# Addressing pressures on health services in Belo Horizonte, Brazil through community-based care for poor older people: a qualitative study

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The Lancet Regional Health - Americas 2023;27: 100619

Published Online xxx
https://doi.org/10.1016/j.lana.2023.100619

## Summary

**Background** In low and middle-income countries, there is growing interest in managing pressures on health services through community interventions for older people. Evidence on the effects of such interventions is scarce. We draw on qualitative data to examine these effects for a specific scheme, *Programa Maior Cuidado* (PMC) in the Brazilian city of Belo Horizonte.

**Methods** Building on quantitative findings reported elsewhere, we use qualitative data to develop and test theories of change. These include data from 50 meetings with policymakers, managers and staff in 30 health centres and social assistance posts. Data collection was embedded in key informant interaction and knowledge coproduction. Data include participant and non-participant observation, focus groups and semi-structured interviews with key informants, as well as older people and carers from seven families.

**Findings** The data reveal three theories of change. Theory 1 is PMC maintains older people's health which reduces their need for inpatient or outpatient care. We find strong evidence to support this, through effects on use of medication, chronic disease management and risk prevention. Theory 2 is PMC promotes timely intervention by anticipating health problems, thus reducing demand for emergency and acute care. We find some evidence for this, but it was limited by limited availability of timely treatment or referral beyond PMC. Theory 3 is PMC facilitates hospital discharge. We find limited evidence for this, reflecting a lack of formal liaison between PMC and hospitals.

**Interpretation** Schemes like PMC have potential to reduce pressures on health service utilisation by older people, if they are well articulated with wider health services.

**Funding** Medical Research Council, Newton Fund and Brazilian Council of State Funding Agencies.



**Keywords:** Older people; Primary health care; Long-term care

## Introduction

In 2021 there were over 300 million people aged 70 or more in low and middle-income countries (LMICs).[1] By 2050 the number of people aged 70 or more in LMICs is projected be three times greater than in high-income countries, and to exceed one billion by 2056.[1] Population ageing in LMICs is occurring in contexts of limited resources for health services and, at best, incipient social care systems. Without substantive policy responses, these trends will quickly overwhelm service capacity. In high-income countries, integration between health and social care, with a focus on community provision is seen as essential for the sustainability of health systems.[2] Potential benefits of integrated community-focussed strategies include prevention or timely treatment of conditions that would otherwise require hospital care, avoiding hospital admissions for conditions amenable to ambulatory care and reducing delays to hospital discharge.[3] This paper examines the effects of a related intervention in the Brazilian city of Belo Horizonte.

In Brazil the number of people aged 70 or over will almost treble between 2020 and 2050, from 13 to 37

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## Research in context

### Evidence before this study

We searched PubMed for studies on the effects of community-based care interventions for older people on health service use. We used the following search terms: (ADMISSIONS) OR (DELAYED DISCHARGE) AND (OLDER PEOPLE) AND (COMMUNITY) AND (CARE) AND (INTERVENTION). Our search was limited to studies which were published before 20 September 2023, without language limitation. Other than our own previously published studies on PMC, our search identified 1674 studies. These were individually screened for relevance, which identified 286 studies, almost all relating to high-income country settings. Evidence is limited to schemes offering relatively limited, temporary support by professional teams. Studies report varying rates of effect on unplanned admissions, readmissions and inappropriate use of medication. There is no published evidence of specific effects on patterns of outpatient service use, such as reason for consultation or rates of unplanned visits. There is little specific evidence about processes leading to these outcomes.

### Added value of this study

This study examines an intervention (Programa Maior Cuidado, PMC), with unique features operating in a specific city (Belo Horizonte) in a middle-income country (Brazil). It builds on previous qualitative process and quantitative impact evaluations to develop and test potential explanations (theories of change) about how PMC may affect health service use. The strength of evidence corroborating specific theories of change varies. It shows that PMC has an overall effect on reducing some types of health service use, but that specific effects are sometimes limited by weaknesses in wider health service infrastructure. The study provides new insights into how the potential of schemes like PMC to reduce pressures on health systems may be optimised.

### Implications of all the available evidence

All countries are facing pressures on health services due to population ageing and a lack of adequate support for older people in community settings. There is an urgent need for evidence about both "what works" and "why it works" with reference to innovative interventions. Alongside other studies of PMC, this paper adds to the limited knowledge base for both these questions. The study shows that interventions like PMC have significant potential to enhance patterns of health service use and they should therefore be prioritised by national and local governments.

million.[1] Due to prevalent disability and chronic comorbidities, around 20% of this population is currently care-dependent, with higher rates among the poor.[4] From 2009 to 2015 people aged 60+ accounted for 29% of Brazil's hospital admissions and 52% of ICU admissions.[5] From 2000 to 2013 31% of inpatient hospital spending on people aged 60 or over was for conditions amenable to treatment in other settings.[6] A survey of hospitalisations of people aged 60 or over in Rio de Janeiro reported 2260 cases exceeded a year, mainly due to inadequate care in the community.[7]

This paper examines the effects of a novel community-based health and care intervention on health service utilisation. Since 2011 *Programa Maior Cuidado* (PMC) has been supporting care-dependent older people living with vulnerable families in poor districts of Belo Horizonte. Local health posts and social assistance centres work together to identify eligible families and provide integrated support (Fig. 1). Trained paid caregivers, recruited from similar communities, provide families 10–20 h of support a week. This aims to offer families respite from round-the-clock care-work and to build their care-giving skills. Specific roles and duties for PMC carers include supporting family care-giving and a limited set of clinical responsibilities (Table 1). PMC carers are expected to operate as bridges between older people, their families and local health and social assistance services. This includes monitoring older people's condition and reporting back to monthly case reviews. Personal care plans are developed collaboratively between families, PMC carers and health and social assistance staff. Most older people remain in PMC until the end of their lives.

