the motivation to initiate referrals (Quote 22).

Day-to-day implementation of ComSA-PCMH was perceived to be burdensome in two areas: i) systematic case finding of target population using age and postcode, which was thought to be labor intensive while producing low yields (Quote 23); and ii) risk stratification using the 37-item ComSA-BPS-RS, which was deemed too long and the highest two risk categories too restrictive for operational definitions of “complex needs”. However, implementation partners agreed that selectivity was strategically necessary because ComSA-PCMH was resource intensive thus should be reserved for complex needs patients (Quote 24). Some measures were adapted or rejected to reduce implementation burden. For example, ComSA-BPS-RS was experimented with briefly and eventually abandoned and replaced by implementation partners’ pre-existing risk stratification tools (Quote 25).

Innovation III. Shared care with local private GPs for complex chronic patients

ComSA-PCMH aims to partner with local private GPs to share care for complex needs patients. The initial idea was for both parties to provide complementary services to each other to retain patient care in the community. For example, ComSA-PCMH might offer CM services to GPs’ existing patients with psychosocial care needs while GPs who had their practices opened during evenings and weekends might offer after-hours care to ComSA-PCMH patients (Quote 26).

Change strategy: outreach to local private GPs

In the initial two years of implementation, targeted outreach was made to GPs through phone calls, personal visits by the ComSA-PCMH chief physician, lunchtime networking and seminars (Quote 27).

Initial perception of private GPs: characterized by adoption of ComSA PCMH

Findings are based on initial impressions of ComSA-PCMH by two private GPs in Whampoa. One GP was aware of ComSA-PCMH's intent to target patients with more complex needs, through direct interactions with the ComSA-PCMH chief physician and involvement in networking sessions. However, there was a misconception about ComSA-PCMH being a free clinic for low-income patients (Quote 28). The other GP had no direct interactions with ComSA-PCMH and was unaware of ComSA-PCMH. This GP thought that only certain social or rehabilitative care would be complementary to GP services. However, medical services provided by ComSA-PCMH were perceived to pose competition to private GPs and replicate public polyclinic services (Quote 29). Both GPs did not understand the functions of the CM service.

Lessons learnt

Two emerging themes were identified for lessons learnt during the initial implementation of the innovation: i.e., working with the *complexity* and working with *novelty* of the innovations (Fig. 2).

To work with complex innovations with a high number of soft peripheries, three key ingredients are needed: i) *time* – needed for experimentation, negotiations and adaptations of various adaptable components between implementers with different perspectives; ii) *leadership* – needed for facilitating and providing a clear direction for the assimilation process, which could otherwise be too lengthy and inconclusive; and iii) *a simple, reliable and standardized method* for guiding complex decisions, for example population segmentation or risk stratification.

Innovations in their early implementation were still novel to the users due to low observability and trialability. To work with novelty, three further key ingredients are needed: iv) *time* – needed by implementers to do outreach activities in addition to direct patient care; v) *direct communication* with the implementers, as the novelty of ComSA-PCMH could not be understood through a comparison to usual PC; and vi) *awareness building initiatives* – needed for understanding less-known service designs, such as CM and empanelment.

Table 1
Exemplary quotes

Quote no.	Category – theme / code	Exemplary quotes
Innovation I. Team-based care delivering integrated medical and psychosocial services		
1	Change strategies – repurposing TF's pre-existing resources and infrastructure	"...the idea of having a comprehensive primary care that serves the needs of the patients and his caregivers and to integrate the care between outside providers as well as internal colleagues, is similar. The idea of developing a PCMH is similar (to existing TF services)." (Implementer #11)
2	Change strategies – integration between PC clinic and CM service	"...to integrate them and make sure that the patients that is cared for by CM and the clinic can actually have a seamless coordination of care without having some care components falling through... working out how each of the different components work together... so there are the different work processes that we are learning as we operationalize the whole PCMH... we have morning huddles - where we actually have a quick word with each other twice a week... and we attend interdisciplinary meetings." (Implementer #11)
3	Change strategies – service redesign based on local needs	"In the beginning, when we are still looking at rental houses (i.e., lower-income neighborhoods), you still know they have family but they are left alone, on their own. But right now, the clientele that we are seeing in the past one and a half year, I think we are seeing a lot more with families." (Implementer #22)
4	Negotiations – ComSA-PCMH should be reserved for patients with highest needs (example 1)	"This clinic is resource intensive, (so) we should not see low risk patients. Otherwise, no value because the GPs and polyclinics are doing a great job in that. However, I think (other implementers) want to see (patients) earlier. I think they want this clinic to be like a real clinic, across life-course." (Implementer #21)
5	Adaptations – patient eligibility criteria were revised (example 1)	"Initially we put at 4 (ComSA-BPS-RS risk category), then drop to 3, then drop to 2." (Implementer #21)
6	Experimentation – ComSA-PCMH physician providing home medical service without supporting funding (example 2)	"The home visit is not covered by the government, they don't subsidise, I can't charge him (the patient) for the home visit, because he has no means to pay and it will disengage, it will make things worse. So the only thing I can do is to go do a home visit." (Implementer #02)
7	Negotiation – different perspectives on the need for ComSA-PCMH to provide home-based care (example 2)	"I feel that, when you deal with frail elders, the primary care has to be more flexible than this. I know where they (i.e., implementers with different perspective) come from. They are coming from a place of financial sustainability (while) I come from a person-centered perspective." (Implementer #21)
8	Adaptations – a new home medical program was introduce & nurse care managers provide some home nursing (example 2)	"Now for home care in Whampoa, a new home medical service (would) go and see (the patients)... The doctors don't do home visit, the (clinic) nurse don't do home visit. Then the care managers – there's a bit of tweaking. Now care managers can do direct nursing care. By right also cannot, care manager strictly no touching." (Implementer #21)

