HealthLinks: Chronic Care evaluation
Summary report
Victorian Department of Health
CSIRO

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| HealthLinks: Chronic Care evaluation |
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| HealthLinks: Chronic Care evaluation  Summary report |

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# Summary

Flexible funding and patient selection tools changed the way health services responded to patients with complex and chronic healthcare needs.

## Background

Patients with chronic conditions often have complex health and care needs that, for many, results in frequent use of the health system and higher associated healthcare costs.[[1]](#endnote-2) Current models of health care and funding systems are largely designed to respond to episodic care, but many people with complex and chronic diseases require long-term, proactive and systemic approaches. It is generally well accepted that integrated community-based care and active management can result in better outcomes for people living with chronic conditions and may help reduce their need for inpatient services; however, there are several barriers to implementing integrated care models.

In response to the growing population of older people with multiple health needs, as evidenced by national increases in hospital admitted-patient expenditure of 45 per cent from 2004 to 2012,[[2]](#endnote-3) and the cost of treating chronic diseases being 36 per cent of all healthcare spending,[[3]](#endnote-4) the Victorian Department of Health and Human Services (now the Department of Health [the department]) sought to investigate if flexible funding enables health services to develop and implement alternative models (to inpatient acute care) that provide better experiences and outcomes for patients with chronic conditions, at equal or lower cost.

The department designed the HealthLinks: Chronic Care (HealthLinks) funding model to remove the funding barriers to delivering alternate models of integrated care for this highly complex patient group. The funding initiative began on 1 July 2016 and ran for three years to 30 June 2019. During this time, six participating health services (five of which participated in the HealthLinks funding model for varying periods of time and one observer health service) and three control health services across metropolitan Melbourne and Geelong took part.

The HealthLinks trial allowed participating health services to convert projected inpatient activity-based funding – weighted inlier equivalent separation (WIES) – for the enrolled cohort to create a capitated funding model (flexible funding). The capitated funding model provided a funding source that could be used to deliver a more flexible mix of services in home and community settings. It also provided financial incentives by enabling health services to benefit from any cost savings achieved through service innovation and efficiency.

The enrolled HealthLinks cohort was determined through an algorithm developed by the department, which predicts that approximately a third of the identified cohort will be admitted three or more times over the next year. The approach sought to create a capitated funding model with sufficient flexibility to support service innovation.

While the algorithm determined which patients became enrolled in the HealthLinks trial and therefore funded through the capitated model, health services determined clinical care and whether the health service’s HealthLinks intervention model was suited to the enrolled patient.

Health services had flexibility to design a model of care that suited the needs of their patient population and service system. Intervention models could be continuous improvement of existing services or new models of care, but all aimed to deliver an integrated mix of services. Health services also set the budget and resourcing model for their HealthLinks interventions drawing from the capitated funding model and, in some cases, other resources (such as ‘in kind’) from within the health service.

Three Communities of Practice were established to co-design the HealthLinks trial: Clinical Collaborative Group, HealthLinks Data and Analysis, and the Operations Group. The Communities of Practice were critical in shaping the design and implementation of HealthLinks in the lead-up to, and first year of, the trial. The Clinical Collaborative Group offered a forum for the department and health services to work collaboratively in developing the model and sharing implementation experiences throughout the trial.

The department partnered with the Commonwealth Scientific and Industrial Research Organisation to undertake a comprehensive mixed-methods evaluation of the HealthLinks trial. The overall aim of the HealthLinks evaluation was to determine if flexible funding enables health services to develop and implement alternative models (to inpatient acute care) that provide better experiences and outcomes for patients with chronic conditions, at equal or lower cost. Secondary aims included determining the impact of the flexible funding model on the delivery of care from a system perspective and, where possible, a patient perspective.

## Findings

### Hospital utilisation

The evaluation of the HealthLinks trial found that most outcomes measured showed little effect for those patients directly involved in an intervention apart from hospital and emergency department (ED) length of stay measures for one health service. Patients from flexibly funded health services seemed to have fewer ED presentations and reduced length of stay in the ED; however, it is unclear whether this is due to the effects of flexible funding or differences in outcome trajectories before flexible funding began. Although some workforce participants believed there were early signs of fewer ED presentations, especially at health services that implemented interventions for extended periods of time.

