



A qualitative system model to describe the causes and drivers of frequent potentially avoidable presentations to the emergency department

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A B S T R A C T

Frequent potentially avoidable presentations to Emergency Departments (EDs) represent a complex problem, driven by multiple interdependent and interacting factors that change over time and influence one another. We sought to describe and map the drivers of frequent potentially avoidable presentations to a regional ED, servicing regional and rural areas, and identify possible solutions from the perspectives of key stakeholders. This study used a qualitative, community-based systems dynamics approach utilising Group Model Building (GMB). Data were collected from two 3-h online workshops embedded with small-group discussions and conducted with stakeholder groups operating within a regional health system. Stakeholders were guided through a series of participatory tasks to develop a causal loop diagram (CLD) using Systems Thinking in Community Knowledge Exchange software (n=29, workshop one), identify potential action points and generate a prioritised action list to intervene in the system (n=21, workshop two). Data were collected through note taking, real-time system mapping, and recording the workshops. Each action was considered against the Public Health 12 framework describing twelve leverage points to intervene in a system. A CLD illustrating the complex and interrelated factors that drive frequent potentially avoidable ED presentations was developed and classified into four categories: (1) access to services; (2) coordination; (3) patient needs; and (4) knowledge and skills. Nine action areas were identified, with many relating to care and service coordination. Most actions aligned with lower-level system impact actions. This study provides an in-depth understanding of influencing factors and potential solutions for frequent potentially avoidable ED presentations across a regional health system. The CLD demonstrates frequent potentially avoidable ED presentations are a complex problem and identified that a prevention response should engage with system- and individual-level solutions. Further work is needed to prioritise actions to support the implementation of higher-level system impacts.

1. Introduction

The global increase in use of Emergency Departments (EDs) [1,2] has focused attention on individuals with frequent potentially avoidable presentations (hereafter referred to as frequent presentations) to the ED, who generate a disproportionate number of ED visits and are heavy users of the broader healthcare system and social services [3,4]. As a population, frequent presenters are heterogenous with highly varied individual characteristics, and complex physical, mental, and social problems [3,4]. Existing interventions focus primarily on isolated, individual-level (micro-level) interventions and have experienced mixed success in addressing the complex and interdependent range of health and social care needs driving frequent presentations [5,6]. Notably, frequent

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presenters, variably defined between ≥ 3 and ≥ 7 ED visits/year, experience brief periods of intense need before typically returning to infrequent use [7–10].

Burton et al. (2022) identified frequent presentations follow a power law distribution and conceptualised frequent presentations as a “continuum of attendance rather than a discrete problem of exceptional individuals” [11]. This suggests micro-level interventions directed towards these complex patients fail to address wider macro- and meso-level systems driving frequent presentations [12]. For example, case management, the most frequently implemented intervention to address frequent presentations, is tailored to individual patient needs and designed to connect individuals with existing services [5,13]. However, case management typically does not seek to change or adapt existing services [12].

Evidence suggests the complex system driving frequent presentations means while micro-level interventions may benefit the individual, macro- and meso-level issues remain unchanged [11]. As such, the system continues to drive individuals to frequently present to the ED with the burden on the healthcare system remaining unchanged [11]. A broad range of international studies identify systemic healthcare barriers leading to seeking ED care include difficulty in accessing healthcare services (in particular, primary care) [14–23], inadequate discharge processes [21–24], costs associated with primary care [19], primary care physician shortages [19], lack of continuity of care outside the ED and poor collaboration between services [21]. In contrast, easy access to the ED 24 h a day, 7 days a week [16,21], ready transport [16,17,21], the availability of specialist care, technology and tests in one location [14,22], and the ED acting as gateway to other specialist services e.g., addiction services [23] were notable healthcare system enablers to seeking ED care. This suggests solutions may be more effective by embracing complexity, acting at multiple levels using multiple strategies, and engaging with multiple individuals and organisations [25].

System science reframes complex problems from simple, linear, causal models to complex models of multiple interdependent and interacting components that change over time and influence one another within a connected whole [26–28]. This approach is increasingly advocated to develop and evaluate solutions for such ‘wicked’, intractable problems [26–28]. The development of causal loop diagrams (CLD) is a common systems science method to visually represent all involved components and their interconnections operating in the system of interest [29].

People living in rural areas of high-income countries including Australia, USA and Canada experience an increased burden of disease, worse health and mortality outcomes, reduced access to primary care, and higher rates of hospitalisations than their metropolitan counterparts [30–32]. Healthcare inequities in rural areas are further constrained by limited access to health care services, higher costs, and chronic health workforce shortages [33]. Rural populations are more likely to attend ED and their presentations are often in the lower triage categories, less urgent and potentially avoidable [34,35]. As a result of these challenges, rural populations may engage with the healthcare system differently than metropolitan populations and require solutions tailored to rural context.

There is scarce literature on exploration of frequent presentations using systems science, globally or in a rural context, despite the high need to provide a better system for the delivery of acute, unscheduled care, and improve population health. Therefore, the aim of this study was to: (1) describe a shared understanding of the causes and drivers of frequent presentations to the ED and, (2) to identify potential actions to address this challenge in a rural context.

2. Materials and methods

2.1. Study design and setting

This research is an ongoing qualitative community-based participatory study. Complexity theory underpins this study and refers to interdependent agents interacting, learning from each other, and adapting their behaviours in a system [36].