Quote no.	Category – theme / code	Exemplary quotes
9	Initial experience (by implementers) – assimilation (implementers collectively adopt new roles and workflow)	"They (implementers) need to talk to each other, be comfortable negotiating about their role. Because they need some clarity of what each is supposed to do, but there's a lot of blurring in the middle, you kind of just have to figure out what's the best way of doing what... You kind of have to work out a collaborative arrangement, between the different team members." (Implementer #13)
10	Initial experience (by implementers) – assimilation (challenged by soft peripheries and multiple perspectives)	"So, everybody had their own way of working, their own ideas, they came with different baggage right, because they are all from different walks of professions. So to put them together and, I think also, ComSA-PCMH is a work in progress, it's evolving. So nobody really know you must go this way or not, so it was confusion." (Implementer #11)
11	Barrier to assimilation – perceived lack of leadership in decision-making	"Nobody really know you must go this way or not... so it was confusion because there wasn't clear leadership..." (Implementer #11)
12	Barrier to assimilation – slow progress in transforming the clinical information systems	"The information technology basically still functions in silo... So everyone uses their own little components, you know. But there is no function... there's no structure, so communication is happening in an unofficial way, which is very difficult to keep track. That's why when you research us, you want to find information, it's like everywhere." (Implementer #11)
13	Facilitator for assimilation – intrinsic motivation to contribute to aged care	"My impression of them (i.e., the implementers from TF) is that they are very passionate about their work. So lots of energy and enthusiasm to do more and do better." (Implementation partner #18)
14	Facilitator for assimilation – relevant competencies and/or training	"the (ComSA-PCMH) model's different, and the competencies required is actually higher. And we almost cannot hire people with that kind of training background, experience nor certainly not people with that kind of mindset required in the service model... So when you hire somebody, you have to really train them up to the competencies of the model, while getting them to understand why we chose to do things the way we do" (Implementer #13)
15	Facilitator for assimilation – observability of impacts from invested efforts	"I think the direction is clearer (after 1.5 years), and people could see their contributions. Then, they would, they work happier because they know that what they're doing is of value. And that it's not so frustrating you know." (Implementer #11)
Innovation II. Empanelment of a specific population		
16	Innovation – targeting patients in a specific risk stratum between primary and specialist care (whose needs are unmet by usual PC)	"...you need some provider who can interface with the hospital and the community. Because the rest of the community providers, particularly the doctors like the GPs or the polyclinics, are not yet at the level where they want to provide the kind of care that older people – especially the frail, complex ones - that they really need. So until such time, you need a more specialised unit that sits between the hospital and community that can really provide intervention at a population level as well as at the individual-care level by looking at catalysing health systems and connecting all the dots between hospitals, providers and the people." (Implementer #13)