Outcomes for intervention patients assigned a high-risk status did not differ from low-risk patients for most health services apart from one health service where high-risk patients had fewer hospital admissions over time compared with low-risk patients. These findings counter what Stokes et al.[[4]](#endnote-5) discovered in their high-risk group but agree with the author’s initial hypothesis that high-risk patients benefit more from intensive interventions than low-risk patients. Perhaps the targeted strategies employed by the health service for the high-risk patients, a higher proportion of which were treated for a single specific condition, had a positive effect.

Considerable research has been invested in the implementation and evaluation of models of care for people living with chronic conditions. Wagner et al.[[5]](#endnote-6) first described the Chronic Care Model and ways it can be applied in managing chronic illness. However, a recent systematic review of the literature examining the implementation of different models of care found limited evidence of their overall effectiveness in reducing patients’ use of health services.[[6]](#endnote-7) Benefits from interventions were mainly confined to patient satisfaction measures. A recent randomised control trial looked at the effect of an intensive intervention for 800 patients with a very high use of health services. For these patients there was no difference between 180-day readmission rates for intervention and usual care groups.[[7]](#endnote-8) Some studies have found a reduction in the hospital utilisation rates, but many have not conducted rigorous analysis and patient selection methods are likely to be heavily biased (for example, Bird et al.[[8]](#endnote-9)). Chronic care models that do seem to improve patient outcomes are those specifically set up to deal with specific diseases such as diabetes,5 congestive heart failure[[9]](#endnote-10) and asthma.[[10]](#endnote-11) The perceived weakness of these studies, however, is that the programs were generally provided under research conditions and that the cost-benefit of these temporary programs was short-lived.

There is an emerging view that the effects on patient outcomes from chronic disease models of care may be more apparent in the longer term. A recent evaluation of an integrated care program in England looked at the long-term impact of a range of interventions within the program.[[11]](#endnote-12) It found that patient outcomes, such as ED visits, initially increased for two years consecutively after introducing the intervention; however, by year 6, ED visits were significantly lower compared with a matched control group. Similar patterns were found for emergency hospital admission, inpatient length of stay and 30-day readmissions. The authors hypothesised that the long-term pattern of impacts may be consistent with better care management and with developing more responsive, coordinated and streamlined care. They also suggested that the initial increase in ED visits may be due to identifying unmet needs or patients being more aware of their healthcare needs in the short term. A similar study by Morciano et al.[[12]](#endnote-13) found the intervention slowed rises in ED admissions but only after about three years. This view has been mirrored by workforce participants who took part in the HealthLinks evaluation. They frequently discussed a need for commitment to funding and resources over a longer period of time, potentially five to 10 years, in order to account for the sufficient time it takes to observe behaviour change.

While some workforce participants believed HealthLinks interventions had little impact on streaming patients to appropriate services outside acute care, analysis of patterns of non-admitted service use suggested intervention patients care pathways focused on more individual specialist services, unlike usual care patients who tended to access a much wider range of services. This suggests that patients may be getting the most appropriate care for their health needs.

### Patient experience

There were no objective measures of patient care satisfaction for inclusion in the evaluation; however, anecdotal evidence from workforce participants and internal health service surveys suggested that most patients found the HealthLinks interventions a positive experience. Intervention patients developed trust with care providers because they felt the holistic approach focused on their needs and ongoing support tended to reduce anxiety and build resilience. Workforce perceptions on the trial’s promotion of self-management varied. Some believed the impact was limited, while others believed the trial had a significant impact on self-care efficacy, health literacy, medication management and early detection of deterioration for participants receiving an intervention model of care. In general, workforce participants acknowledged barriers to adequately engaging patients with psychosocial comorbidities and those from culturally and linguistically diverse backgrounds in the HealthLinks intervention models of care. This was due to a lack of expertise within medically based teams to address mental health concerns, lack of culturally appropriate services or interpreter services and limited services for referral.

### Health services experience

The implementation of the department’s algorithm was problematic in the early phases of the trial mainly due to poor integration into local systems and the ability to replicate the same patient lists as those provided by the department. This also effects inferences that could be made from testing the sensitivity of patient selection. The algorithm identified a broad patient group and this resulted in a number of flow-on effects at the health service level. There was pressure to treat patients whatever their health problems were, while at the same time some health services were not set up to deal with such a diverse group. Conversely, there were perceived equity of care issues where patients were not picked up by the algorithm but were well suited to a HealthLinks model of care.