Previous research has assessed PMC's development and operational fidelity, as well as demonstrating its effects on older people and their families.[8,9] Quantitative analysis demonstrates being in PMC is associated with higher rates of planned relative to unplanned outpatient service use, and with higher rates of visits for rehabilitation and preventive care relative to urgent, emergency consultations.[10] Similarly, being in PMC is associated with lower inpatient costs per admission, possibly because enhanced community care facilitates discharge.[11] These findings have encouraged policy makers to develop new schemes in other Brazilian cities. This paper complements previous analysis by drawing on qualitative data to examine how these effects on patterns of health service use occur, by identifying and evaluating related theories of change.

## Methods

This is a qualitative descriptive study drawing on a set of qualitative data collected over a three-year period (Table 2).[12] This includes an initial process evaluation, followed by an impact evaluation which was interrupted for 16 months due to the COVID-19 pandemic. During the pandemic, we conducted an online questionnaire survey with health posts and social assistance centres specifically related to the effects of the pandemic on PMC.

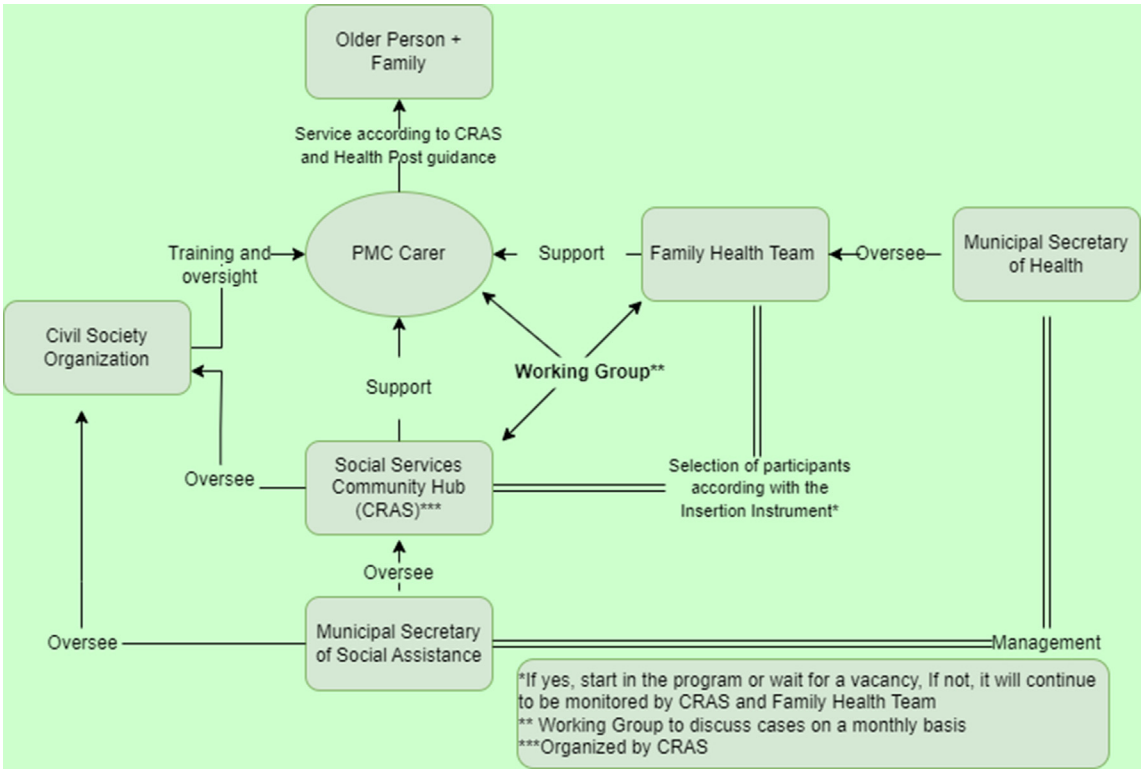


***Fig. 1:*** Main components of Programa Maior Cuidado.

The original study was approved by the International Development Research Ethics Committee of the University of East Anglia in the UK (MR/R024219/1) and the René Rachou Research Ethics Committee, Fiocruz, Brazil (CAAE: 96033418.9. 0000.5091). After the onset of the COVID-19 pandemic, a revised protocol was approved by the International Development Research Ethics Committee of the University of East Anglia in the UK (MR/R024219/2). All study participants provided written informed consent.