This study was conducted at a regional public health service serving a catchment population of around 250,000 people [37]. Care is delivered across the hospital, community, and the home [37]. The catchment can be characterised from a healthcare access perspective using the Modified Monash Model (MMM) scoring system (range 1–7) as a rural pattern incorporating a regional centre (MM2, scores ≥ 2 to < 3), and large (MM3), medium (MM4), and small (MM5) rural towns [38]. Several areas within the catchment have lower health status and low socioeconomic status compared to Victorian state-wide rates [37]. In 2019, the main public hospital, located in the regional centre, had approximately 46,800 total ED visits (≥ 18 years), of which 11,800 visits were frequent presentations (presented ≥ 5 /year) accounting for 25 % of total presentations. Frequent presentations were defined as ≥ 5 presentations in a 12-month period based on the definition proposed by Shukla et al. (2020) [39].

2.2. Selection of participants

Participants were identified through purposive and snowball sampling [40]. Inclusion criteria included people with the authority or ability within stakeholder organisations to influence change, or with lived experience of the health system; were ≥ 18 years of age; and able to access online platforms for workshops. Stakeholder organisations represented health and community services caring for people with chronic and complex conditions that may have frequent presentations to the ED e.g., hospital services, paramedic services, drug and alcohol services, hospice care. Participants from health and community services included a broad range of clinicians, nurses, executives, managers, program leads, and research coordinators. Exclusion criteria included limited English language proficiency or any condition that limited their ability to provide informed consent (e.g., cognitive impairment), or inability to commit to attending the workshops. Participants were sent an email letter of invitation and asked to complete and return a consent form or consent was documented in the first workshop by participants in the chat.

2.3. Group Model Building

This study was a community-based systems dynamics approach utilising Group Model Building (GMB). Facilitation of the 3-h GMB workshops conducted in October (workshop 1) and November (workshop 2), 2021, and were guided by a precise set of scripts adapted from Scriptapedia [41]. This study describes the initial two online GMB workshops. The workshops consisted of several participatory tasks in small breakout rooms followed by whole group discussions. GMB workshops were recorded, with field notes taken of the discussion during each workshop (see GMB process outline in Appendix 1).

The GMB workshops explored the system drivers of frequent presentations with information collated using Systems Thinking for Community Knowledge Exchange (STICKE) [42] software to create a CLD. A CLD is a visual representation of the participants shared understanding of the problem and demonstrates two kinds of feedback mechanisms; reinforcing loops where change in one direction is compounded by more change, and balancing loops where change in one direction is countered by change in the opposite direction (see Fig. 1) [43]. Participants were asked “What are the current drivers of frequent presentations to the ED?. Team reflexivity occurred during debriefing sessions following workshops, to reflect, to give and receive feedback, discuss what worked well and what could be improved individually, as a team and at a session level.

Two modellers (SA, LA) worked with the stakeholders to develop a CLD of their understanding of the drivers of frequent presentations to the ED. A broader team of facilitators (MaM, AWS, MM, KM) and 3 non-author clinicians) worked with stakeholders in smaller breakout rooms to identify potential action points and generate prioritised actions to intervene in the system. Each action was assessed to determine their potential to produce system-level effects.

2.4. Data analysis

The initial CLD was created during the first workshop and refined following the workshop by reviewing the recorded audio and notes. The refined CLD was presented at the second workshop and through an iterative and reflective process, participants reviewed the CLD, confirmed modifications represented their perceptions, refined any inaccuracies, and discussed further if necessary. Following finalisation, researchers (MaM, MM, KM, AWS) independently organised factors into potential categories before meeting to review and reconcile discrepancies by consensus to achieve the final four emergent categories. The recorded audio and notes were used to describe participants’ knowledge of the local healthcare system within each category.

The potential points for intervention and prioritised actions to intervene in the system were created during the second workshop.

