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Mapping the way: functional modelling for community-based integrated care for older people

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Abstract

Background Healthcare system sustainability is challenged by several critical issues; one of the most pressing is the ageing population. Traditional, episodic care delivery models are not designed for older people who are medically complex and frail. These individuals would benefit from health and social care that is more comprehensive, coordinated, person-centred and accessible in the communities in which they live. Delivering this is a challenging endeavour. Community-based health and social care professionals are siloed, dispersed across various locations and sectors, each with their own mental models, electronic health information systems, and means of communication. To move away from fragmented care delivery models and towards a more integrated approach to care, an analysis of the process of community-based comprehensive geriatric assessment was conducted in an urban location in Atlantic Canada. The purpose of the study was to identify where in the community-based comprehensive geriatric assessment process challenges and opportunities existed for moving towards a more integrated model of care delivery.

Method The functional resonance analysis method (FRAM) and dynamic FRAM (DynaFRAM) modelling were used to model the community-based health and social care system and create a hypothetical patient journey scenario. Data collected to inform modelling consisted of document review, focus groups, and semi-structured interviews with health and social care professionals providing care and service to older people in the community setting.

Findings. Challenges and opportunities for implementing integrated care in the local context were identified. Findings from the FRAM and DynaFRAM analysis informed the co-design of multi-level process improvement recommendations that aim to move the local community-based comprehensive geriatric assessment process towards a more integrated model of care.

Conclusions A transformative redesign of community-based health and social care in the local context is necessary but cannot be accomplished without an understanding of how health and social care professionals conduct their work and how older people may receive care under the dynamic conditions. The FRAM and DynaFRAM modelling provided an enhanced understanding of system operations and functionality and demonstrated a critical step that should not be overlooked for decision-makers in their efforts to implement a more integrated model of care.

Keywords Functional resonance analysis method, Integrated care, Comprehensive geriatric assessment, Healthcare process modelling, Systems thinking

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Background

Like many countries worldwide, Canada is facing demographic changes that have a significant impact on future healthcare system functioning and sustainability. Canada's older adult population will grow by 68% in the next 20 years [1]. Additionally, 25% of Canadians over age 65 are frail [2]. An ageing population coupled with rising service demands is concerning given how the Canadian healthcare system is currently designed. Traditional, episodic healthcare delivery models do not support the long-term and intersecting health and social care needs of older people [3, 4]. Integrated care solutions are needed that can help older people to maximize health and wellness achieve the outcomes that matter to them.

To move towards delivering care that is more integrated, a group of Geriatricians in one Atlantic Canadian city began conducting community-based comprehensive geriatric assessments (CGA). A CGA is multidimensional process that aims to identify the medical, social and functional needs of older hospitalized people to develop an integrated care plan to address their needs [4–7]. Despite the success of the CGA in the hospital setting, further work is required to explore its applicability in other settings due to difficulties in coordinating multidisciplinary work [8]. In the community, professionals are siloed, dispersed across various locations, each with their own mental models and methods of communication. Due to this fragmentation, older people may find themselves navigating an uncoordinated collection of clinical encounters [9]. The WHO [4, 7] advocates for action across health and social care sectors worldwide to enable the delivery of integrated care by enhancing and optimizing the way current services are designed and delivered to older people. This study used a novel methodological approach to gain an improved understanding of how the local system functions and operates. From these valuable insights, the research team was able to develop multilevel recommendations that can inform the design and implementation of a more integrated model of care delivery.

The functional resonance analysis method

A new approach to collecting data is necessary that acknowledges and confronts the complexity and variability of everyday healthcare operations. Variability in healthcare can be attributed to dynamic and uncertain processes and systems. Within a complex socio-technical system, human and organizational performance will always vary and adjust to meet demands. These adjustments will produce positive outcomes but can also at times result in poor outcomes. Having an improved understanding of variability and its impact on operations can assist in the design and integration of people, processes, policies and organizations [10]. The functional resonance analysis method (FRAM) is a systemic, nonlinear mapping approach used to produce a functional model of the everyday activities, interdependencies and variabilities within a process or system, demonstrating complexity which may otherwise be invisible [11]. The FRAM refers to activities in a process as "functions" [12]. Ross et al. explains that functions are continuously carried out in complex processes and can be human, organizational or technological. Functions are described in terms of six aspects – input, output, resources, time, control and preconditions – that occur when work within a process or system happens [13]. Functions are diagrammed as a hexagon with its six aspects branching from each corner. An example of a function from Hollnagel et al. is provided in Fig. 1 [14].

The aspects that characterize functions are best described by Clay-Williams et al. [15].

1. The input is what the function acts on or changes (what is used to start the function).
2. The output is what emerges from the function (an outcome or state change).
3. A precondition is a condition that must be satisfied for a function to be executed.
4. The resources are materials or people needed to execute a function.
5. Control is how the function is regulated or controlled (guidelines, protocols).
6. Time refers to any temporal requirements of the function.