| Family care support | Health duties | Interaction with social assistance and health centres |
|---|---|---|
| Follow the personal care plan agreed with the local social assistance and health team. | Provide cognitive stimulation and occupational therapy. | Participate in monthly case review meetings. |
| Guide the family's organisation of care for the older person. | Assist in physical exercises recommended by the local health team. | Provide monthly updates on the status of the older person to local social assistance and health team. |
| Prepare food for the older person, in accordance with the personal care plan. | Manage the older person's medications, only administering those which have been prescribed by a health professional. | Discuss personal care plans, including modifications to them, with local social assistance and health team. |
| Assist with bathing the older person, in accordance with the personal care plan. | Do not administer non-prescribed medication including traditional remedies. | Immediately inform supervisor of emergency situations that put either the older person or their caregivers at risk. |
| Identify potential modifications to the home environment to reflect the older person's needs. | Do not perform specialist nursing tasks, such as providing injections or measuring blood pressure. | Participate in ongoing training and capacity-building programmes. |
| | Pay attention to physical or emotional changes in the older person and inform the local health team. | |
| | Assist and supervise the nutrition and hydration of the older person, as well as continence. | |
| | Inform the health team of significant changes to stools or urine. | |
| | Accompany the older person on visits to hospitals and clinics, as needed. | |
| | Follow public health guidance to reduce risk of infection of COVID-19 or other respiratory diseases. | |

***Table 1:*** **Selected roles and duties of PMC carers.**

| | Objective | Timing | Design |
|---|---|---|---|
| Stage 1 | Mapping the intervention and process evaluation | December 2018 to October 2019 | Review of documents and programme records. Participant observation of meetings (n = 20 meetings; 90% female, median age 40). Focus group discussions with key informants (n = 7 groups with 51 participants; 90% female, median age 40). |
| Stage 2 | Truncated impact evaluation | December to January 2020. | Semi-structured interviews with PMC families (n = 2 families). Regression analysis of outpatient and inpatient health service use data sets. |
| Stage 3 | COVID-19 monitoring | May to September 2021 | Structured virtual interviews with health and social assistance staff (n = 36 staff; 80% female, median age 45). |
| Stage 4 | Completion of impact evaluation. Process evaluation of reform implementation. | March to December 2021 | Structured interviews with health and social assistant staff involved in PMC (n = 24 staff; 80% female, median age 45). Case studies of PMC families (n = 7 families; 6 female and 1 male caregiver; median age 53; 4 female and 3 male care receivers; median age 78). Non-participant observation of GT meetings (n = 16 meetings; 90% female, median age 40). |

*Table 2:* **Research design and data summary.**

Over the study more than fifty meetings were held with different health and social assistance agencies responsible for PMC. This occurred as a process of continual key informant interaction, as part of a co-productive research design and collaborative knowledge transfer strategy. The process evaluation included focus groups with staff in 30 health centres and social assistance posts. The evaluation included key informant interviews with a variety of professionals, including nurses, social assistants, managers in all participating health and social assistance posts. The evaluation also included non-participant observation of monthly case review meetings over eight consecutive months in two posts and in-depth interviews with older people and carers in seven families. These families were selected from lists held at the two social assistance posts where the case review observations took place. The total number of families in these lists was 37. Family selection was largely opportunistic, but looked to maximise variation in terms of the length of time families had been in PMC and the level support they received. In line with our ethical protocol, we checked the suitability of each family with local social assistants: of these one was excluded since it was experiencing a specific crisis. A further family we approached declined to participate on no specific grounds.

The data were mainly collected by PC, one of the authors. PC is a trained physiotherapist specialising in geriatric health, with a master's degree in public health. PC has never played a role in PMC and has not been employed by any department in the municipality of Belo Horizonte or by any organisation that might be understood to be a stakeholder in PMC. Two authors independently coded the data with specific reference to how PMC may affect health service use by older people. Triangulation of preliminary interpretations was based on the consistency of findings across different sources and types of data. The authors shared, discussed and resolving discrepancies in their coding. Following a grounded theory approach, manual coding identified preliminary theories of change.[13] These theories of change were then discussed and interpreted in partnership with local key informants, in accordance with our co-productive strategy. All interviews were recorded and transcribed by a member of the authorship team. All data were analysed in the original Portuguese with selected translation only for the purpose of publication. Our qualitative methods comply with the Standards of Reporting of Qualitative Research guidance (Supplementary Tables S1 and S2).[14]

We apply a theory of change approach, relating intermediate outcomes to a primary, distal outcome of interest.[15] Findings are presented in the form of overviews, supported by evidence in the form of representative quotations (Table 3) and two case studies. These case studies draw on interviews with older people, family carers and PMC carers. Observational, documentary and routine monitoring data were used to triangulate and contextualise these findings.

### Role of funding source

The research and preparation of the article were funded by the UK Medical Research Council, UK Newton Fund and Brazilian Council of State Funding Agencies. The funding sources had no such involvement in the conduct of the research or preparation of the article.

## Results

### Theory of change 1: PMC carers, individually and in collaboration with families, maintain the health of the older person which reduces their need for inpatient or outpatient care

Table 1 summarises PMC carer competencies and duties, including activities which should not be undertaken such as providing injections. Basic training is provided before the start of their employment. Additional training on specific issues such as physiotherapy and medication, as well as general guidance are provided by local health staff (quotation 1). Nevertheless, informants sometimes report frustration or confusion about the range of activities PMC carers are permitted to perform (quotation 2).