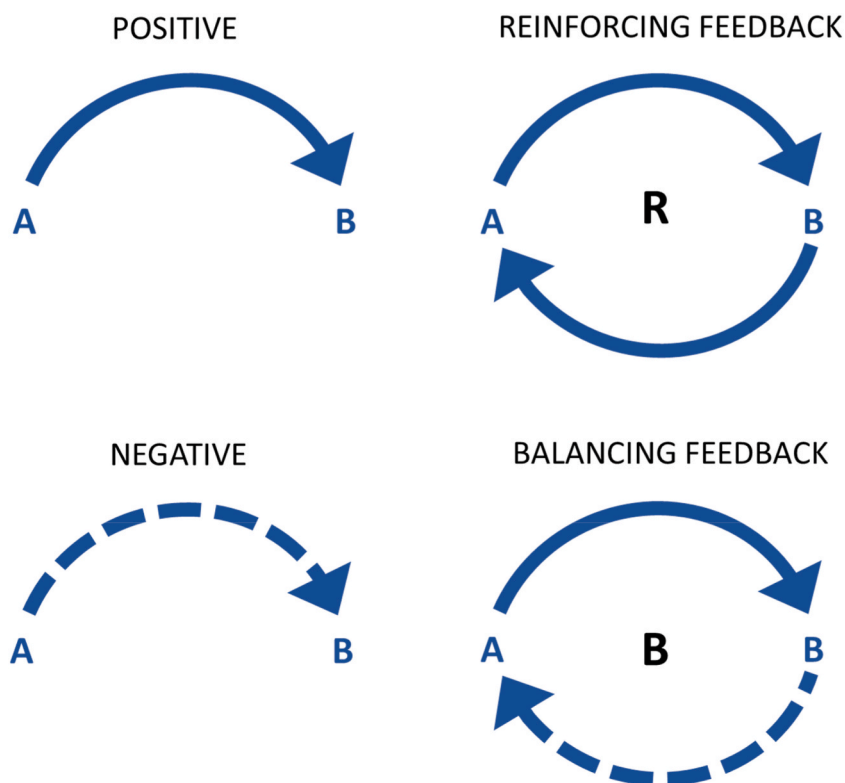
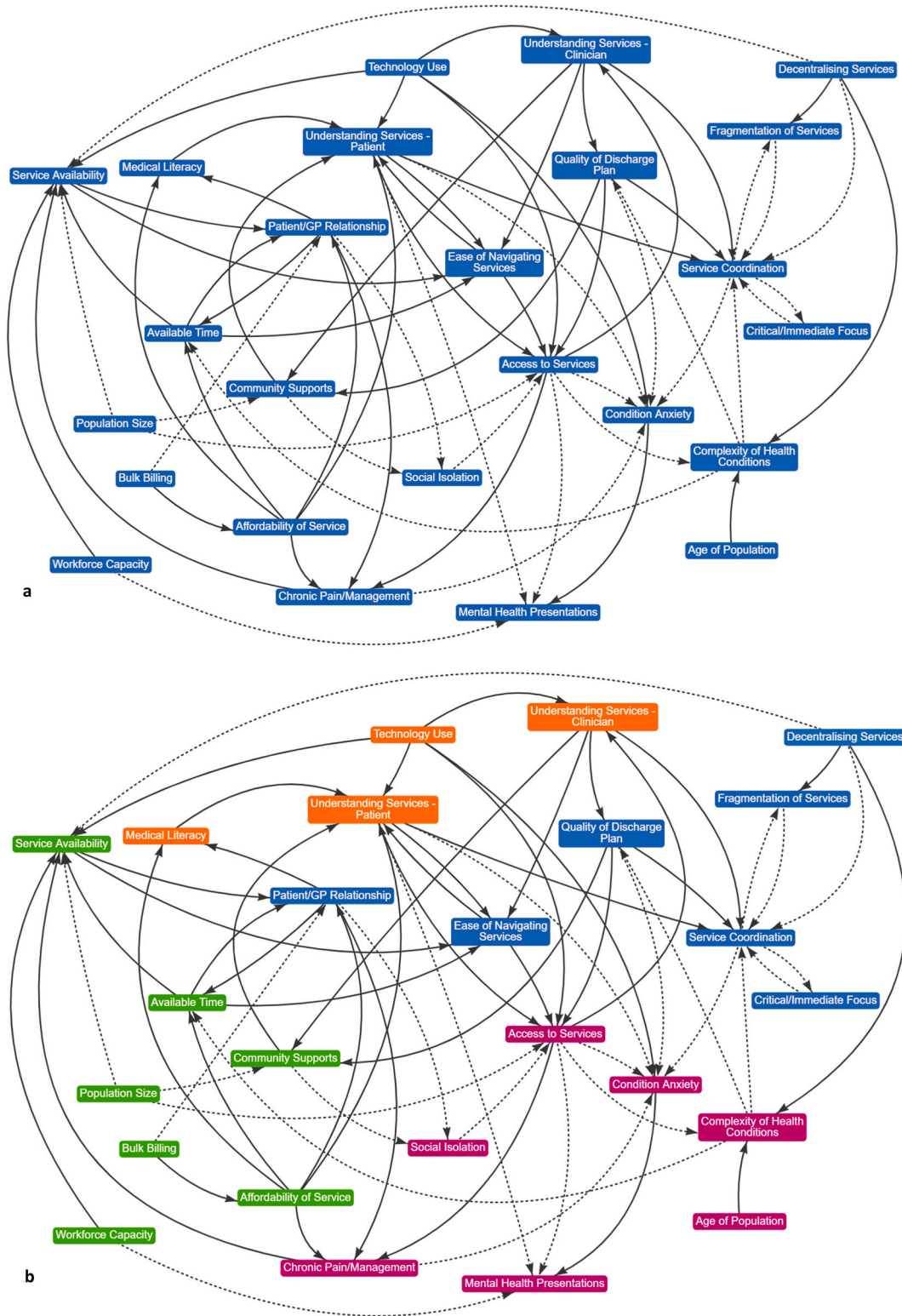


Fig. 1. Causal loop diagram notation. A solid line shows a positive relationship between factor A and factor B whereby factor B increases or decreases in a way that is the same as the factor A. A dashed line shows a negative relationship between factor A and factor B whereby factor B increases or decreases in a way that is opposite to factor A.



(caption on next page)

Fig. 2. Fig. 2a Causal loop diagram of the causes and drivers of frequent presentations to the emergency department. A solid line shows an increase in factor A increases factor B, and decrease in factor A decreases factor B. A dashed line shows an increase in factor A decreases factor B, and a decrease in factor A increases factor B.

Fig. 2b Causal loop diagram of the causes and drivers of frequent presentations to the emergency department classified in four categories: access (green), coordination (blue), patient needs (pink), and knowledge and skills (orange). A solid line shows an increase in factor A increases factor B, and a decrease in factor A decreases factor B. A dashed line shows an increase in factor A decreases factor B, and a decrease in factor A increases factor B.

The recorded audio, notes, and potential actions documented by participants was reviewed by researchers following the workshop to compile a list of identified actions. Researchers (MaM, MM, KM, AWS) met to organise the actions, develop a framework of overarching action areas, define each action area, and classify each sub-action within the framework. Differences were discussed and any disagreements resolved through consensus.

The Public Health (PH12) framework for translation of the ‘Meadows 12 places to act in a system’ was used to categorise actions according to the level of impact in the system [44]. Table 1 presents the definitions of the framework consisting of 12 levels with increasing order of effectiveness from level 12 to 1 [44]. Allocation of actions to PH12 categories was retrospective, iterative and guided by the researchers who developed the PH12. Researchers (MaM, KM, AWS) initially categorised actions independently and compared findings. Differences were discussed and any disagreements resolved through consensus by researchers (MaM, KM). Alignment was also informed by researcher experience with similar actions and the types of activities typically associated with these actions.