Quote no.	Category – theme / code	Exemplary quotes
17	Change strategies – partnering with RHS to create supporting infrastructure and pathways in the delivery system	“ComSA was then a service provider partner, in this whole setup. So, I guess then one can see that the collaboration grew from not just the support of subsidized medications but that of actually the RHS hosting the infrastructure in terms of holding the tenancy for the building where they were sited, and along with the various factors such as enabling factors such as finance, flow of patients.” (Implementation partner #12)
18	Change strategies – processes involved in referral management	“One of the executives will churn out a list of patients that fulfil the (eligibility) criteria. This list is then sent to one of our care facilitators, who then... prompts the doctor that when the patient arrives, discuss ComSA-PCMH referral with the patient... And then the patient gets transferred to one of our care facilitators... What she then does is to dive into greater detail about the COMSA clinic... And then she will set up appointments if patient's agreeable... then we will create a referral letter and send it across.” (Implementation partner #18)
19	Change strategies – options for patients to return to medical specialists if necessary	“If there's anything (that warrants patient care to be transferred back to the hospital), let's say patient condition worsens or what, there's this telecommunication that the doctors there (in ComSA-PCMH) and our doctor (in the hospital) can communicate to update each other whether there's a need to come back or what or, you know.” (Implementation partner #17)
20	Perceived value – comparison to usual PC (ComSA-PCMH more experienced in aged care)	“But again the level of care between GP and ComSA-PCMH (can) provide might be very different. ComSA-PCMH does provide a more holistic kind of care to patients. That's why we see value and we see that in fact, they may feel safer that if our geriatric patients are cared for by ComSA-PCMH.” (Implementation partner #16)
21	Perceived value – comparison to usual PC (access to RHS-based health financing schemes in the community)	“So the advantage of this is that... in the near future, ComSA-PCMH patients will be able to receive their medications, their very competitively priced chronic medications on the same day of the consult. Now I say competitively priced because the moment they moved onto this model... ComSA-PCMH would then be receiving medications at that price which typically no non-RHS primary care provider would normally receive it at.” (Implementation partner #12)
22	Perceived value – influenced by opportunity for direct communication with implementers	“I think two different people would have different opinions depending on how they receive the information... at different points in time. So, staff who knew about this service early on, knew that it was a service meant for patients who had psychosocial challenges. They knew that they would be able to fill a service gap that the polyclinic has problems trying to fill, so they were much more happy to, and receptive towards referring patients who would fulfil their criteria. However, in current state where we inform the doctors that this is another collaboration, then to them it is another collaboration. Just that the referral criteria, the inclusion criteria is somewhat different. So they may not be able to understand the true meaning and the intentions and the vision and mission that the ComSA clinic has... So they may just look upon it as a business as usual, rather than something that may value add to the patient.” (Implementation partner #18)
23	Perceived burden – systematic case finding was labor intensive and producing low yield	“In one month, I pull (i.e., case find) 40 plus (potentially eligible patients). But out of the 40 plus – this is just a rough number – maybe I already taken out, like, uh, 10 because of various reasons: maybe they are still not stable or they haven't concluded their diagnosis... Yeah then after that there's patient choice (i.e., that patients might not agree to be referred) and all that... So you really have to funnel, funnel, funnel, funnel. Then the number will not be a lot.” (Implementation partner #14)
24	Perceived value – ComSA-PCMH is resource intensive hence should be reserved for complex needs patients	“If we have abundant resources, then we can shift the (ComSA-BPS-RS risk category) cut-off for delivering that service at a lower ComSA-BPS-RS score (i.e., lower-risk patients). But if I were to tell you that we are very scarce in terms of resources, then we need to shift the ComSA-BPS-RS cut-off very high. ...hence, the point about sustainability lah. I don't think that's a question about whether you should or should not have this service. The question then really is who do you deliver this service for, given the resources you have.” (Implementation partner #18)

Quote no.	Category – theme / code	Exemplary quotes
25	Perceived burden – replacing ComSA-BPS-RS with biomedical markers	"So patients who would be seen and followed up by ComSA-PCMH were those who were ComSA-RS positive plus medical problems. But we basically told them (i.e., TF implementers) that, for us to try and do the ComSA-BPS-RS for you... (it) would be challenging because there are very few patients who will satisfy the ComSA-BPS-RS positive criteria. So we actually said, we just use biomedical markers, is that okay? So they eventually said okay." (Implementation partner #18)
Innovation III. Shared care with local private GPs for complex chronic patients		
26	Innovation – shared care with private GPs for complex chronic patients	"Reaching out to the GPs definitely is a very key thing... We thought that the GPs were not seeing as many older people for several reasons. One is that, it takes a lot of time, and, and they get paid very little, right. So, having been in private practice, I understand that you really cannot see too many, so therefore they maybe see fewer (older patients). Secondly, older patients are very complex. And some of the GPs may not have been practicing that way, and there may be some knowledge gap, I would think, in terms of taking care of older people... a lot of things are just social problems and they (i.e., the private GPs) can't take care of their social problems... (while) ComSA-PCMH has coverage (for complex needs patients), but we're not open (on weekends and evenings). So, one GP was very happy to see them during those hours, but he feels like it may be better to work with us so we can share the care. We take on the ongoing, long term kind of like, care for the chronic diseases and the social problems and all that. But they're happy to see them for the ad-hoc, acute things, and then there'll just be communication." (Implementer #13)
27	Change strategies – targeted outreach to private GPs	"Certainly the previous chief physician had more than done their fair share of making their rounds (in) the (private) GPs in the Whampoa neighbourhood. They have organized what they term as brown bag engagement sessions, where they just buy simple lunch, unlike the buffet spread that people, drug companies offer. But what they make up for in lack in food they make up for with sincerity." (Implementation partner #12)
28	Initial perception – understand ComSA-PCMH's intent to provide complex care needs but misunderstand its care provision as free	"I think they have done a good job you know, taking care of the elderly in this area... You know, offering free services to them.. rehabilitation and management chronic diseases and I think that's a good outlet for the people here to go to. I think they are quite comprehensive in the care of the elderly." (Private GP #1)
29	Initial perception – perceived complementarity of ComSA-PCMH services to private GPs' in social care only	"We are getting more and more dementia patients. And that's very hard for us (i.e., private GPs) to manage. So that's where you all (i.e., ComSA-PCMH) have the time and the facilities to get them (i.e., the patients), get together, mix together, and socialise together. That's important. Because a lot of them are lonely you see. So that's what community centre is about, and you facilitate that. And then you give... erm... You have the gym, you have the dancing classes, that's useful, and maybe once in a while have a visiting physiotherapist, something like that. That'll be useful. But to have clinics to take over from GPs... I don't think GPs will be happy with that... we don't refer at the same level (i.e., to physicians in ComSA-PCMH). We refer to specialists. You know what I mean?" (Private GP #2)