| Theory of change | Quotation and number | Source |
|---|---|---|
| Theory of change 1. | 1. The PMC carers are sometimes trained in specific tasks, like administering insulin, by the local health post, and the physiotherapist will show them particular exercises for their patients. | I12, Psychologist, social assistance centre. |
| | 2. We have a bedridden older man with a colostomy bag. Some professionals at the health centre claim that managing that type of thing should be restricted to a qualified health professional.... Although PMC carers supposedly get training and are responsible for these older people, they don't know how to handle colostomy bags. | I42, Social Worker, Family Health Team, |
| | 3. As PMC carer, one of my jobs is to renew the prescription for their medication every month. I pick up the medication for them, and make sure it is ready for them to take every morning, afternoon and evening. | I28, PMC Carer |
| | 4. We work with many highly deprived families where nobody can read or write or administer medicine properly. | I12, Psychologist, social assistance centre. |
| | 5. The programme was stopped during the pandemic, and it was very tough for us. We weren't able to take our medicine properly, because I can't read and my wife can't see. So I didn't take them right and then I got really ill. | I33, Older person |
| | 6. When I get there, she's in bed and her incontinence pad usually ends up leaking. As PMC carer, I change the bed sheets... bathe her... make sure she's clean and hygienic. Then I put on a fresh pad for her. While we have breakfast together, I make sure she takes her meds. After that we do some physiotherapy exercises -I was given a set for her by the physio here at the health post. | I28, PMC carer |
| | 7. Even though the PMC carers don't visit every day, they really help with older people's hydration and nutrition. They have the time to be patient, to encourage them to eat just a little more, to help them get out into the sun and maybe walk around a bit. We find that older people get some strength back when they're not always stuck in bed or a wheelchair, and thanks to the physio they do with the carer. And as they get more mobile, they don't get bed sores anymore.... These are all little things, but when you put them all together, they have a big effect on older people's healthcare needs. | I15, Social Worker, social assistance centre. |
| | 8. They used to have a bathmat that was always slipping. I had been warned about this in my training, and so I said that, if they didn't mind, could they remove the mat because their sister is so weak she could easily trip on it. And they were happy to get rid of it. | I28, PMC carer |
| | 9. There's a woman with a history of frequent falls. She's blind and has Parkinson's. She lives with her children, but they are out all day. And, anyway, the children see having falls as just normal, 'an old age thing'. They have no idea about what it means to care for an older person. | I43, Nurse, Family Health Team |
| | 10. Some older people here have family in theory but not in practice... I know one old man who has ten children, but only one bothers to help him. When the PMC carer started going there it really helped with improving child's health: they had been so over-burdened before. | I44, Social Worker, Family Health Team |
| Theory of change 2. | 11. We don't really do screenings on a regular basis. What happens is our team identifies older people who should be included in PMC and their families apply. We only do screenings as a matter of course at that point. We have been thinking about doing regular follow-ups, it could be useful. | I6, Physiotherapist, Family Health Team |
| | 12. The social assistance worker and PMC carer re-evaluate parts of the personal care plans, and parts of the plan that are more to do with health are reviewed by the health post. When it's possible the PMC carers can suggest modifications to care plans at the monthly case reviews. They take a close interest in that. | I40, Social Worker, social assistance centre. |
| | 13. The PMC carer sets up his oxygen supply and stays with him chatting about this and that... She's always on the look-out in case there is anything different about him. She notices little things and then she'll tell me: "Look, there must be something going on with him. I'll have word with the people at the health centre." | I47, Family Carer |
| | 14. Older people often develop a close bond with their PMC carers. This means that they sometimes share information with this person that they would avoid mentioning to a doctor. This really helps the people in the health centre to ensure they are OK. | I46, Nurse, Family Health Team |
| | 15. During the pandemic all we could do was phone people... But for more the most vulnerable families it was still necessary to go in person -it's just not the same as a phone call. | I15, Social Worker, social assistance centre. |
| | 16. My first PMC carer stayed with me for a year and four months. I adored her. There will never be another carer like her [cries]. | I45, Older person |
| | 17. Older people included in PMC are so much better attended to and have much better contact with the health services. Every month the PMC carer informs us about what is needed, based on what they see during their visits. They start to understand how caregiving and health relate to each other. Then, the review team follows up as best we can. It might be a general consultation or a referral to a specialist, a dietician or a physio. | I7, Nurse, Family Health Team |
| | 18. Sometimes an older person hasn't had a diagnosis. You know what they have, but you can't tell them, you can't do anything. You just have to wait for the diagnosis, so the doctor can tell the family what is going on. | I28, PMC carer |
| Theory of change 3. | 19. If the older person goes into hospital and if their family is really unable to visit the hospital, then the PMC carer may go to see them there in the hospital during their usual work hours. | I40, Social Worker, social assistance centre. |
| | 20. It sometimes happens, but only now and again. For example, if an older person gets really ill and there isn't anyone at home, then the PMC carer will ride in the ambulance with them. They will try to stay at the hospital until someone from the family can take over. But this doesn't happen often. Hospitals are usually a long way off and so it's logistically very difficult. | I40, Social Worker, social assistance centre. |
| | 21. Until now I can't think of a time when any hospital has got in touch specifically with the PMC team. That said, in our health post we deal with a lot of older people who don't have much family support. And sometimes the hospital keeps calling us here, to see if we can help with this so that older patients can be discharged. Otherwise, they will stay in hospital for a long time, what we call a "social hospitalisation". | I41, Social Service, Family Health Team |
| | 22. You see a lot of older people staying in hospital for longer than they should because there is nobody to look after them. We try to work together with the health staff, but sometimes there simply isn't any family support, so the older person just stays put. | I6, Physiotherapist, Family Health Team |

(Table 3 continues on next page)

| Theory of change | Quotation and number | Source |
|---|---|---|
| (Continued from previous page) | | |
| | 23. When PMC older people are discharged from hospital the monthly review team always discusses their cases. We try, as far as possible, to increase the number of PMC care hours they get. For example, we have a very frail couple at the moment. The wife had an operation on her knee and needed extra care, so the PMC carer increased her visits from three to five times a week, Monday to Friday. We could see that this was a very vulnerable time for her. The Programme is able to adapt to this kind of situation, to help people recover more quickly when they come home. | I41, Social Service, Family Health Team |

*Table 3:* **Representative quotes for theories of change.**

The data show PMC carers usually assist older people to manage chronic health conditions which might otherwise lead to emergency health service needs. Helping to manage medication was especially important as many older people and family caregivers had limited literacy (quotations 3, 4 and 5). Chronic health management often overlapped with preventing risk factors and providing more general forms of care. This was especially evident in areas such as hygiene and hydration (quotations 6 and 7).