3. Results

3.1. Characteristics of study participants

Participants from nine organisations (including health, community, and social services) attended workshops 1 (n = 29) and 2 (n = 21) (Table 2) with 19 participants attending both workshops, 10 attending the first workshop only, and 2 attending the second workshop only. Participants included nurses, ED staff, allied health professionals, senior administration staff, and consumers.

3.2. Causal loop diagram

The shared understanding of the causes and drivers of frequent presentations to the ED (Fig. 1a) were illustrated using four colour-coded categories: access, coordination, patient needs, and knowledge and skills (Fig. 1b). Multiple feedback loops were observed that were interconnected and traversed these categories. Feedback loops illustrate how cause can be delineated through a chain of variables, back to the original cause [43].

Table 1
Public Health 12 translation of the Meadows 12 system leverage points.

| Level | Meadows 12 (M12) | Public Health 12 (PH12) |
|-------|----------------------------|---|
| 1 | Transcending paradigms | The ability to continually adapt collective fundamental beliefs leading to widespread change in the way things are, to respond effectively to multiple complex problems. |
| 2 | Paradigms | A population-level shift in fundamental beliefs (e.g., cultural shift) on how to respond effectively to complex problems (a change in the way things are). |
| 3 | Goals | Where a fundamental goal of a system is challenged and changed. |
| 4 | Self-organisation | Creating and maintaining infrastructure (e.g., political or governance) for implementing a combination of various level 5–12 actions over time. |
| 5 | Rules | New modified rules such as incentives and accountability mechanisms for change. |
| 6 | Information flows | Movement of vital information to shift power dynamics that opens the decision-making processes to more (and the right) people. |
| 7 | Reinforcing feedback loops | Initiating a movement toward a target that is self-reinforcing and growing exponentially in the desired direction. |
| 8 | Balancing feedback loops | Taking action to stabilise a part of the system to achieve a specific intended goal. |
| 9 | Delays | Strategic planning to align timeframes with available resources, current readiness, and intended outcomes. |
| 10 | Stock and flow structures | Building of new physical infrastructure, providing financial infrastructure, and/or improving physical movement through the system. |
| 11 | Buffers | To maintain a safety net within our community or system to absorb reasonably foreseeable, but unexpected events without adversely affecting the way things are. This includes supports for individuals and groups built into environments, schools, workplaces. |
| 12 | Numbers | To increase or decrease one isolated, existing part of the system. |

Adapted with permission from Bolton et al., 2022 [44].

Table 2
Participating stakeholder organisations.

| Organisation | Number of Participants | Roles |
|------------------------------------|------------------------|--|
| Paramedic Service | 4 | Director, program leads, area manager |
| Community Health Services | 3 | Director, executive managers |
| Hospice Care | 2 | Clinical coordinator, research coordinator |
| Hospital ^a | 19 | Senior clinicians, nurses, care coordinator, occupational therapist, psychologist, clinical manager, executive director, liaison staff, pharmacist |
| Consumers | 3 | |
| Disability Services | 1 | Outcomes specialist |
| Primary Care and Pharmacy Services | 1 | Chief executive officer |
| Drug and Alcohol Service | 2 | Intervention clinicians |
| Primary Health Network | 2 | Program leads |

^a Includes stakeholders from the Hospital Admissions Risk Program; Emergency Department; Disability Liaison; Family and Domestic Violence; Aboriginal Hospital Liaison; Allied Health; Pharmacy; Pain Management.

3.3. Access

Access to healthcare services was influenced by supply and demand, and affordability of healthcare services, and was also related to the ability of healthcare services to address chronic conditions. Participants suggested neither healthcare capacity nor workforce size had kept pace with the growing population, limiting the ability for healthcare services to “keep up”. Compounding this was a lack of general practitioner (GP) care or an urgent care centre after-hours, resulting in the perception of the ED as providing default care. Participants also noted difficulty to obtain timely appointments with GPs and declining continuity of care as longstanding GPs retire. Affordability of healthcare services was another important aspect of access to healthcare services with participants suggesting fully government-subsidised (“bulk-billing”; where health professionals opt not to charge a discretionary co-payment) services were lacking, precluding those most vulnerable from seeking and receiving healthcare. The general lack of bulk-billing services increased the length-of-time to access bulk-billing GPs leading to patients seeing multiple GPs further contributing to declining continuity of care. Access and affordability of healthcare services was associated with the development of positive relationships between patients and their GP. In parallel, changing needs of patients required healthcare services to shift from providing acute care to managing long-term chronic and complex conditions. Participants highlighted the challenges of an ageing population influenced access because of an increase in the complexity of health conditions and number of patients with multiple chronic conditions. Further, participants suggested GPs often have short consults with insufficient time to address complexity.

3.4. Coordination

Care coordination was impacted by ongoing decentralising (e.g., disability services) and siloed healthcare services, the quality of discharge planning, and the strength of the relationship between the patient and their GP. Decentralising healthcare services increased the complexity of the health system, negatively affected coordination and increased fragmentation, leading to “silos” of healthcare. Participants identified poor communication between different healthcare services and with patients hampered coordination and reinforced healthcare silos. Similarly, participants suggested that engagement between the local hospital and community had declined with a lack of senior clinician oversight and support for community services (e.g., aged care, paramedic services) leading to a gap in responsibility for developing care teams. An important consequence of the healthcare silos identified was the narrow focus (i.e., not holistic) of the ED and other healthcare services, the communication and coordination barriers between healthcare services, and lack of clear clinical pathways (e.g., inadequate discharge planning). Participants suggested consequences of fragmentation and lack of coordination meant healthcare providers and frequent presenters were unsure of appropriate services and programs, and as a result the ED became a default setting for care. Participants noted that there were gaps in the responsibility for funding and development of care coordinators and difficulties with accessing existing care coordination because of strict eligibility criteria. Further, the strength of the patient/GP relationship was identified as important for the ease of navigating services and service coordination because of the increased support and guidance provided (e.g., medical literacy).