Functions are interconnected through mutually shared aspects. A FRAM model is a visual depiction of all the functions and connections existing in a healthcare process. This is a strength of the method, allowing clinicians and administrators to visualize the complexity of

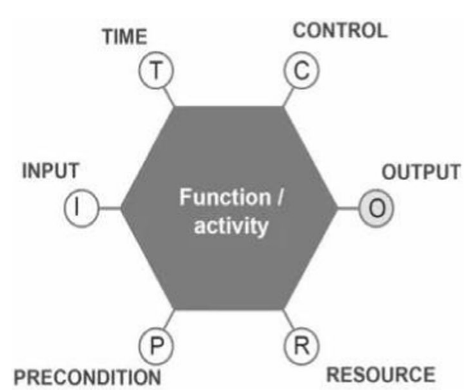

Fig. 1 FRAM function hexagon

a process as well as all the potential ways a process can take place. FRAM models can also be used to conduct dynamic FRAM modelling (DynaFRAM). This approach, developed by Smith et al., can depict the variations that belong to specific executions of a process over a set period, known as functional signatures [16]. The result is the ability to visualize a unique functional path (functional signature) through a process or system.

Integrated care

Integrated care aims to improve the quality and efficiency within and across the micro- (clinical, patient level), meso- (organizational, professional) and macro- (policy, sector) levels of health and social care while ensuring it is organized around the needs, preferences and goals of older people [3]. There are several models, standards and frameworks in the literature to guide integrated care design and implementation [7, 17, 18]. Threapleton et al. found there to be a lack of robust evidence identifying the most effective or beneficial approaches to integrated care implementation: The authors offer a more pragmatic approach by presenting three potential prerequisites [19].

(i) Understanding the key components of integrated care for older populations.
(ii) Understanding how integration takes place through the micro-, meso- and macro-levels of the health care system.
(iii) Anticipating implementation challenges to effectively make changes within different care contexts and settings.

The present study followed this approach and will begin by providing an overview of the literature on the key components of integrated care for older people as well as the levels and dimensions through which integrated care can take place. To anticipate challenges as well as opportunities in the implementation of integrated care, an examination and analysis of the current process of community-based CGA in an Atlantic Canadian city was conducted using the FRAM and DynaFRAM modelling.

Understanding key components of integrated care for older people

For care to be organized, coordinated and delivered around the needs and goals of older people, care models need to be designed with the goal of maintaining and preventing decline in an older person's intrinsic capacity and functional ability [3]. The WHO defines intrinsic capacity as all the physical and mental capacities that an older person can draw upon [4]. Functional ability defined by WHO [4] "comprises the health-related attributes that enable people to be and do what they have reason to value" (p. 28). The WHO has introduced the Integrated Care for Older People (ICOPE) approach, which aims to support the delivery of integrated care models globally by encouraging governments, health organizations and clinicians to approach health and social care delivery through the lens of intrinsic capacity and functional ability [20]. To achieve this, efforts should be made to reorganize services to include the following key components:

(i) person-centred care
(ii) comprehensive geriatric assessments
(iii) interdisciplinary teams
(iv) case management
(v) goal-setting and shared decision-making
(vi) support for self management
(vii) amalgamated information and data sharing systems
(viii) supportive leadership, governance and financing mechanisms
(ix) home-based interventions [3, 4, 7, 19]

Understanding the Levels and Dimensions of Integration

Much of the evidence on the effectiveness of integrated care is at the micro-level with little focus on meso-level and macro-level elements [3, 21]. Although there may be positive change and efficiency at the micro-level, sustainability may not be possible without considering inter-level interactions [19]. For there to be inter-level connectivity and sustainability there needs to be consideration for the levels and dimensions of integrated care prior to implementation. Table 1 provides descriptions of the micro-, meso- and macro- levels through which integrated care for takes place, as well as the domains of integration – normative and functional – that connect the levels of the system [18, 20, 21].

Methods

Study purpose and objectives

The purpose of the study was to identify where in the community-based comprehensive geriatric assessment process challenges and opportunities existed for moving towards a more integrated model of care delivery. The research objectives were:

(1) To map the everyday activities and interdependencies of the CGA process in the community-based system using the FRAM to produce a functional model.
(2) To identify instances of potential variability occurring in the CGA process from the data obtained from health and social care providers who conduct everyday work in the system.
(3) To provide an example of variability in the CGA process by developing a functional signature from

Table 1 Descriptions of the levels and dimensions of integrated care

Levels	*Descriptions*
Micro-level	The clinical or interventional level, which is concerned with how health and social care services are coordinated and delivered to older people
Meso-level	The organizational and professional level The organizational level is concerned with inter-organizational shared governance, collective action and collaboration The professional level is concerned with partnerships among health and social care professionals that have a shared accountability to provide care and service delivery to older people
Macro-level	The policy or sector level. Concerned with governmental, educational and regulatory arrangements that guide organizations and professionals in the delivery of comprehensive care and services to older people
Dimensions	***Descriptions***
Normative	The development of a shared vision/culture among stakeholders and organizations (clear goals and objectives) that can facilitate interdisciplinary collaboration to meet the needs of older people
Functional	The coordination of support functions essential for service delivery to older people, such as information technology, financial management, human resources, strategic planning and quality improvement

a hypothetical patient journey scenario using DynaFRAM.