Maintaining the health of the older person usually required collaboration between family members and the PMC carer (case study 2). This included reducing the risk of falls, such as by modifying the home environment (quotation 8). However, family members were not always predisposed to care for older relatives, even with the support and encouragement of PMC carers (quotations 9 and 10). PMC operates exclusively in deprived urban settings where family dynamics were often unstable and their capacity to care was framed by a wider set of social and economic challenges. Consequently, collaboration between PMC and families was sometimes affected by frequent changes in the identity of the main caregiver (case study 2).

### Theory of change 2: PMC promotes timely intervention by anticipating health problems, thus reducing demand for emergency and acute care

Most older people referred to PMC have recently been in hospital or have experienced an acute health episode (case study 1). A nurse and social worker make a home visit to apply a standardised screening tool relating to the older person's health and functional status, as well as risk factors for emergency health service use, such as frequent falls, and uncontrolled hypertension or diabetes. These screening visits typically require an hour with the older person and their family. There should be regular follow-up assessments for older people enrolled in PMC, but informants reported this rarely occurs (quotation 11). More priority is given to updating personal care plans as older people's needs change (quotations 11 and 12).

PMC carers spend between two and 4 h a day with each older person, Monday to Friday, depending on their assessed level of need. This intensity of engagement enables familiarity with the older person, facilitating communication and identification of significant changes (quotations 13 and 14). During the COVID-19 pandemic these visits were suspended for several months (quotation 15). This continued through the first half of 2021, since PMC carers were not formally defined as frontline health workers and therefore not prioritised for vaccination. More generally, a policy of occasionally rotating PMC carers across families (to avoid over-familiarity compromising the professional status of the carer), was often unpopular with families and disrupted relationships (quotation 16).

PMC carers have specific responsibilities to communicate between older people, their families and health providers (Table 1), which can sometimes facilitate appropriate treatment and referrals before conditions become acute (quotation 17; case study 1). However, the limited availability of health services often led to long waiting lists and delayed treatment (quotation 18; case study 2). Health worker participation in monthly reviews usually involved less experienced staff, and frequent staff rotation in health posts meant those who attended were often unfamiliar with PMC.

### Theory of change 3: PMC facilitates hospital discharge by increasing confidence in community support for older patients

In theory, PMC carers can continue to support older people when they are in hospital. Although there some were examples of this, they were exceptional since hospitals are not located close to communities served by PMC (quotations 19 and 20). There is no specific liaison between PMC staff and hospitals when an older person was admitted, with hospitals only communicating directly with patients' families [21]. Nevertheless, key informants including hospital staff claimed PMC increased their confidence in safely discharging older patients back into the community, potentially reducing unnecessarily long hospital stays (quotations 21 and 22). In some cases, PMC carers supported older people's recovery immediately after hospitalisation, reducing the risk of readmission (case 1). In some cases, the case review team increased the number of PMC support hours on the older person's discharge, in order to limit the risk of rapid readmission (quotation 23).

### Case study 1: Mr G

G is 95 and has a range of chronic conditions, including diabetes, heart disease and COPD. In 2015 he was hospitalised for several weeks. His daughter and main carer said this happened because he had been careless about his diet and medication.

After being discharged from hospital, G was screened and enrolled in PMC. He was assessed as highly care-dependent: bed-bound and doubly incontinent. Over the following year his condition gradually improved: a follow-up assessment found he was no longer incontinent and could walk around the house. G remained enrolled in PMC, but his personal care plan was revised and the number of visit hours was reduced. According to his daughter:

*They [G and PMC carer] do different kinds of exercise. She helps with bathing, prepares his food, chats and pays attention to him. When he gets tired, she sets up his oxygen.*

During the pandemic the PMC carer was unable to visit. This was a blow to both G and his daughter, although she was able to meet most of his needs having learned from the PMC carer.

Since joining PMC, G has not been hospitalised again and he only visits the health post for planned appointments. Most recently, this was for a test after he complained to his PMC carer of kidney pain. At the time of fieldwork, the PMC carer reported to the monthly review that G had started to self-medicate. The review arranged a home visit by a nurse to discuss this issue with G and his daughter.

### Case study 2: Mrs E

E is 86 and has been enrolled in PMC for about two years. She has hypertension and was initially assessed as semi-dependent. However, E's care needs have since increased and she has symptoms of dementia. She receives three weekly visits from a PMC carer, each lasting 4 h.

E's main carer had been her husband, who had died six months previously. Since then, other family members have started to take on this role with support from PMC. However, there is no fixed family carer, with the role shifting from day to day. According to her younger brother:

*This is a massive responsibility and I've got absolutely no experience. It's the first time I've had to do this [caring for older person], having to take responsibility for everything.*

Family members had neglected to renew E's prescriptions, so the PMC carer visited the local health post to attempt resolve this issue.