3.5. Patient needs

Patient needs incorporated patient-related factors and healthcare service-related factors driving unmet need, including demographic (e.g., age of population), psychosocial (e.g., social isolation), medical needs (e.g., complexity of health conditions), and the acute focus of healthcare services. As the age of the population increased, the complexity of health conditions and multimorbidity increased. A similar increase in socially isolated patients with a lack of support structures presenting to the ED has been observed by participants and may be related to the ageing population. Participants suggested patients prefer to stay at home (rather than enter aged care), resulting in complicated home management and challenges associated with home care packages. Participants suggested primary care and early intervention healthcare services find it increasingly difficult to address the needs of people with complex conditions particularly mental-physical multimorbidity and foster self-management. Further, participants suggested the medical model overrides

Table 3
Actions identified, defined, and aligned with the Public Health 12 framework.

| Overarching action | Definition | No. Actions | Identified Actions | PH12 Level (1–12) |
|---|---|-------------|--|-------------------|
| Improving after-hours access | Extend normal business hours for services that offer more appropriate care than the ED. | 4 | • Extending hours of normal operation of business hours to facilitate equitable patient care independent of time. | 11 |
| | | | • Need for supportive services to be able to respond rapidly, rapid access to care. Extending normal operating hours from 10am–10pm. | 11 |
| | | | • Provide access to services (urgent or non-urgent) after hours. Fast food model of care/walk in clinic near the hospital. | 8 |
| | | | • Providing out of hours services and social isolation support. | 11 |
| Improving quality and access to chronic disease management | Developing effective and accessible systems to improve the management of people with chronic and complex conditions. | 3 | • Develop a pain management centre. | 10 |
| | | | • More chronic pain management to decrease the length of time spent on a waiting list for a consultant review. | 11 |
| | | | • Create a regional best practice model for chronic condition support and management. | 4 |
| Improving service coordination | Create mechanisms at an organisational/system level for better planning and seamless delivery of care for people with chronic and complex conditions. | 13 | • Create care planning teams to improve sharing of information between health services and paramedic services for better tailored care. | 10 |
| | | | • Nurse coordination model to support more in-depth ongoing planning (e.g., ED and broader systems). | 11 |
| | | | • Implement new roles: discharge planners and community health service navigators. | 10 |
| | | | • Improve quality of complex ED discharge plans (e.g., flag complex patients). | 12 |
| | | | • Intervention at quality of ED discharge plan. | 12 |
| | | | • Focus on referral pathways and communication/accountability. | 10 |
| | | | • Allocate a nurse coordinator to manage waiting lists and service coordination (e.g., GPs/ED/Pain clinic). | 12 |
| | | | • Build better relationships between paramedic services, aged care services and residential in-reach services. | 9 |
| | | | • Upskill and educate staff on discharge planning and service access. Educating ward staff on when and who to refer to. Upskilling discharge planners. Educate staff on criteria/guidelines for referral process (e.g., health pathways). | 10 |
| | | | • Create a sustainable system for sharing knowledge of what various services are available and knowing how to access these services consistently. Include a patient advocate for vulnerabilities (e.g., frailty, NESB, drug and alcohol issues). | 10 |
| | | | • Increase awareness of services and develop an agreed process, augmented by high functioning IT software systems which are user friendly. | 12 |
| | | | • Increase ED staff understanding of services available. | 12 |
| | | | • Repository of services adjusted for time of arrival (e.g., dynamic resource- web or other). | 12 |
| Improving care coordination | Implement ongoing and direct patient-centred care coordination to ensure comprehensive support and coordination to patients at high risk of future ED admissions. | 4 | • Support clinicians to provide hybrid models of care (e.g., telehealth and face to face): | 10 |
| | | | o Support access and utilisation of telehealth platforms. | 10 |
| | | | o Identify appropriate conditions for telehealth/in person. | 10 |
| | | | o Create and test new models using these methods. | 10 |
| | | | • Create a dedicated coordination team. | 10 |
| | | | • Care navigator: | 10 |
| | | | o Primary care practices with navigators with knowledge of local services/social prescribing. | 10 |
| o Network between hospital care navigators and community care navigators. | 10 | | | |

(continued on next page)

Table 3 (continued)