(4) To determine how the emergence of negative and positive variability can create challenges or generate opportunities for delivery of integrated health and social care for older people.

(5) To co-design multi-level process improvement recommendations supported by normative and functional dimensions of integration.

Research design and data collection

This study was conducted in an urban location in Newfoundland and Labrador and incorporated multi-disciplinary perspectives on the process of community-based CGA. Ethical approval was obtained from the Newfoundland and Labrador Health Research Ethics Authority; IRB00011348. All participants provided written consent. An exploratory case-study design was employed by the researchers. Mixed method data collection was conducted using semi-structured interviews, document review and focus groups. Purposive sampling was used to draw from community-based managers and health and social care professionals providing care and service delivery to older people at any stage (before, during or after) of the CGA process (See Table 2). Participants were approached by email. The Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist was used to guide the reporting of research for this study (Appendix A). To build an accurate FRAM model, the researchers aimed to capture the variation in sampling by including one or more participants from each health and social care professional and managerial groups in the study. Ultimately, data saturation determined sample size. In total, 17 health and social care professionals and community-based managers were enrolled in the study.

Table 2 Description of participants

Healthcare professional	Number of participants
Geriatrician	3
Registered nurse	3
Nurse practitioner	1
Family doctor	2
Physiotherapist	1
Occupational therapist	1
Social worker	2
Pharmacist	2
Manager (community supports program)	2

Data collection

Semi-structured interviews. Semi-structured interviews were conducted individually in a private setting over the WebEx videoconferencing platform. Interviews were conducted by A.M. with V.S. as a note taker. Interviews were recorded and then transcribed. The length of the semi-structured interviews varied (range 47–120 min, mean 71 min). Interviews were directed by an interview guide (Appendix B). Questions and prompts were developed to elicit the data necessary to identify and describe functions and their aspects, the interdependencies between functions and how the CGA process may vary under dynamic conditions. Transcribed interviews were not returned to participants for comment or correction and there were no repeat or follow-up interviews. A.M. is a PhD candidate who has completed graduate level studies using the FRAM and has domain expertise in nursing. V.S. is a postdoctoral fellow with an academic research background in engineering and the application of the FRAM in the healthcare domain. Although the domain expertise of the interviewer could be viewed as a strength, it also could introduce bias due to the potential for preconceived assumptions or understandings of how health and social care services are delivered. In acknowledgment of the potential for bias, the interviewer and note taker met after each interview as a reflexive exercise to discuss interviews and to make any necessary adjustments for future interviews.

Document review. A review of documents identified by participants that assist in the completion of their everyday work with older people was conducted. Documents included older adult assessment guidelines and standardized referral forms. The documents reviewed assisted in confirming functions and aspects identified in interviews.

Focus groups. Focus groups were conducted using the WebEx platform. Participants completed a member checking exercise to validate the model. Participants were given time to examine the model and then ask questions and offer feedback on accuracy (Appendix C). Participants eliminated redundant functions and identified new functions and interdependencies to ensure the model was an accurate representation of their work.

Data analysis: steps of the FRAM

In keeping with the FRAM approach, data collected were used to undertake a stepwise examination and analysis. The following sections explain the five steps of the FRAM, and how the research team moved through the steps of the method to meet the study objectives.

Step 0: clearly describing the study purpose

The research team wanted to gain a better understanding of everyday operations and system functionality. The study purpose planned to identify where in the community-based comprehensive geriatric assessment process challenges and opportunities existed for moving towards a more integrated model of care delivery. Having a clear purpose and scope of the FRAM analysis allowed the research team to:

(1) Delineate the boundaries of the process they intended to examine.
(2) Prepare a sampling plan.
(3) Determine the most appropriate methods of data collection.

Step 1: mapping functions

The first study objective was to map the everyday activities and interdependencies of the CGA process in the community-based system using the FRAM to produce a functional model. Activities (functions) were mapped in terms of their aspects through data gathered from semi-structured interviews. Interview transcripts were analysed, and then selective coding of functions and their aspects was conducted by A.M. The data gathered from semi-structured interviews and document reviews informed the building of an initial FRAM model. FRAM model visualizer (FMV) software was used to graphically depict a preliminary model [22]. Two members of the research team met over 3 days to review the model and reach a consensus. The researchers conducted an inter-coder reliability assessment to measure the level of agreement regarding how the data were coded. A second team member performed selective coding of functions on three randomly selected interview transcripts. Codes were compared with those of the first team member. The percentage of agreement on identified functions ranged from 86% to 88%. The FRAM model of the community-based health and social care system is demonstrated below in Fig. 2 and is further described in the results section. The model as well as individual subsystems of the model can also be found in Appendix D.