Discussion

As one of the first PCMHs in Singapore, the creation of ComSA-PCMH was a community ground-up effort led by early adopters of the care model. This brought about a different implementation experience than PCMH demonstrations which have been introduced into the delivery system by government agencies. For example, PCMHs are systematically disseminated in the US by dedicated national quality assurance bodies through accreditation and technical assistance in the form of quality improvement coaching (51–53). In Australia, the PCMH (or "health care home") program is helmed by the Department of Health that rolled it out in ten Primary Health Network regions since 2016 (54). Without government-led dissemination, early adopters of PCMH in Singapore had to path-find and resolve contextual challenges particularly model incompatibilities with the delivery system. ComSA-PCMH, in this case, employed some creative and pragmatic strategies to develop a care model that is both distinct from usual PC models and integrated with the delivery system. First, it empaneled only patients whose care should remain in the community but unmet by usual PC. This strategy differentiated its target patient segment from patient populations in usual PC and specialist care. It was also compatible with the Ministry of Health's national strategies to shift care from hospital to community and to close service gaps in the usual PC in providing quality, community-based care for complex needs patients (55). Second, ComSA-PCMH reduced the payment gradient between the subsidized RHS clinics and the new care model by adapting the pre-existing RHS-based subsidies. If patients had to pay substantially more when transferring their care to ComSA-PCMH, this care model might not attract patients. Although this payment reform was small-scaled and adaptive, it presented an opportunity to explore better financing mechanisms for high-need patients to receive care in

the community. Evidence suggests that primary care financing mechanisms which modify the traditional fee-for-service model or replace it with pay-for-performance, bundled or capitated payments, can incentivize multidisciplinary team-based, person-centered care in the PCMHs.(56, 57).

ComSA-PCMH practices empanelment, which enables the provision of first-contact access, as well as continuous, coordinated and comprehensive care (39). However, empanelment was a novelty in the PC sector in Singapore, thus was not commonly understood. Our findings show that it was challenging for other service providers in the delivery system to adopt this innovation. Without adequate outreach efforts, private GPs serving the Whampoa community at large may still regard ComSA-PCMH as a competitor. Meanwhile, RHS implementation partners tended to directly compare ComSA-PCMH to usual PC models. This perception might have inhibited the characterization of ComSA-PCMH as a valuable new care model that is different from the usual PC. They were likely to be affected by low trialability and observability of the innovation, which could be addressed with more time and awareness building initiatives for its less-known service designs. In fact, implementation challenges due to novelty was also faced by other new community-based services in Singapore (58). As the innovation matures and adoption improves, empanelment may become routinized in the delivery system without requiring dedicated efforts for case finding, risk stratification and referral management.

Despite a lack of understanding of the care model, there was consensus among implementers and implementation partners that ComSA-PCMH, as a higher-resourced program, should be reserved for more complex patients. This is congruent with the evidence about PCMHs yielding more cost savings and clinical improvements in patients with the most complex needs (59). However, different definitions of the nature and threshold for complex needs were found to exist. Indeed, “complex needs” is an emerging term in health services that was found to have inconsistent interpretations (60). In Singapore, there has been a lack of standardized method for defining complex needs in chronically ill patients (61). Efforts have been underway to define patient needs by segmenting the population based on medical and utilization indicators from the National Electronic Health Records (NEHR), such as diagnosis and the number of inpatient admissions (62, 63). As NEHR is limited by a lack of systematic clinical inputs for functional and social health (64, 65) non-NEHR based tools were also developed to incorporate them but they often had to be administered by clinicians (66). ComSA-BPS-RS was developed and locally validated to define needs through risk stratification of the population based on all bio-psycho-social dimensions. It could be administered by trained surveyors instead of clinicians (67). However, our findings show that its adoption was low due to perceived burden. For better efficiency and equity in resource allocation, an improved standardized stratification or segmentation tool that is simple and reliable is needed to correctly identify intended populations for the innovation.