| Overarching action | Definition | No. Actions | Identified Actions | PH12 Level (1–12) |
|--|--|-------------|---|-------------------|
| | | | o Informed by similar models used in Northern Territory and Eastern Melbourne. | |
| | | | • The introduction of multi-disciplinary teams from across different services and sectors collaborating on solutions with the patient (i.e., patient centred care). | 10 |
| Improving information sharing | Use of IT/alerts to promote systematic identification and information sharing for people who are at high risk of avoidable ED presentations. | 2 | • Community alerts to improve admission and discharge processes. | 12 |
| | | | • IT investment in technology and patient management programs to support flagging of patients, development of care and discharge plans (e.g., aligning IT platforms across the region). | 4 |
| Streamlining triage processes | Create mechanisms/resources and decision-making processes to bypass ED and divert patients to alternative and more appropriate care. | 6 | • Have a 'one stop' entry point to care coordination for ED with a 24-h presence. | 11 |
| | | | • Have a single assessment body to streamline assessment. A 'one stop shop' for access to services regardless of age, condition etc. | 10 |
| | | | • Create a potential bypass to the ED where suitable. Particularly for palliative care, supportive care, and life care when there are no further interventions or investigations. | 8 |
| | | | • Bypass the ED and provide direct access to admissions. | 8 |
| | | | • Improving models for immediate response after hours and considering the context of the population. | 11 |
| | | | • Create new patient pathways to avoid transport to ED and care where appropriate. | 10 |
| Upskilling staff on managing complex patients | Empower ED staff to address the holistic needs of complex patients at risk of frequent presentation. | 1 | • Ongoing training programs and resources for mental health support and competency in working with frequent ED attenders. | 11 |
| Developing/ implementing alternative ED models | Develop alternative model of ED delivery and/or implementing ED care solutions. | 1 | • ED in the home, "flying squad". Flying squad of doctors, nurses, paramedics, MET call trigger, to trouble-shoot in the home. | 8 |
| Improving patients' health literacy | Implement interventions and programs that will improve patients' ability to determine appropriate health service utilisation. | 5 | • Patient education in medical/health literacy. Health education (e.g., How does the body work? How do I prevent illness and promote wellness?). | 11 |
| | | | • Patient education on hospitals (e.g., When do I need to go to hospital? What are the benefits of seeking ED care? What are the negatives of not attending the ED?). | 11 |
| | | | • Focus on what is the core business of the ED? How to shift the ED being the default setting? | 11 |
| | | | • Improve patient's understanding of services. Paramedic services can act on this by informing patients/having information about alternative patient pathways and residential in reach services that is accessible to paramedics and aged services staff when and where they need it. | 11 |
| | | | • Educate people on the benefits of advanced care plans and how to complete them. | 11 |

Abbreviations: *GP* General Practitioner; *ED* Emergency Department; *IT* Information Technology; *MET* Medical Emergency Team; *NESB* non-English Speaking Background.

the social model of health with healthcare services addressing the immediate and acute need (i.e., a single medical issue) rather than address the broader and related issues to break the cycle of re-presentations to the ED.

3.6. Knowledge and skills

The combination of knowledge and skills allow health professionals to provide high quality healthcare to people with complex health conditions and enables patients with complex healthcare needs to navigate the healthcare system. Participants suggested increasing knowledge and skills of ED healthcare professionals and patients increased capacity to access alternative care options and reduced presentations to the ED. Participants identified the increasing healthcare system complexity made it challenging to keep abreast of the service ecosystem (i.e., which services and programs are available). A need for ED healthcare professional training to

focus on mental health, a holistic approach to the provision of healthcare, and the promotion of self-management for people living with chronic conditions was also identified. Similarly, training and resources were viewed as important for general practices and primary care providers to support understanding of services available. Health literacy was an important factor contributing to the understanding of services by patients with participants suggesting patients lack awareness of alternative care, or what constitutes an emergency thereby using the ED as a default system of care. Participants also suggested clinicians required knowledge of community supports available and clear referral processes to facilitate patient education and access to alternative services. The role of technology to increase clinician and patient understanding of services was less clear. Participants suggested technology and the availability of telehealth improved communication between services; however, increased patient condition anxiety due to the issues of abundance or readily available, but not necessarily credible, online information, and the risk of self-diagnosis.

3.7. Action areas

Nine action areas were identified by participants (Table 3). There was a focus on improving healthcare coordination through organisational level actions to foster seamless delivery of care for people with chronic and complex conditions (e.g., improving discharge planning). Several actions centred on streamlining triage processes to divert patients to alternative and more appropriate care (e.g., bypass the ED and provide direct access to admissions). A range of actions to address patients' health literacy were a focus to improve the ability of patients to determine appropriate health service utilisation (e.g., medical/health literacy education).

Other action areas included care coordination with actions directed towards provision of care coordination support to patients at high risk of future ED presentations (e.g., care navigation); improving after-hours access to alternative care options (e.g., extending business hours); and improving the quality and access to chronic disease management for seamless delivery of care for people with chronic and complex conditions (e.g., regional best practice model for chronic disease support and management).

Some actions were developed to address information sharing and upskilling staff on managing complex patients. A high-functioning IT system to support information sharing and alerts to systematically identify high-risk patients and the need to empower ED staff to address the holistic needs of high-risk complex patients through education and training were considered important. Similarly, developing alternative ED models (e.g., ED in the home) was also considered important.

There were several macro-level actions suggested by participants including increasing bulk billing capacity in primary care and Medical Benefits Schedule rebates (government subsidised health services), improving nurse-to-patient ratios, improving access to National Disability Insurance Scheme (in particular, for those aged over 65 years), and commissioning needed services e.g., mental health. Because these actions require local, state, and federal support, they were beyond the scope of this study.

Table 3 presents the actions categorised according to the level of impact based on the PH12 framework. Of 39 actions documented, more than three-quarters ($n = 32$) were allocated between levels 10–12 (lower-level system impact actions). Five actions were allocated to level 8–9, and 2 actions allocated to between level 4–7 (higher-level system impact actions). Higher level actions included creating a bespoke regional best practice model for chronic disease management to address chronic and complex conditions (level 4). This action included a region-wide group with shared guidelines across organisations to support governance and a shared understanding of processes, identification of patients with frequent presentations, and a patient-centred approach to management of patients with chronic conditions according to best practice. Similarly, improving information sharing by aligning IT platforms across the region was another high-level action (level 4). This action generates a structure to create and maintain seamless sharing of information (i.e., communication within and between services) and acts on various level 5–12 actions over time. An example of a lower-level action is to increase ED staff understanding of services available (level 12). This action increases knowledge in one isolated part of the system that already exists within the health system.