Step 2: identifying performance variability

The second study objective was to identify instances of potential variability occurring in the CGA process. Hollnagel advises researchers to differentiate between the potential variability of functions (the model) and the actual variability of functions (an instantiation) [11]. Potential variability is defined as what might happen in the CGA process under dynamic conditions [12]. An instantiation represents how a subset of functions within the FRAM model are mutually coupled under certain conditions or within a certain time [14]. If considering an older person, an instantiation of the community-based CGA process would be their individual journey through the CGA process. The FRAM model itself can only demonstrate the potential variability of the community-based CGA process and not its actual variability. Examining the reasons why the output of a function varies (internal and external forces) as well as how variability will be demonstrated in the function's output (time and precision) should be conducted to gain an understanding of how downstream functions could potentially be impacted [12]. Semi-structured interview data informed the analysis of potential variability. Participants were asked specific questions on how the outputs from functions could vary and how that variability could show itself in the process (Appendix B). The analysis of potential variability is shown in Appendix E. Functions from which variability emerged were classified into five categories:

(i) Intake.
(ii) Assessment.
(iii) Decision-making.
(iv) Care planning.
(v) Communication.

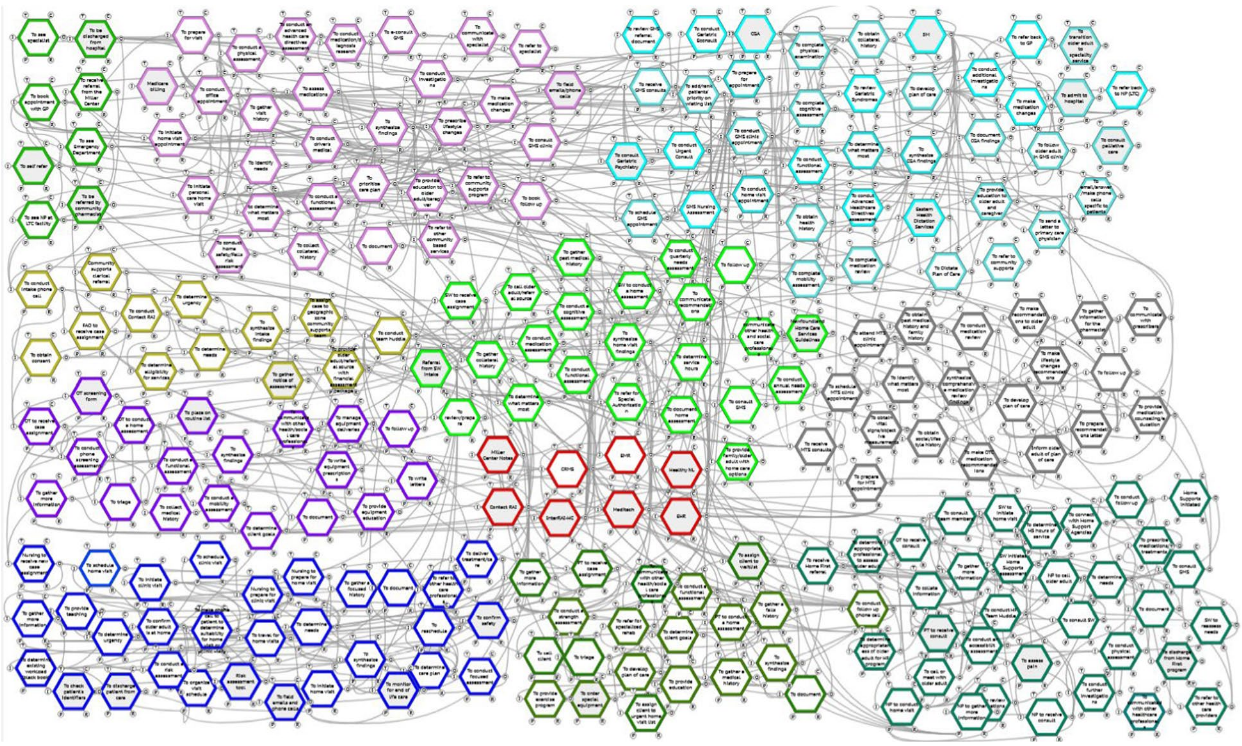

Fig. 2 FRAM model of the community-based health and social care system

Each category details the functions demonstrating potential variability, the manifestations of variability in terms of time and precision, the potential downstream effects of variability and proposed multi-level (micro-, meso-, macro-levels) recommendations to enhance positive variability and dampen negative variability. Hollnagel et al. [14] explain actual variability will always "be a subset of the potential variability" and researchers should take the time to conduct the exercise of characterizing potential variability to "avoid being unduly biased by having a specific scenario" (p. 53). The analysis of potential variability provided an improved understanding of how variability can potentially emerge and impact outcomes.

Step 3: determining the aggregation of variability

The third study objective was to provide an example of variability in the CGA process by developing a functional signature from a hypothetical patient journey scenario using DynaFRAM. Functions occurring earlier in healthcare process (upstream) can have an impact on functions later in the process (downstream). This is also known as the aggregation of variability. Functional resonance occurs when variability emerges in a system and aggregates in ways that lead to unexpected outcomes [11]. The DynaFRAM software was designed to be complementary to FRAM model visualizer (FMV) software [23]. The FMV can provide a visual representation of potential variability and DynaFRAM can provide a visual representation of actual variability using functional signatures, which are comparable to instantiations [16]. This is achieved by capturing and visualizing the variability of functions of an older adult's journey through the community-based CGA process. The unique journey and the particulars of variability of that journey (functional outputs) are monitored over time. The team developed a hypothetical patient journey scenario of how variability can emerge in the CGA process by using a composite of data gathered from the semi-structured interviews (Appendix F). The scenario demonstrates how variability emerges and can impact the community-based CGA process for older people. A patient journey is described as the many "touchpoints" with healthcare professionals (formal and informal) that occur over time and in numerous locations [9, 24]. The hypothetical patient journey scenario depicts Fred, a 76-year-old male patient who is referred by his family doctor to the GMS clinic for a CGA due to new onset of cognitive impairment. Figure 3 illustrates the active functions that depict Fred's patient journey. The functional signature provides an animation of multiple interactions Fred has with health and social care professionals in the community over a period, demonstrating extensive the waiting times, service duplication