Another pragmatic strategy employed by ComSA-PCMH was to leverage on the pre-existing services and infrastructure. The initial teething issues encountered by the implementers in assimilating new roles and workflow resonated with the experience of early adopters of PCMHs in other countries, which suggests that behavioral change needs to start from a shift in practice and policy perspectives, accompanied by sufficient resources, good leadership and time which are crucial ingredients for transformation (68–70). The literature also emphasizes the importance of applying cultural change strategies for getting whole-staff engagement, shifting practice perspectives and inculcation of self-reflection on PCMH care philosophies (71, 72). The implementers’ experience resonated with how assimilation was commonly experienced, i.e., “complex”, “messy” and “non-linear” (73). Challenges faced in assimilation was explained by the theme on “soft peripheries”, which are inherent to innovations and point to the importance of allocating focal and conscious attention from organizational leadership to support efforts to experiment, negotiate and adapt when an innovation is at its experimental phase (50).

ComSA-PCMH is a complex innovation that is continuously evolving, situating within a delivery system that is also continuously evolving. Multiple perspectives are common in the initial experience and perception, for example, the different emergent perspectives by implementers on the operational definitions of complex needs and the self-organizing behaviors by different implementation partners in adopting or abandoning risk stratification tools. These findings point to the realities of working in complex systems, which comprise many “diverse, interdependent and semi-autonomous actors” whose self-organization and interaction with each other might produce non-linear trajectories in the system (74). This echoes the calls of implementation scientists to shift perspective from seeing implementation as stepwise, linear processes to one that pays attention to both the risks and opportunities in multiple perspectives, emergent causalities, and nuanced pluralities (75–77). Therefore, the sustainability of an innovation is less about achieving routinization but more about the ability of the innovation to continuously develop, or evolve (78).

This is the first study that links PCMH transformation with theories on diffusion of innovations. Grounded in the data, diffusion of innovations emerged as an overarching theory – explaining the antecedents and rationales for change strategies, initial responses through early adoption or assimilation of innovations, and how the inherent characteristics of innovations (complexity and novelty)

posed certain implementation challenges. The study also fills in the literature gap about the implementation of a new PCMH in an Asian context, with detailed descriptions on the contextual challenges and accompanying strategies to overcome them. It was part of a larger study which also evaluated the impacts of ComSA-PCMH on patient experience, quality of life, patient activation, healthcare utilization, and costs. Findings from other parts of the larger study have been published elsewhere (79). This study was limited by the application of single-method, though that was complemented by analysts' ethnography-like experience. The evolution of the innovations was not fully captured due to a cross-sectional study design, limited contact with the key informants and a lack of participation from other stakeholders in the delivery system such as other PC and community service providers. We recommend further research to examine four areas: i) the later stages of implementation; ii) development of care management models based on local needs; iii) strategic partnerships for PC innovations ; and iv) organizational readiness for complex implementation, using multiple methods in a longitudinal fashion (80).

Conclusions

Using a grounded theory approach, this study unpacked the complexities in change strategies, initial experience and perception, and lessons learnt from implementing a new PCMH in Singapore. As an early adopter of the patient-centered care model, ComSA-PCMH experimented, negotiated, and adapted creative strategies based on pragmatic considerations to overcome both country-specific contextual challenges and the inherent complexities of the care model. Assimilation and adoption were identified as the challenging steps, as they involve complex processes participated by multiple players who might exhibit less predictable, self-organizing behaviors. Key ingredients found to be crucial for transformation were time, leadership, standardized methods, direct communication, and awareness building for the innovations.

Abbreviations

CM: Care Management

ComSA: Community for Successful Ageing

ComSA-BPS-RS: ComSA BioPsychoSocial Risk Screener

GP: General Practitioner

PC: Primary Care

PCMH: Patient Centered Medical Home

RHS: Regional Health System

TF: Tsao Foundation

Declarations

Ethics approval and consent to participate

All procedures performed this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study was approved by the Domain Specific Review Board (DSRB), National Healthcare Group (NHG), Singapore (NHG DSRB Ref: 2017/00352). DSRB's research policies are based on local and international ethical guidelines, including Belmont Report, Declaration of Helsinki, and Ministry of Health Singapore Code of Ethical Practice in Human Biomedical Research. Informed consent was obtained from all individual participants included in the study.

Consent for publication

Not applicable.

Availability of data and materials

The datasets generated and/or analysed during the current study are not publicly available due to individual privacy rights of our participants as outlined to them during the consenting process.