E has not been tested for dementia. The monthly case review placed her on a waiting list for the city's specialist geriatric service and followed up on several occasions. The case review also referred E to the local health post for other issues, but she has not been seen due to short staffing. As E's dementia progresses, her behaviour has become increasingly challenging. She refuses to drink water, and only recently was it possible to hydrate her with sugary sodas. According to her nephew:

*She used to get much too much sugar. She'd need the toilet at night and would just wee anywhere. Now that we have help from the PMC carer the situation has really improved.*

E often refuses to take showers and is violent if pressed to do so. Only when the PMC carer and family work together, is it possible to bathe E consensually and safely.

## Discussion

This paper uses qualitative data to identify and explore potential theories of change relating to previously observed statistical associations relating to PMC and aspects of health service use. Quantitative methods have only limited value in revealing the processes or mechanisms through which statistically significant effects occur. Qualitative data can potentially provide additional insights about these processes.[16]

There are no published evaluations of inpatient health service effects of schemes comparable to PMC. This reflects the unusual nature of PMC and the scarcity of studies evaluating inpatient effects of community-based interventions for older people, especially in LMICs. A community-based health management intervention for older people in China was found to reduce outpatient service use.[17] However, this intervention mainly consisted of health education, was not focussed on care-dependent older people and did not include support from paid carers.

PMC scheme shares some elements with interventions in high-income countries, including home-based primary health care and hospital at home.[18,19] Like PMC, these interventions often combine geriatric assessment with case management based on personalised care plans and periodic monitoring.[20] However, the specific form PMC takes and the context in which it operates are distinctive. PMC does not rely primarily on teams of clinical and non-clinical professionals. PMC carers have only a limited set of competencies, but their low cost enables a high ratio of carers to older people, permitting them to spend between 10 and 20 h a week with individual families. This differs to schemes in high-income countries, which typically entail shorter and less frequent visits rather than extended periods of support.[21] At the same time, PMC operates in settings very distinct to most high-income ones. Although

Brazil's state health system is theoretically universal and provides services free at the point of use, per capita health spending is less than 17% Canada's. Consequently, the availability of services is often very limited.

Bearing these differences in mind, studies of broadly comparable interventions in high-income countries report varying rates of positive effect on unplanned admissions, readmissions and inappropriate use of medication.[22,23] There is, however, no published evidence of specific effects on patterns of outpatient service use, such as reason for consultation or rates of unplanned visits. This reflects a general neglect of these effects in the academic literature on outpatient services.[24]

Evidence about comparable interventions is almost entirely quantitative and focusses on outcomes rather than processes or theories of change. Our study identifies three theories of change relating to PMC and use of health services, deploying both corroborating evidence, as well as evidence of limiting or nullifying effects.

Our study finds strong evidence to support the first theory of change (PMC reduces overall demand for health services by sustaining older people's health). We observe positive effects on use of medication, chronic disease management and risk prevention. These positive effects were facilitated by good collaboration between PMC carers and families, despite the challenging social settings where PMC operates. Similar effects have been reported by studies of community-based chronic disease and falls prevention interventions.[25,26] For example, maintaining the hydration and hygiene of older people reduces the risk of conditions such as urinary tract infections, which account for a high proportion of emergency hospital admissions of older people in high-income countries.[27]

The second theory of change is that PMC promotes timely intervention by anticipating health problems, thus reducing demand for emergency and acute care. PMC's screening tool includes elements of comprehensive geriatric assessment and extends these to consider the wider family situation. A systematic review of comprehensive geriatric assessment among community-dwelling older people in high-income countries reports reduced risk of unplanned hospital admission.[28] After this initial assessment PMC carers maintained a high level of general contact with families which fed into monthly reviews. Communication between PMC carers and review teams appears to be effective. By contrast, studies of community health workers in LMICs report limited embeddedness within formal primary health care systems.[29,30] However, the capacity of these monthly PMC reviews to follow up with timely treatment and referral was restricted by a shortage of health services and uneven engagement with PMC by health professionals.

We find some evidence to support the third theory of change (PMC facilitates hospital discharge by increasing confidence in community support). However, this effect was *ad hoc* and occurred despite an absence of formal lines of communication between PMC and hospitals. As such, PMC cannot be described as a transitional care intervention.[31] Existing research on such interventions is more focussed on outcomes related to readmission risk than on timely discharge, and evidence of their effects is uneven.[32,33] Unlike PMC, most transitional care programmes focus narrowly on physical rehabilitation and do not to consider the potential social vulnerabilities of older people's families and their capacity to provide post-discharge care.

Our study has several strengths and limitations. The overall study design is somewhat *ad hoc* and opportunistic, encompassing a wide range of components and types of data. Much of these data are derived from intensive engagement over several years, reflecting our collaborative, co-productive research strategy. The richness of these data reflects the level of access researchers had with actors involved in policymaking and the daily operation of PMC. However, these close relationships raise issues about the researchers' positionality and the risk of positive bias. The study seeks to reduce these potential problems by specifically seeking out effects that both promoted and impeded theories of change and by triangulation across different sources. Also, it is possible that the theories of change that emerge from our data do not include relevant effects that were not mentioned by our informants.