However, the widespread implementation of the algorithm has enabled health services to look across the system more collaboratively to identify care gaps generally in their own and other health services. The algorithm has enabled health workers to identify patients who would benefit from HealthLinks intervention models of care and highlight high frequency users and allow health services to develop appropriate care plans accordingly. Future refinements to the algorithm were suggested so that it identified a more targeted cohort to ensure care is being provided to those who would benefit the most, especially at the individual health service level. The integration of aspects of the Western 9 questionnaire to stratify the patient’s risk of readmission based on their debility and psychosocial risk factors, for example, into the algorithm may provide an additional filter. Workforce participants also suggested potential benefits of adapting the algorithm to identify patients before their needs became acute or highly complex because they believed there would be greater opportunities for behaviour change for these patients who would potentially require less resource intensive intervention models of care. A more appropriate cohort to target would warrant further investigation into algorithm refinements.

There was an overall view from workforce participants that for an intervention model like HealthLinks to succeed there needs to be a change in mindset of chronic disease management and acknowledgement that the acute setting has a significant role to play in the care of patients with chronic and complex care needs. Some participants also believed participation in the HealthLinks trial was the push their health service needed to generate discussions about taking a long-term outlook of healthcare models for chronic disease management. Given the care of patients with chronic and complex conditions spans multiple departments within health services, participants believed change should ultimately be implemented at the organisational level and that this would break down funding barriers in the siloed system and show departments the health service is committed to making change. Common themes such as the need for chief executive officer (CEO) support, commitment to funding and resources, staff champions and staff education were prevalent throughout health services. These enablers are widespread in the literature as well[[13]](#endnote-14) and are much of the focus of delivering successful implementations of models of care.[[14]](#endnote-15)

Overall, participants believed participating in the HealthLinks trial was a positive experience. It allowed flexibility and creativity, and provided learning opportunities. For healthcare providers, seeing the valuable contribution to improving patients’ care was rewarding. There were, however, diverse discussions among workforce participants about the impact the trial had on workloads. Some participants reported an increase in workload, particularly for healthcare providers at the start of the trial.

### Funding utilisation

Some health services found the capitated funding model a challenging concept to understand, and it was often seen as a financial risk, especially in a challenging financial environment faced during the trial period. Most participating health services took a risk-averse approach to participation. Some workforce participants believed an upfront funding boost may have better facilitated the transition to a capitated funding model. Workforce participants across all health services believed that providing integrated models of care to a larger cohort would require greater resource investment and the development of less resource intensive care models that were agile to patient needs.

While the evaluation found that intervention patients used more WIES than usual care patients, it was not more than expected considering the patients’ casemix and demographic profile. Without a rigorous randomised control trial it is not possible to separate intervention patients with potentially more complex needs than is measured through activity data and usual care patients. In parallel with the increase in healthcare utilisation reflected in patient outcomes, the increase in WIES may reflect additional unmet needs in the intervention group, which incurs more health system costs in the short term but should bring benefits through improved patient outcomes over time. In the absence of data on intervention patients’ quality of life outcomes, it is not clear whether this is the case and limits the ability to assess the cost-effectiveness of the intervention. Although the initial year appears relatively expensive in terms of patients treated as health services were gradually enrolling patients, in the most recent year for which data are available, costs per patient for the intervention appear to have stabilised.

## Evaluation snapshot

In general, workforce participants across health services believed participation in the HealthLinks trial quantified the true demand for services and highlighted the importance of funding community-based care for chronic disease management. They described that it provided an opportunity for health services to observe service gaps and think about how to shape services and allocate funding to more effectively address patient needs. They also highlighted a need to consider non-financial measures in determining intervention effectiveness such as patient outcomes, quality of life and value-based care.

### Did flexible funding enable health services to develop and implement alternative models to inpatient acute care?

Yes, five health services adopted flexible funding and implemented redesigned and new models of integrated care.

CEO support as well as staff champions across varying levels of the health service were seen as vital for successful implementation of the initiative.

The trial started a shift in mindset of chronic disease management and the role acute services can play in the care of patients with chronic and complex care needs. Some workforce participants believed the trial was the push their health service needed to start taking a long-term outlook of healthcare models for chronic disease management.

### What effect did the trial have on the system?

Overall, workforce participants interviewed as part of the evaluation found participation in the trial a positive experience but that there was a need to manage workload.

The capitated funding model was considered a challenging concept to understand and it was often seen as a financial risk, especially in a challenging financial environment faced during the trial period.

Intervention patients did not accrue relatively more WIES than usual care patients in the last two years of the trial, and there was potential for reducing inpatient and ED services for some comorbidity groups, especially over a longer period such as six years.11 Patterns of non-admitted service use for intervention patients focused on more individual specialist services, unlike usual care patients who tended to have a more complex healthcare journey.