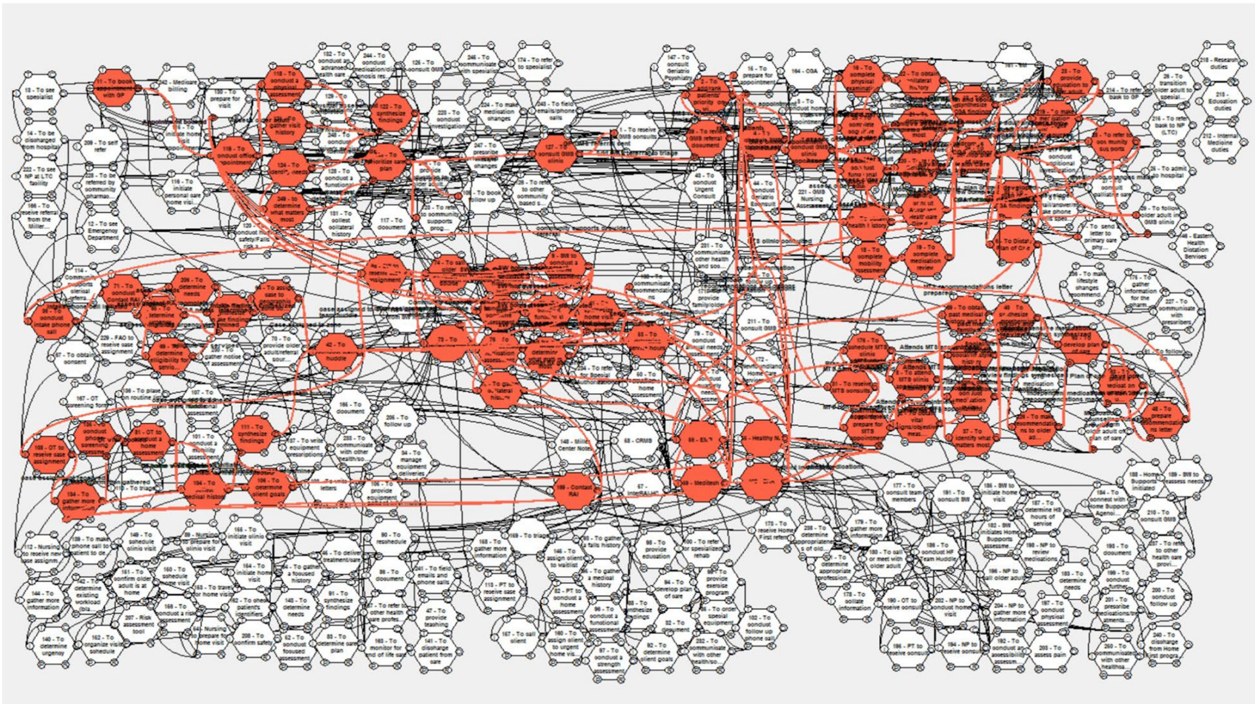

Fig. 3 Hypothetical patient journey scenario

and uncertainty experienced by Fred and his wife [23]. The scenario also demonstrates system strengths, such as interdisciplinary team huddles and opportunities for education, engagement and the development of self-management skills for older people.

The fourth study objective was to determine how the emergence of negative and positive variability can create challenges or generate opportunities for delivery of integrated health and social care for older people. Appendix G details the analysis of variability in the output of the functions that emerged along Fred's patient journey and the downstream effects that resulted from the emergence of positive or negative variability.

Step 4: make recommendations (propose ways to manage variability)

The fifth objective of the study was to co-design multilevel process improvement recommendations supported by normative and functional dimensions of integration. Rather than simply proposing recommendations and ways to manage variability, the team conducted an additional focus group with participants. The FRAM model and functional signature of the hypothetical patient journey were presented to participants, followed by study findings and preliminary recommendations. Study participants were invited to dialogue and provide feedback so that recommendations to manage variability could be co-designed. The visual depiction of work in the FRAM model and in the animation of the hypothetical patient journey using DynaFRAM provided the professionals the opportunity to examine and appreciate the work being conducted outside of their respective subsystems and mental models. Visualization of system inefficiencies, such as extensive waiting times and duplication of services, was impactful and generated dialogue and feedback that informed the co-design of recommendations. The professionals also dialogued about system strengths that can be further enhanced, such as team huddles, opportunities to build self-management skills and scope of practice optimization. The co-design of recommendations was a valuable exercise and not only ensured practicality and relevancy, but also provided professionals with a sense of engagement and ownership of process improvement efforts.