Competing interests

CHW is employed by Tsao Foundation, the non-profit family foundation leading the PCMH implementation investigated in this study by the time following manuscript writing, but not affiliated to it at the time of study conception, data collection, data analysis, and manuscript writing. HJMV has received previous funding from Tsao Foundation as the advisor for this study and currently receiving funding for other studies. Tsao Foundation has no part in data collection, analysis, or manuscript writing. The remaining authors declare that they have no competing interests.

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Authors' contributions

CHW conceptualized the study. CHW and MLG contributed to the study design. Data collection was first conducted by MLG, later by ZZBL and MMK following modification to study design. Analysis and interpretation were performed by ZZBL and MMK. HJMV and JY provided guidance to the overall study as advisors. The first draft of the manuscript was written by ZZBL with assistance from MMK. All authors commented on subsequent versions of the manuscript. All authors read and approved the final manuscript.

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Figures

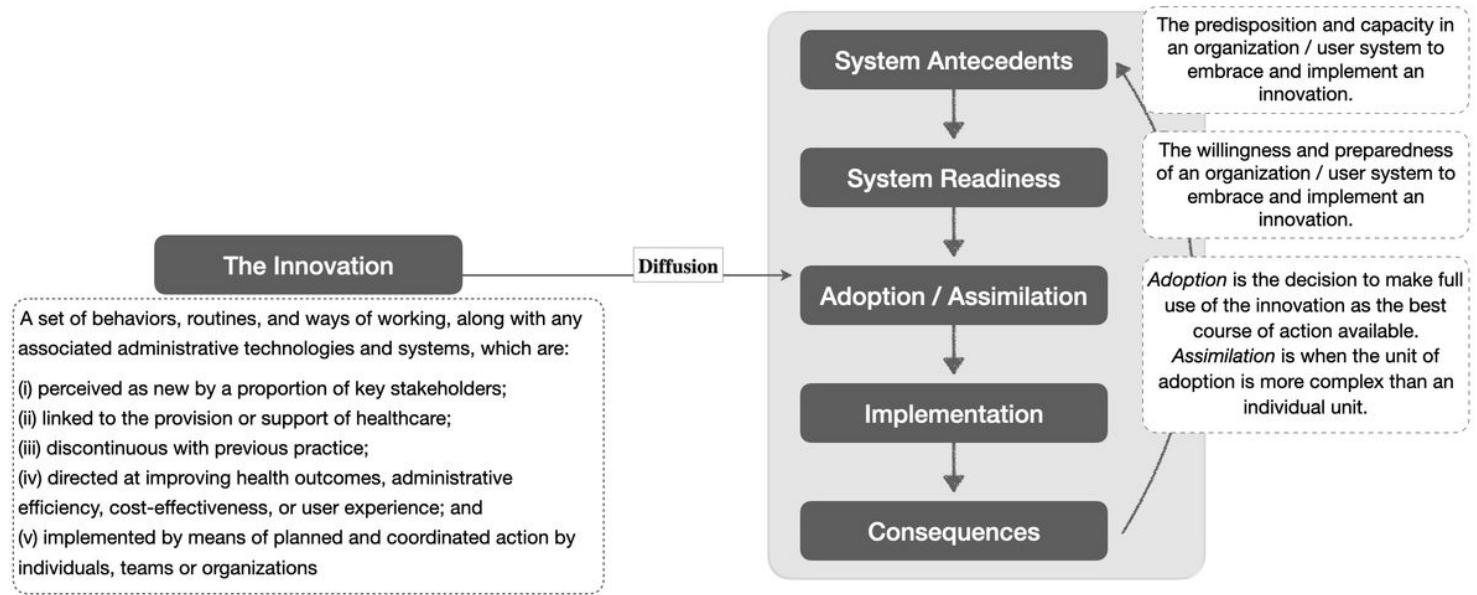


Figure 1

Simplified theoretical framework on the diffusion of innovation with definitions for its key constructs. Figure and definitions adapted from (45).