Our findings are policy-relevant, as they identify opportunities to reinforce or modify theories of change related to outcomes of interest. Specific examples include a need for more systematic screening and information systems, as well as linking PMC to hospital discharge decisions. These changes have been discussed with PMC policymakers in Belo Horizonte and are now being implemented. Our findings deepen existing evidence about the effects of PMC on a range of outcomes. This evidence prompted the Federal Ministry of Health to fund pilot interventions based on the PMC model in several new cities, and the promotion of PMC as a model of good practice by global health agencies.[34]

#### Contributors

All authors (PLS, PFC, KCG and LS) conceptualized the study. PLS performed data analysis and wrote the first draft. All authors discussed the results and contributed to the final manuscript. PLS, PFC and KG directly accessed and verified the data reported in the manuscript. All authors were responsible for the decision to submit the manuscript.

#### Data sharing statement

Data collected for the study are available, in anonymised and non-identifiable format and in Portuguese. Requests should be made to the corresponding author.

**Declaration of interests**
The authors declare no conflict of interests.

**Acknowledgements**
Funding: Medical Research Council, Newton Fund and Brazilian Council of State Funding Agencies. The funding sources had no such involvement in the conduct of the research or preparation of the article.

**Appendix A. Supplementary data**
Supplementary data related to this article can be found at https://doi.org/10.1016/j.lana.2023.100619.

**References**
1 United Nations. 2022 revision of world population prospects [cited 2022 Nov 29]. Available from: https://population.un.org/wpp/; 2022.
2 Reed S, Oung C, Davies J, Dayan M, Scobie S. *Integrating health and social care. A comparison of policy and progress across the four countries of the UK*. Nuffield Trust; 2021. vol. 97. Available from: https://www.nuffieldtrust.org.uk/research/integrating-health-and-social-care-a-comparison-of-policy-and-progress-across-the-four-countries-of-the-uk.
3 Lloyd-Sherlock P, Billings J, Aredes JS, et al. Meeting the complex challenge of health and social care provision for rapidly-ageing populations: introducing the concept of "avoidable displacement from home". *Cad Saúde Pública*. 2020;36:e00162819. https://doi.org/10.1590/0102-311X00162819.
4 Inter-American Development Bank (IADB). Aging in Latin America and the Caribbean: social protection and quality of life of older persons. Available from: https://publications.iadb.org/publications/english/document/Aging-in-Latin-America-and-the-Caribbean-social-protection-and-quality-of-life-of-older-persons.pdf; 2022.
5 Dias RD, Barros JV. Burden of hospitalisation among older people in the Brazilian public health system: a big data analysis from 2009 to 2015. *J Epidemiol Community Health*. 2019;73(6):537–543. https://doi.org/10.1136/jech-2018-210783.
6 Souza DK, Peixoto SV. Estudo descritivo da evolução dos gastos com internações hospitalares por condições sensíveis à atenção primária no Brasil, 2000-2013*. *Epidemiol Serv Saúde*. 2017;26:285–294. https://doi.org/10.5123/S1679-49742017000200006.
7 Romero DE, Marques A, Barbosa AC, Sabino R. Internações de idosos por cuidados prolongados em hospitais do SUS no Rio de Janeiro: uma análise de suas características e da fragilidade das redes sociais de cuidado. In: Camarano A, ed. *Cuidados de longa duração para a população idosa: um novo risco social a ser assumido?* Rio de Janeiro: Ipea; 2010. Available from: https://www.icict.fiocruz.br/sites/www.icict.fiocruz.br/files/Capitulo%209_Internacao%20de%20Idosos_SUS.pdf.
8 Aredes J de S, Billings J, Giacomin KC, Lloyd-Sherlock P, Firmo JOA. Integrated care in the community: the case of the Programa maior cuidado (older adult care programme) in Belo Horizonte-Minas Gerais, BRA. *Int J Integr Care*. 2021;21(2):28. Available from: https://pubmed.ncbi.nlm.nih.gov/34220392/.
9 Lloyd-Sherlock P, Giacomin K, de Carvalho PF, de Sousa QNF. Integrated long-term care partnerships between government social care and health agencies in Brazil: the Belo Horizonte model. *Int Soc Secur Rev*. 2022;75(3–4):103–120. https://doi.org/10.1111/issr.12309.
10 Lloyd-Sherlock P, Giacomin K, Sempé L. The effects of an innovative integrated care intervention in Brazil on local health service use by dependent older people. *BMC Health Serv Res*. 2022;22(1):176. Available from: https://bmchealthservres.biomedcentral.com/articles/10.1186/s12913-022-07552-y.
11 Sempé L, Lloyd-Sherlock P. Programa Maior Cuidado: an analysis of hospitalisation effects [cited 2022 Nov 21]. Available from: https://corona-older.com/2022/11/18/programa-maior-cuidado-an-analysis-of-hospitalisation-effects/; 2022.
12 Kim H, Sefcik JS, Bradway C. Characteristics of qualitative descriptive studies: a systematic review. *Res Nurs Health*. 2017;40(1):23–42. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5225027/.
13 Chun Tie Y, Birks M, Francis K. Grounded theory research: a design framework for novice researchers. *SAGE Open Med*. 2019;7:2050312118822927. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6318722/.