Results

Constructing the FRAM Model

Model Orientation. The FRAM model demonstrates the scale and complexity of the system in which health and social care professionals conduct their work and that older people are required to navigate to access care. The functions are grouped by colour to depict nine interconnected subsystems in which different health and social care professionals conduct their everyday work (See

Table 3 Subsystem by colour

Subsystem model	Function C¡colour
Occupational therapy	Purple
Physiotherapy	Army green
Community supports intake	Yellow
Pharmacist	Grey
Social work	Lime green
Home First Program	Dark teal
Nursing	Blue
Geriatrician	Light teal
Family doctor	Pink

Table 3). Subsystems are also depicted individually in Appendix D.

Organization and Categorization of Functions. When examining the functions of each subsystem it was determined that health and social care professionals each organized care for older people in a similar manner. Professionals moved through five categories: intake, assessment, decision-making, care planning and communication. The intake functions often consist of receiving a referral or being assigned to the care of an older person, followed by a determination of urgency. Appointments are then scheduled, or the older adult is placed on a waiting list for an appointment. The assessment functions vary on the basis of the professional lens. Despite the different professional backgrounds, several functions are repetitive, including collating information from multiple electronic health platforms, gathering medical history, current medications and functional, cognitive and mobility assessments, as well as determining needs and goals. Decision-making functions consisted of the synthesis of information gathered in the appointments. Care planning functions were dependent on the professional's scope of practice, and consisted of arranging follow/referral, prescriptions or discharge from care. Communication functions consist of verbal, fax, email, direct messaging and documentation in electronic platforms.

Model Complexity. Upon first examination, the model is vast and crowded, and the sheer number of functions is overwhelming. When examining the model in more detail, it can be appreciated as a collection of interconnected sub-systems or silos representing how work is described by the different professional groups. There are nine interconnected models that make up the larger system model (Appendix D). The number of functions in each subsystem range between 12 and 40, with an average of 27 functions per model. There are also two smaller clusters of functions. A red cluster of functions depicts the multiple electronic health platforms that are used by workers everyday. The cluster of green functions depict the multiple ways the CGA process can be initiated. When each sub-system is examined further, the functions and interdependencies can be appreciated like any other FRAM model, with one difference being that the boundaries of each sub-system are expanded by their connections to other subsystems.

Building the Model – Time and Human Resources. The time required of the team to transfer study data into each sub-system model varied. A logbook was kept by a member of the research team throughout the building process. The total building time of the community-based model was approximately 113 h (Table 4). As subsequent sub-system models were built, the proficiency in building improved.

Challenges for integrated care implementation

Challenges for integrated care implementation are also listed in Appendix H with participant quotations presented to illustrate the findings.

Primary care structure

Family doctors in the local setting practice medicine within the confines of the fee for service structure ,which limit most appointments to 15 min. This leaves little opportunity for older people to communicate their needs and have their needs met. The current structure challenges a family doctor's ability to deliver comprehensive care.

Siloed design

Each professional spends time gathering health information from multiple electronic health platforms, then assesses the urgency of needs and conducts assessment functions. Older people will find themselves "starting over" with every professional encountered in the process. No one is responsible for monitoring and assisting older

Table 4 Sub-system building time

Sub-system model	Number of functions	Approximate time to build in hours
Occupational therapy	19	7
Physiotherapy	21	7
Community supports intake	12	5
Pharmacist	20	10
Social work	24	12
Home First Program	34	14
Nursing	31	14
Geriatrician (GMS clinic)	40	27
Family doctor	31	17

people with the multiple services that they may need to access.

Electronic health record interoperability

Patients do not have one medical record; they have multiple records. There are platforms that store hospital-based records, prescription medication history and manual charts storing professional domain specific documentation. Each of these platforms may or may not be accessible to each professional. As a result, there is a lack of awareness of the involvement of other professionals in the circle of care.

Expertise of professionals/unregulated workers

Participants communicated that they lacked specialized training and education in the care of older people. Formal healthcare education programs graduate generalists, challenging the ability to build capacity across the health and social care workforce. There is currently no regulation of personal support workers and no standardization of education and training programs. This results in different levels of knowledge, skills and abilities in providing care and service delivery to older people.

Communication

Currently there are few mechanisms in place to facilitate interdisciplinary communication and shared care planning. Practice demands for health and social care professionals limit their availability to connect in a timely way. This also impacts consultation and referral practices. There is variability in the specification and completeness of consultation forms resulting in delays in care for older people.

Geriatrician accessibility

Waiting time from consultation to appointment can be as long as 2 years. Geriatricians described completing the bulk of the CGA, which is a lengthy exam (approximately 2 h). Geriatricians also described having various practice demands including academic and research responsibilities, as well as hospital-based clinical responsibilities.

Outcome measurements

There are currently no Patient Reported Outcome Measurements being collected that can provide a means of evaluating current programming.

Shared goals and objectives

There are no written/documented shared goals and objectives to guide community-based health and social care delivery.

Opportunities for integrated care implementation

Opportunities for integrated care implementation are also listed in Appendix H with participant quotations presented to illustrate the findings.