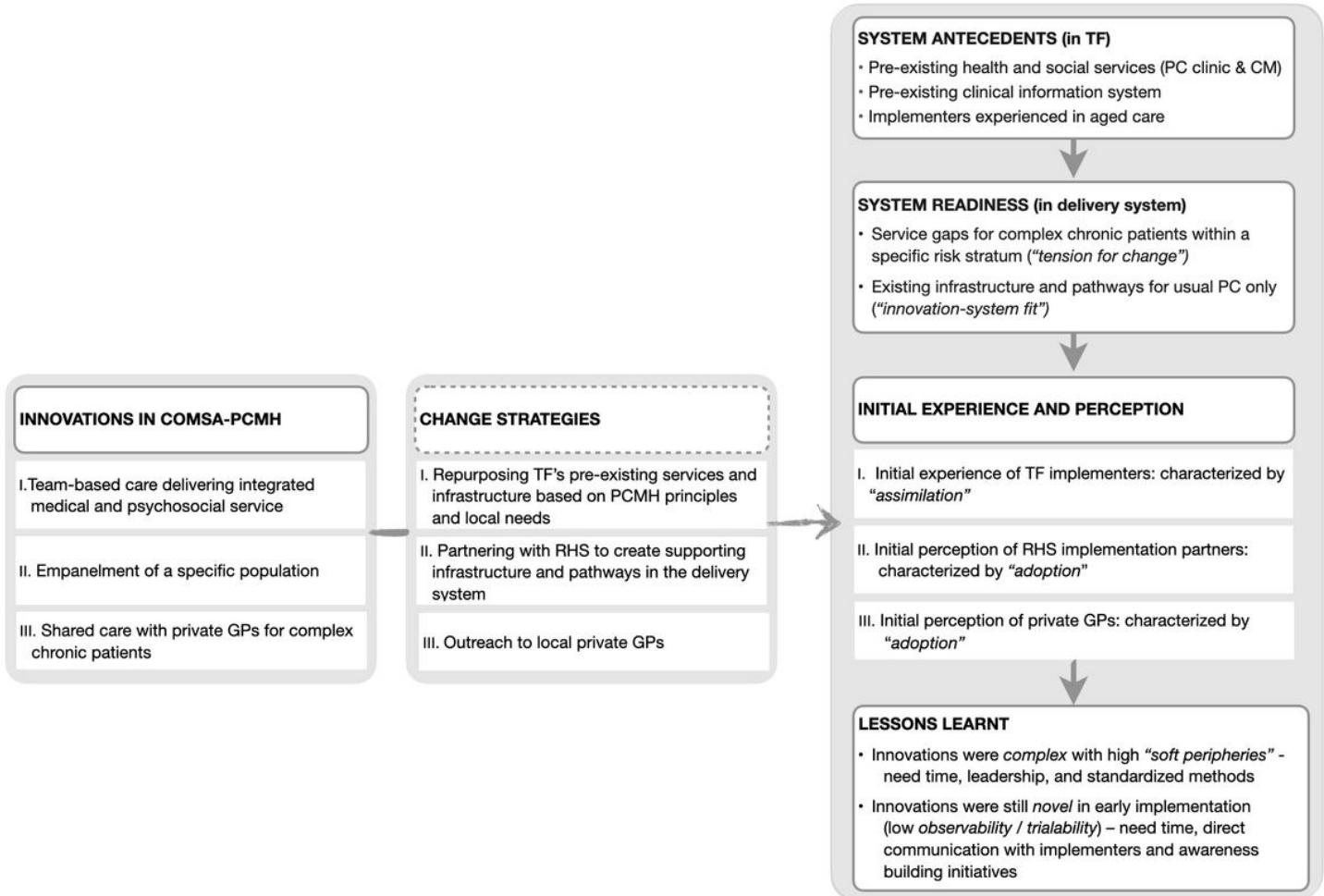


Figure 2

Key themes for Innovations, Change Strategies, Initial Experience and Perception, and Lessons Learnt. TF: Tsao Foundation; RHS: Regional Health System; GPs: General Practitioners; PC: Primary Care; CM: Care Management.