14 O'Brien BC, Harris IB, Beckman TJ, Reed DA, Cook DA. Standards for reporting qualitative research: a synthesis of recommendations. *Acad Med*. 2014;89(9):1245–1251. Available from: https://journals.lww.com/academicmedicine/Fulltext/2014/09000/Standards_for_Reporting_Qualitative_Research__A.21.aspx.
15 Breuer E, Lee L, Silva M, Lund C. Using theory of change to design and evaluate public health interventions: a systematic review. *Implement Sci*. 2016;11:63. https://doi.org/10.1186/s13012-016-0422-6.
16 Rao V, Woolcock M. *Integrating qualitative and quantitative approaches in program evaluation*. World Bank; 2011. vol. 27. Available from: https://www.researchgate.net/publication/253431574_Integrating_Qualitative_and_Quantitative_Approaches_in_Program_Evaluation.
17 Chao J, Wang Y, Xu H, et al. The effect of community-based health management on the health of the elderly: a randomized controlled trial from China. *BMC Health Serv Res*. 2012;12:449. Available from: https://pubmed.ncbi.nlm.nih.gov/23217036/.
18 Langhorne P, Baylan S. Early supported discharge services for people with acute stroke. *Cochrane Database Syst Rev*. 2017;7:CD000443. Available from: https://pubmed.ncbi.nlm.nih.gov/28703869/.
19 Mas MÀ, Inzitari M, Sabaté S, Santaeugènia SJ, Miralles R. Hospital-at-home Integrated Care Programme for the management of disabling health crises in older patients: comparison with bed-based intermediate care. *Age Ageing*. 2017;46(6):925–931. Available from: https://pubmed.ncbi.nlm.nih.gov/28655169/.
20 Stoop A, Lette M, Gils PFV, Nijpels G, Baan CA, de Bruin SR. Comprehensive geriatric assessments in integrated care programs for older people living at home: a scoping review. *Health Soc Care Community*. 2019;27(5):e549–e566. Available from: https://pubmed.ncbi.nlm.nih.gov/31225946/.
21 Sempé L, Billings J, Lloyd-Sherlock P. Multidisciplinary interventions for reducing the avoidable displacement from home of frail older people: a systematic review. *BMJ Open*. 2019;9(11):e030687. Available from: https://bmjopen.bmj.com/content/9/11/e030687.
22 Rytter L, Jakobsen HN, Rønholt F, et al. Comprehensive discharge follow-up in patients' homes by GPs and district nurses of elderly patients. A randomized controlled trial. *Scand J Prim Health Care*. 2010;28(3):146–153. Available from: https://pubmed.ncbi.nlm.nih.gov/20429738/.
23 Wan CS, Mitchell J, Maier AB. A Multidisciplinary, community-based program to reduce unplanned hospital admissions. *J Am Med Dir Assoc*. 2021;22(6):1331.e1–1331.e9. https://doi.org/10.1016/j.jamda.2020.09.034.
24 Solaligue DES, Hederman L, Martin CM. What weekday? How acute? An analysis of reported planned and unplanned GP visits by older multi-morbid patients in the patient journey record system database. *J Eval Clin Pract*. 2014;20(4):522–526. Available from: https://pubmed.ncbi.nlm.nih.gov/24835519/.
25 Burton E, Lewin G, O'Connell H, Petrich M, Boyle E, Hill KD. Can community care workers deliver a falls prevention exercise program? A feasibility study. *Clin Interv Aging*. 2018;13:485–495. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5875587/#:~:text=Conclusion,part%20of%20their%20current%20services.
26 Lawn S, Zabeen S, Smith D, et al. Managing chronic conditions care across primary care and hospital systems: lessons from an Australian hospital avoidance risk program using the flinders chronic condition management program. *Aust Health Rev*. 2018;42(5):542–549. Available from: https://pubmed.ncbi.nlm.nih.gov/28835321/.
27 Foxman B. Epidemiology of urinary tract infections: incidence, morbidity, and economic costs. *Am J Med*. 2002;113(Suppl 1A):5S–13S. Available from: https://pubmed.ncbi.nlm.nih.gov/12113866/.
28 Briggs R, McDonough A, Ellis G, Bennett K, O'Neill D, Robinson D. Comprehensive Geriatric Assessment for community-dwelling, high-risk, frail, older people. *Cochrane Database Syst Rev*. 2022;5:CD012705. Available from: https://pubmed.ncbi.nlm.nih.gov/35521829/.
29 Mhlongo EM, Lutge E, Adepeju L. The roles, responsibilities and perceptions of community health workers and ward-based primary health care outreach teams: a scoping review. *Glob Health Action*. 2020;13(1):1806526. Available from: https://pubmed.ncbi.nlm.nih.gov/32892739/.

30 Kok MC, Dieleman M, Taegtmeyer M, et al. Which intervention design factors influence performance of community health workers in low- and middle-income countries? A systematic review. *Health Policy Plan*. 2015;30(9):1207–1227. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4597042/.
31 Finlayson K, Chang AM, Courtney MD, et al. Transitional care interventions reduce unplanned hospital readmissions in high-risk older adults. *BMC Health Serv Res*. 2018;18(1):956. https://doi.org/10.1186/s12913-018-3771-9.
32 McGilton KS, Vellani S, Krassikova A, et al. Understanding transitional care programs for older adults who experience delayed discharge: a scoping review. *BMC Geriatr*. 2021;21(1):210. Available from: https://pubmed.ncbi.nlm.nih.gov/33781222/.
33 Zurlo A, Zuliani G. Management of care transition and hospital discharge. *Aging Clin Exp Res*. 2018;30(3):263–270. Available from: https://pubmed.ncbi.nlm.nih.gov/29313293/.
34 WHO. *Framework for countries to achieve an integrated continuum of long-term care*. Geneva: World Health Organization; 2021. Available from: https://www.who.int/publications/i/item/9789240038844.