Communication

Direct messaging between pharmacists and geriatricians through the electronic health record was identified as convenient and facilitates shared decision-making and avoids lost productivity due to missed communication.

Team huddles

Team huddles were conducted 3 days/week in one of six community health zones. These team-based care meetings provided a means of developing shared care planning and identifying which professional(s) could best meet the needs of the older person. Professionals were also given opportunities to problem solve together and develop shared care plans.

Opportunities to build self management skills

Workers reported older people gained an improved understanding of their prescription and over-the-counter medication regimes as well as self-management skills from comprehensive medication reviews conducted by pharmacists. Physiotherapists, occupational therapists, and registered nurses (RN) also offer older people these opportunities when providing teaching on exercises, the use of mobility aides and instruction on conducting wound care and medication administration.

Accessible of health and social care professionals

Nurse practitioners, pharmacists, RNs and social workers can accommodate timely access for older people referred to their care when compared with geriatrician access.

Comprehensive examinations

Community-based CGAs provide older people access to comprehensive care planning that aims to maintain and prevent decline in an older person's intrinsic capacity and functional ability.

Recommendations – Managing variability

The FRAM analysis assisted the research team in gaining an understanding of how health and social care work is done on an everyday basis. The hypothetical patient journey provided an example of the functional path that could be taken by an older person. Gaining an understanding of potential variability and how variability emerged along the hypothetical journey and its downstream impacts assisted in anticipating challenges and opportunities for implementing integrated care in the local context. Findings from the FRAM analysis informed the development of co-designed multi-level process improvement recommendations that aim to move the local community-based CGA process towards a more integrated model of care and service. Recommendations are listed in Appendix I and are also listed as they relate to specific functions of the community-based CGA process in Appendixes E and G.

Discussion

The current siloed nature of the community-based health and social care system is not person-centred and promotes service duplication. The WHO [4] states "unless a people centred and integrated health approach is adopted, health care will become increasingly fragmented, inefficient, and unsustainable" (p. 7).

A transformative redesign is necessary but cannot be accomplished without an understanding of how health and social care professionals conduct their work and how older people receive care under dynamic conditions. The National Academies of Sciences Engineering and Medicine [9] state:

> *Without examining each level of the healthcare system – the environment, the organization, the health workers, and the patient at the center and how they interact and either help or inhibit one another, it is difficult to discern how their incentives and activities align and contribute to positive or negative effects on quality. (p. 9)*

This study examined and analysed these necessary parameters. The goal of a FRAM analysis is not to point out how a process or system is failing, but rather to describe and analyse how the system works [25]. A strength of the FRAM and DynaFRAM is the ability to depict the operations and functionality of a complex healthcare process. The model provided a map of the complex functional paths older people and professionals navigate daily. The functional signature demonstrated how the current process is designed to satisfy the structural and organizational fragmentation of health and social care delivery.

Study limitations and future research directions

The FRAM aims to examine processes and systems in local settings and provide context-specific recommendations to manage variability; this limits the transferability of study findings. An additional limitation is that the study would have benefitted from the perspectives and opinions of older people and their family/caregivers given the aim of integrated care delivery being centred around patient needs, preferences and goals. This study was able to demonstrate the use of a functional signature to represent a hypothetical patient journey across multiple subsystems. Future research could seek to create functional signatures depicting patient journeys using data from prospective or retrospective case study analyses. Case study data would likely provide important insight and perspectives from older people not identified in this study. Literature published to date on patient journey mapping indicates that it holds significant promise for understanding and improving complex care processes [26]. This study demonstrated how FRAM and DynaFRAM modelling could be used as a methodological approach to patient journey mapping in complex healthcare processes.

Conclusions

Addressing the health and social care needs of older people will continue to be a challenge as the population ages. Shifting towards integrated models of care will take time and require both bottom up (micro-level) and top down (meso-, macro-levels) support (20). The recommendations presented in this study aim to nudge clinicians, organizations and governments along the right path. FRAM modelling has demonstrated it can be a useful map to guide them.

Contributions to the literature

Transformative health system design cannot be accomplished without an understanding of how variability emerges under dynamic conditions and its downstream impact on how health and social care professionals conduct their work and how older people receive care.

FRAM modelling depicts the scale and complexity of the system in which professionals conduct their work and that older people must navigate to receive care.

The findings of this study demonstrate how FRAM modelling and analysis can achieve an enhanced system understanding and inform the development of recommendations to move the system towards more a more integrated model of care delivery.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12961-024-01196-6.

Additional file 1.
Additional file 2.
Additional file 3.
Additional file 4.
Additional file 5.
Additional file 6.
Additional file 7.
Additional file 8.
Additional file 9.

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Author contributions
The preparation of the semi-structured interview and focus group guides were completed by A.M., R.M., D.S. and B.V. Data collection was conducted by A.M. and V.S. A.M. analysed data and built the initial FRAM model. V.S. and A.M. finalized the FRAM model. D.S. and A.M. developed the DynaFRAM functional signature and animation. Contributions were made by all authors to the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials
The datasets analysed during the current study are not publicly available. To ensure participant privacy, restrictions apply to the availability of these datasets, which were used under licence for the current study.