4. Discussion

This study described and mapped the drivers of frequent presentations to a regional ED, servicing rural areas, identified potential points for actions, and created a prioritised list of actions through engaging key stakeholders within system. A detailed CLD was developed to characterise system drivers of frequent presentations and the interactions between these drivers. Key drivers aligned to four categories: access; coordination; patient needs; and knowledge and skills. Nine action areas were identified with many actions categorised as lower-level system impact actions. To our knowledge this study is the first to apply systems thinking to the issue of frequent presentations and builds on emerging evidence for the use of systems thinking in public health and emergency medicine. Our study describes the complexity of frequent presentations, shifting the focus from individuals to a whole system view and highlights the need for system- and individual-level interventions to improve health delivery and patient outcomes.

This study provides important evidence for the use of systems science in rural health services in Australia, aligning with the strong global consensus to adopt systems thinking as an essential approach for strengthening health systems [26]. Bringing together a wide range of stakeholders for GMB workshops anecdotally supported connections between 'silos' within the health system and encouraged relationship building among and between individuals and organisations. Silos or fragmented care has been associated with a range of negative patient outcomes including increased mortality, longer length-of-stay, and readmissions [45]. Relationships have been identified as an essential component for systems orientation to foster collaboration, knowledge exchange and innovation [46] and can promote emergence, a system property to turn local changes into meaningful shifts for system-wide change [47].

The CLD provided a dynamic model of how the system is structured and displayed the complex interaction of frequent presentations driven by several multilevel contextual factors and the nature of the interactions between them. Multilevel contextual factors from public policy, community, organizational, interpersonal to the individual interact in complex ways with the potential to enhance or

impair health [48]. The CLD suggests frequent presentations are partially influenced by the context external to the individual, for example, individuals' access to health care is influenced by the quality of discharge planning, ease of navigating services, and population size. Similarly, service coordination is influenced by fragmentation of services, decentralisation of services, and understanding of available services from a clinician perspective. Despite this complexity and evidence of the influence of external context most interventions focus on changing individual behaviour [5,13] without consideration of individual behaviour situated within a broader system context. These micro-level interventions typically have modest effects, are difficult to scale and sustain over time, and are unlikely to change the underlying performance of the whole system [49]. Case management aims to minimise fragmentation of healthcare and is designed to connect frequent presenters with existing services or to 'make the best' of existing services. While case management may improve access to services for frequent presenters it does not change the system (i.e., access to services for those not enrolled in the program) for the broader community. Although case management is a micro-level intervention the key factors identified as contributing to the success of case management impact system-level barriers (e.g., access to and collaboration with healthcare providers and community organisations, coordination of care, and assistance to navigate the healthcare system) [50]. Case management can be viewed as an important safety-net for system failures and intuitively targets the system at an individual level, however, does not remedy the system. This demonstrates the critical importance of macro- and meso-level interventions to address system-wide barriers to accessing care that are driving frequent presentations.

Recently, several systematic reviews have shown inconsistent effects of case management on key measures such as healthcare use and cost outcomes [5,51,52]. The systematic reviews suggest inconsistent effects may be due to multiple methodological and design issues (e.g., lack of a control group, regression to the mean, small sample size, definition of frequent presentations), and the heterogeneity of case management (e.g., fidelity and frequency of various components, context related barriers and enablers, operationalization) [5,51,52]. We identified multi-level contextual factors also influence frequent presentations and consequently may influence the effectiveness of case management. This means co-ordinated efforts are required with action essential across macro-, meso- and micro-levels to drive systemic change across all levels of the system [49]. Indeed, a recent review discussing five examples of high-performing population healthcare systems reported a range of outcomes with some demonstrating reductions in ED presentations, hospital admissions, and health care costs. The authors suggested the examples shared several similarities, notably the actions taken were across macro-, meso- and micro-levels [53]. Features included organisations collaborating across systems to improve health outcomes across the whole of the population (macro-level), different interventions for different subgroups of the population (meso-level), and interventions aimed at improving the health of individuals e.g., case management (micro-level) [53]. Our findings suggest consideration of the local system dynamics is essential for the success of any combination of actions. Actions tailored to the local context may optimise outcomes, identify, and address unique local system drivers, and mobilise local collaborations and resources to support implementation and sustainability.

Approaches to many pressing health challenges are grounded in linear models of cause and effect or reductionist thinking despite their inherent complexity and are rarely solved with a single, simple solution [26]. The use of the PH12 framework helped broaden the understanding of which actions or combinations of actions are most influential and may support participants to prioritise several actions across levels for implementation. Our findings suggest most of the actions identified in this study are lower-level system impact actions. Similar findings have been observed in obesity prevention interventions [54], healthy and sustainable food system recommendations [55], and social and biophysical sustainability interventions [56]. Although the workshops allowed participants to engage with complexity to develop an understanding of frequent presentations, the identified actions were typically small impact, simple solutions. The tendency for recognising the need for higher-level actions only to drift to lower-level actions has been documented in public health [57]. Indeed, a focus on policy and delivery of quick and easily implemented actions [56], targeting proximal presenting risk factors rather than distal health status [54], improving the current system by adjusting and reforming [55] and avoiding challenging existing political factors that perpetuate existing systems [54,55] impact genuine transformational potential. The scripted design of the second workshop that asked participants where action is needed and where they have the power to act, may have shifted focus from the broader system to a micro- or meso-level. Participants may need to consider how actions in one part of the system can reinforce or undermine actions in other parts of the system through the identification of feedback loops. Feedback loops may assist with identification of important leverage points to strengthen the system [43]. Our findings suggest case management (e.g., nurse navigation/coordination) is a lower-level system impact action. Similarly, Burton et al. (2022) identified case management as a micro-level action that addresses one part of the broader system and does not take a whole system view [11]. This highlights the importance of prioritising actions and choosing multiple macro-, meso- and micro-level interventions across the leverage points to drive health system change. It may also identify gaps in the levels where no action is planned.