The algorithm enabled identification of the frequently presenting cohort and had the potential to identify patients who would benefit from an intervention model of care.

However, interventions implemented were resource-intensive, and operating within a siloed health system created implementation challenges.

### What effect did the trial have on patients?

The workforce saw HealthLinks as a positive experience for patients receiving active intervention, including improving patients trust and belief in the health system. However, engaging patients with mental health concerns and finding culturally appropriate services was challenging, and workforce perceptions of the interventions impact on patient self-management varied.

Workforce participants believed patients in need of additional supports were better identified through the algorithm and better patient identification improved streaming and referrals to hospital services and supports.

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| **Health service experience:**  ‘… I think it really helped start a conversation if it wasn’t happening already … everyone knows that we need to divert more people from hospital and keep them out … it proved a really good intermediate step to start conversations and really create some focus …’ | **The algorithm and patient identification:**  ‘… getting this algorithm and getting the patient list each day means that we can actually find the patients … I think it’s definitely positive.’  ‘I think again it really identifies that vulnerable group of clients who would certainly benefit from coordinated, responsive, interdisciplinary care …’ | **Care coordination:**  ‘… they won't know their discharge plan because on day of discharge they get bombarded from every discipline. So I suppose we just put it together for them and we call them, just to reinforce things’ |
| **Demographic:**  ‘… challenging some of our preconceived ideas and misconceptions, so the age … I think everyone thinks everyone that comes in a lot is old, and there is a group … I’d describe them as kind of 30s 40s, 50s … coming in, not staying long but churning around the system a lot’ | **Groups resistant to interventions:**  ‘… that hybrid approach between medical and mental health, psychosocial that requires a different way of thinking … it requires you to actually rise above the chaos and work in a different way with that client group’ | **Patient experience:**  ‘Because we’re not as quick to discharge with HealthLinks … you establish a better relationship with them because you hang onto them a little bit and they get to trust you’ |

### What are the future considerations?

Findings from the literature suggests longer term monitoring of intervention patient outcomes is required to see the impacts of chronic disease models. Such monitoring should consider non-financial measures in determining intervention effectiveness, such as quality of life and value-based care.

The development of an algorithm that targets specific cohorts that align with individual health service strengths, focus and resources could also be considered, including a way to target patients earlier in their disease trajectory.

Establishing a funding approach that can provide ongoing certainty would support planning and monitoring of patient outcomes.

# Introduction

## Background

Patients with chronic conditions often have complex health and care needs that, for many, results in frequent use of the health system and higher associated health care costs.1 *The global action plan for the prevention and control of non-communicable diseases 2013–2020*[[15]](#endnote-16) acknowledges that all developed healthcare systems will need to act differently in the future to effectively respond to the growing number of people with multiple chronic and complex healthcare needs. Current models of health care and funding systems are largely designed to respond to episodic care, but many people with complex and chronic diseases require long-term, proactive and systemic approaches of care.

It is generally well accepted that integrated community-based care and active management can result in better outcomes for people living with chronic conditions and may help reduce their need for inpatient care. Australian health ministers endorsed the *National strategic framework for chronic conditions*1 in 2017. The framework acknowledges that, with an increase in chronic disease, health systems need to shift from treatment of illness to prevention and that chronic disease management requires a consistent, holistic and coordinated approach to care with involvement from a wide range of services across the health system (also known as integrated care). However, the overlapping role and responsibility of ambulatory and inpatient care services, separate funding streams and models of care, as well as activity-based funding for acute care and insufficient infrastructure for accurate and secure data sharing across the system create barriers to implementing integrated care models.

The HealthLinks: Chronic Care (HealthLinks) funding model has been designed as the first step in removing the funding barriers to delivering alternate models of integrated care for this highly complex patient group. The trial forms part of the Victorian Department of Health and Human Services (now the Victorian Department of Health [the department]) approach to public hospital funding reform and its objective of delivering person-centred and integrated care in the right place, at the right time with the vision of achieving best health, wellbeing and safety for all Victorians.

The department obtained expressions of interest for participation from 10 Victorian health services in November 2015. The trial began on 1 July 2016 and ran for three years to 30 June 2019. During this time, six participating health services (five of which participated in the HealthLinks funding model for varying periods of time) and three control health services across metropolitan Melbourne and Geelong took part. As shown in Table 1, participating health services began active participation in the trial at different stages.