Declarations

Ethics approval and consent to participate
This study was approved by the Newfoundland and Labrador Health Research Ethics Authority -IRB00011348. All participants gave fully informed written consent.

Consent for publication
Not Applicable.

Competing interests
The authors declare there are no known competing interests.

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References

1. Candian Institute of Health Information. Seniors in transition exploration pathways across the care continuum 2017 https://www.cihi.ca/sites/default/files/document/seniors-in-transition-report-2017-en.pdf.
2. Muscedere J, Andrew MK, Bagshaw SM, Estabrooks C, Hogan D, Holroyd-Leduc J, et al. Screening for frailty in Canada's health care system: a time for action. Can J Aging/La Revue canadienne du vieillissement. 2016;35(3):281–97.
3. Briggs AM, Valentijn PP, Thiyagarajan JA, de Carvalho IA. Elements of integrated care approaches for older people: a review of reviews. BMJ Open. 2018;8(4): e021194.
4. World Health Organization. World report on ageing and health: World Health Organization; 2015.
5. Ellis G, Gardner M, Tsiachristas A, Langhorne P, Burke O, Harwood RH, et al. Comprehensive geriatric assessment for older adults admitted to hospital. Cochrane database of systematic reviews. 2017(9).
6. Mazya AL, Garvin P, Unosson M, Ekdahl A. Outpatient comprehensive geriatric assessment: Effects on frailty. European Geriatric Medicine. 2016;7(Suppl 1):16.
7. World Health Organization. Framework on integrated, people-centred health services. 2016.
8. Welsh TJ, Gordon AL, Gladman J. Comprehensive geriatric assessment–a guide for the non-specialist. Int J Clin Pract. 2014;68(3):290.
9. National Academies of Sciences Engineering and Medicine. Crossing the global quality chasm: improving health care worldwide. 2018.
10. Kaplan GS, Bo-Linn GW, Carayon P, Pronovost PJ, Rouse WB, Reid PP, et al., editors. Bringing a Systems Approach to Health2013.
11. Hollnagel E. FRAM, the functional resonance analysis method: modelling complex socio-technical systems: Ashgate Publishing, Ltd.; 2012.
12. Hollnagel E, Slater D. FRAMSYNT A FRAM Handbook. 2022.
13. Ross A, Sherriff A, Kidd J, Gnich W, Anderson J, Deas L, et al. A systems approach using the functional resonance analysis method to support fluoride varnish application for children attending general dental practice. Appl Ergon. 2018;68:294–303.
14. Hollnagel E, Hounsgaard J, Colligan L. FRAM-the Functional Resonance Analysis Method: a handbook for the practical use of the method: Centre for Quality, Region of Southern Denmark; 2014.
15. Clay-Williams R, Hounsgaard J, Hollnagel E. Where the rubber meets the road: using FRAM to align work-as-imagined with work-as-done when implementing clinical guidelines. Implement Sci. 2015;10(1):1–8.
16. Smith D, Veitch B, Khan F, Taylor R. Integration of resilience and FRAM for safety management. ASCE-ASME J Risk Uncertain Eng Syst Part A. 2020;6(2):04020008.
17. Sullivan-Taylor P, Suter E, Laxton S, Oelke ND, Park E. Integrated people-centred care in Canada-policies, standards, and implementation tools to improve outcomes. Int J Integr Care. 2022. https://doi.org/10.5334/ijic.5943.
18. Valentijn PP, Schepman SM, Opheij W, Bruijnzeels MA. Understanding integrated care: a comprehensive conceptual framework based on the integrative functions of primary care. Int J Integr Care. 2013. https://doi.org/10.5334/ijic.886.
19. Threapleton DE, Chung RY, Wong SY, Wong E, Chau P, Woo J, et al. Integrated care for older populations and its implementation facilitators and barriers: a rapid scoping review. Int J Qual Health Care. 2017;29(3):327–34.
20. De Carvalho IA, Epping-Jordan J, Pot AM, Kelley E, Toro N, Thiyagarajan JA, et al. Organizing integrated health-care services to meet older people's needs. Bull World Health Organ. 2017;95(11):756.
21. Angus L, Valentijn PP. From micro to macro: assessing implementation of integrated care in Australia. Aus J Primary Health. 2018;24(1):59–65.
22. Hollnagel E, Hill R. FRAM model visualiser instructions. 2020.
23. Smith D. Community-Based Geriatric Medicine Services n.d. https://www.engr.mun.ca/~d.smith/cbgms.html.
24. Devi R, Kanitkar K, Narendhar R, Sehmi K, Subramaniam K. A narrative review of the patient journey through the lens of non-communicable diseases in low-and middle-income countries. Adv Ther. 2020;37(12):4808–30.
25. Sujan M, Pickup L, de Vos M, Patriarca R, Konwinski L, Ross A, et al. Operationalising FRAM in healthcare: a critical reflection on practice. Saf Sci. 2023;158: 105994.
26. Joseph AL, Kushniruk AW, Borycki EM. Patient journey mapping: current practices, challenges and future opportunities in healthcare. Knowl Manage e-learn. 2020;12(4):387.

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