4.1. Limitations

The CLD output and actions are dependent on who participated in the workshops. Consequently, the views of the participants on the causes and drivers of frequent presentations may not be representative of the region (e.g., we were not able to recruit GPs). Similarly, the CLD and actions may not be generalisable to other health systems both within Australia and worldwide. Purposive sampling of participants (i.e., through existing relationships of our study team) may have led to selection bias and contributed to a social desirability in responses. Also, several participants were aware of the intention to introduce a program specifically to address frequent presentations. This may have influenced the actions identified and action prioritisation by participants. Last, descriptions of some actions lacked adequate detail making it challenging to align according to the PH12, while further development of actions over time may shift alignment to a different leverage point.

5. Conclusions

In conclusion, systems thinking provides a comprehensive overview of the causes and drivers of frequent presentations in a regional and rural context, and identifies frequent presentations as a complex problem, for the first time in the literature. A range of potential solutions were identified across the system and highlighted the importance of choosing multiple system- and individual-level interventions. Future research should prioritise actions and implement the most impactful actions feasible across the system.

Ethics declarations

This study was reviewed and approved by the Ballarat Health Services and St John of God Hospital Human Research Ethics Committee with the approval number: LNR/79317/BHSSJOG-2021-281,237(v1) and the Deakin University Human Research Ethics Committee with the approval number: 2021-343.

All participants provided informed consent to participate in the study.

All participants provided informed consent for the publication of their anonymous case details.

Data availability statement

Data will be made available on request.

CRedit authorship contribution statement

Mary Malakellis: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing, Visualization, Validation. **Anna Wong Shee:** Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Writing – review & editing, Validation. **Margaret Murray:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – review & editing, Validation. **Laura Alston:** Conceptualization, Formal analysis, Investigation, Methodology, Supervision, Writing – review & editing, Validation. **Vincent L. Versace:** Conceptualization, Investigation, Validation, Writing – review & editing. **Steven Allender:** Conceptualization, Investigation, Methodology, Resources, Writing – review & editing. **Kevin Mc Namara:** Conceptualization, Formal analysis, Investigation, Methodology, Supervision, Validation, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix 1. Group model building

Summary

Group model building (GMB) is an approach developed to support participatory systems and involves a group of stakeholders working with a modelling team to develop a causal loop diagram (CLD) of their mental model of the drivers of frequent presentations to the ED. A CLD is a qualitative, non-linear representation of how different variables in a system are causally interrelated. Potential leverage points (actions) to intervene in the system were also identified by participants.

Members of the facilitation team were trained to undertake roles such as meeting coordinator, opener/closer, modeler, facilitator, and note-takers. The team consisted of researchers with clinical backgrounds and with research experience in a regional/rural context.

Phase 1. Identification of system drivers of frequent presentations to the Emergency Department - Workshop 1, October 14, 2021.

Stakeholders were invited to attend a 3-h Zoom workshop to understand the system drivers of frequent presentations to the ED from the perspective of the participants from different sectors. Participants received an overview of the project and were presented with a graph of changing frequent presentations over time from the main public hospital in the region, and the case for addressing frequent presentations to the ED explained. The question framing the workshop was “What drives frequent presentations to the ED?”. The participants were guided through a series of participatory tasks including graphs over time, that is, graphing of other changes that have occurred over a similar period that influence or are influenced by frequent presentations to the ED. During group discussion of these changes the modeler recorded each variable into a connection circle using Systems Thinking in Community Knowledge Exchange (STICKE), a software package to build CLDs. Participants identified links, causality, and the nature of the relationship between variables. Links between variables are represented as arrows that indicate the direction of causality with a solid line indicating a positive relationship (i.e., an increase in the causal variable leads to an increase in the effect variable or vice versa) and a dotted line indicating a negative relationship (i.e., an increase in the causal variable leads to a decrease in the effect variable, or vice versa). Through an iterative and reflective process participants were encouraged to add or refine variables and review connections. The initial CLD was refined by reviewing the recorded audio and notes taken through the workshop to ensure the content accurately reflected participants’ discussion in the workshop. The identified variables were refined and organised according to four emergent categories.

Phase 2. Potential actions to address frequent presentations to the Emergency Department - Workshop 2, November 4, 2021.

In this 3-h Zoom workshop stakeholders were reintroduced to the project aims and shown the revised the CLD developed from the first workshop. For the first half of the workshop, participants were asked to review the CLD, confirm the modifications represented their perceptions from the first workshop, and then refine any inaccuracies or misrepresentations, discuss further if necessary, and collapse, expand, or rename variables. Data collection continued to the point where no additional information or insights were identified. For the second half of the workshop, participants were given a theoretical background on how to identify potential points for intervention within the CLD and were given time to discuss and map current actions, where action is needed and where they have the power to act. Participants placed feedback directly onto the CLD using annotate in Microsoft PowerPoint with a cross placed on the CLD for existing actions, and a heart for where there should be more action, with the existing actions and potential actions documented in the chat by participants. Participants further annotated the CLD by circling variables in which they perceive they have some influence and can act. The audio and/or notes from the second workshop were used post workshop to compile a list of nine overarching action areas for discussion and development in subsequent workshops.

Phase 3. Iterative Workshops for action planning and implementation of prioritised actions.

Phase 3 consists of a series of iterative workshops for moving concept actions into reality, is an ongoing process and will be described elsewhere at the conclusion of the process. In brief, this phase includes a series of action planning, prioritisation, and implementation planning tasks. Task teams will be formed by participants willing to commit to actions in areas in which they had an interest and ability to act relative to their role.

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