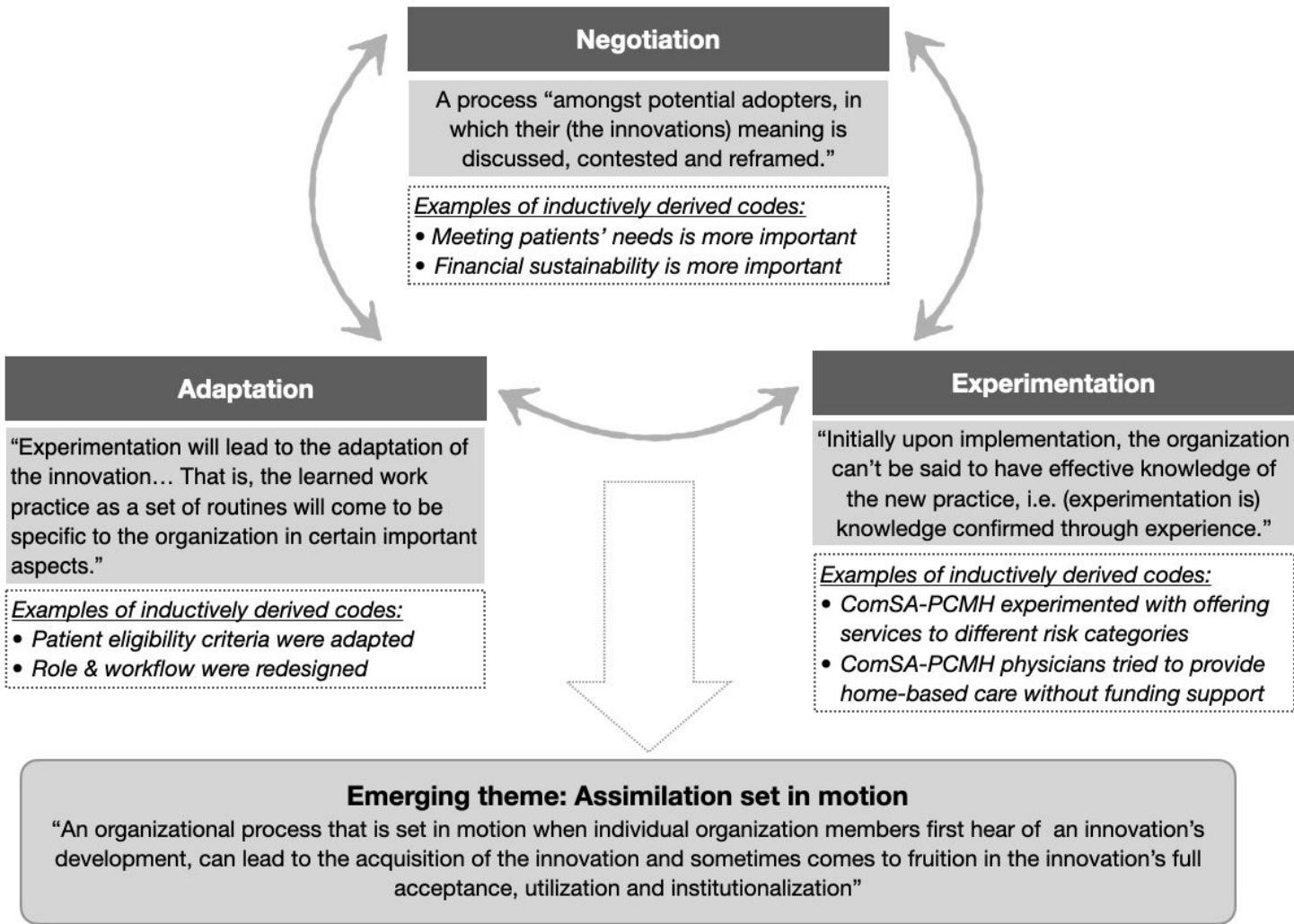


Figure 3

The emerging theme of assimilation. The theme on assimilation emerged from the cyclical relationships between three categories (negotiation, experimentation, and adaptation). Categories were developed from clusters of related codes (examples in italics). Supporting theories (in shaded boxes, adapted from (45,50)) were used to identify categories and emerging theme.

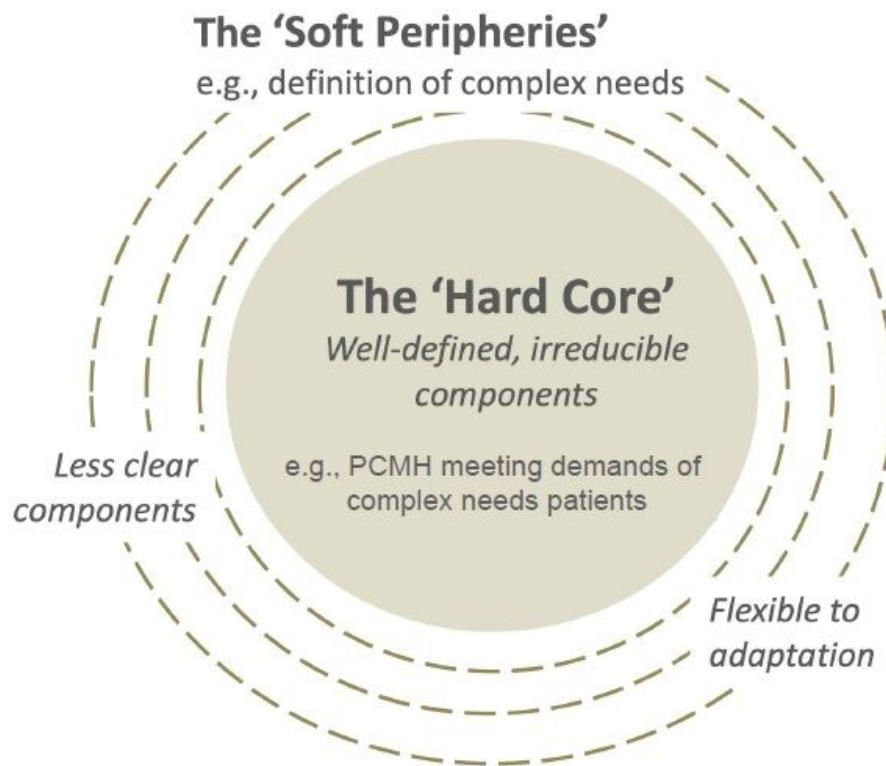


Figure 4

The “hard core” and the “soft peripheries” in a complex innovation. Figure adapted from (45).

Supplementary Files

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