Table 1a: Health service participation activity – participating health services

| **Health service** | **Commenced active participation** | **Intervention start date** |
| --- | --- | --- |
| Alfred Health | 1 July 2017 | 3 August 2017 |
| Barwon Health | 1 March 2017 | 1 March 2017 |
| Eastern Health | 1 August 2018 | 3 October 2018 |
| Monash Health | 1 November 2016 | 1 December 2016 |
| Northern Health | 1 July 2016 | 1 July 2016 |
| Western Health | 1 November 2016 | 21 November 2016 |

Table 1b: Health service participation activity – control health services

| Health service | Commenced active participation | Intervention start date |
| --- | --- | --- |
| Austin Health | 1 July 2016 | N/A |
| St Vincent’s Hospital Melbourne | 1 July 2016 | N/A |
| The Royal Melbourne Hospital | 1 July 2016 | N/A |

Notes:

1. Eastern Health participated as a non-financial health service for the duration of its participation in the HealthLinks trial.

2. Eastern Health did not implement an intervention model of care. Intervention start date refers to the date Eastern Health began using the HealthLinks algorithm to stream patients into its existing HARP services.

3. Northern Health ceased financial participation on 30 June 2017 and participated as a non-financial health service from 1 July 2017.

4. Northern Health began additional intervention models on 16 January 2017 (DPSS), 18 April 2017 (CarePoint, Hume) and 1 August 2017 (CarePoint, Whittlesea).

Health services identified patients at high risk of multiple unplanned hospital admissions through a department-developed algorithm. The algorithm considered and scored patient characteristics and use of inpatient and emergency department (ED) hospital services (refer to Appendix 1 for scoring parameters). Enrolment was triggered on an unplanned medical episode, provided various threshold criteria were met.

At participating health services, a subset of patients enrolled in the trial were offered the intervention model of care, with the remaining cohort receiving usual care. Patients with clinical conditions that were likely to result in frequent and/or costly unplanned readmissions (for example, renal dialysis, cancer treatment, trauma) that were not readily affected by the health service were excluded from the funding modification, as were patients for whom the department was not the funder (for example, private health episode, WorkCover claims; refer to Appendix 2 exclusion criteria).

The HealthLinks trial used the flexible capitated funding model to allow participating health services to convert projected inpatient activity-based funding (weighted inlier equivalent separation [WIES]) for the enrolled cohort to create a capitated funding model for use towards new and/or improved patient-centred models of care. The capitated funding was also used for inpatient services for the enrolled cohort.

Traditionally activity-based funding payments are determined by the estimated cost of hospital admissions, and hospital admissions need to occur in order to attract revenue. Therefore, providing limited incentive for health services to reduce hospital admissions. Alternatively, capitated funding is based on the estimated cost for the number of people being treated based on their past health service use. Therefore, in this alternative funding model the hospital admissions are funded from the total capitated funding model, creating incentive for health services to reduce admissions to reduce the total cost of care.

The key characteristics of each participating health services intervention model of care are summarised in the ‘Key intervention characteristics’ section.

## Communities of Practice

Three Communities of Practice were established to co-design the HealthLinks trial:

* Clinical Collaborative Group – comprised clinical leads (evaluation site principal investigators), project managers and HealthLinks staff from each of the 10 HealthLinks health services. The group focused on the details of the HealthLinks design and implementation, including intervention strategies. The group also guided the evaluation.
* HealthLinks Data and Analysis – membership comprised health service analysts. The group focused on data items and departmental reports that health services required to administer HealthLinks and replicate the HealthLinks patient selection algorithm across the range of analytic software and feeder systems.
* Operations – membership was predominantly project and operational managers. The group focused on the mechanics of executing the trial at the health service level.

The Communities of Practice were critical in shaping the design and implementation of HealthLinks in the lead-up to, and first year of, the trial. The Clinical Collaborative Group offered a forum for the department and health services to work collaboratively in developing the model and sharing implementation experiences throughout the trial. A departmental secretariat supported the communities, and representatives of the HealthLinks trial evaluators, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) were invitees to the Communities of Practice meetings.

Key achievements for the Communities of Practice included the following:

* Refining the case-finding algorithm – the lag in departmental data meant patients had often been discharged from hospital by the time they were identified as enrolled. Furthermore, medical record reviews at individual hospitals indicated that patients at high risk of multiple unplanned admissions were often admitted a number of times in very short succession.

The department and the Data and Analysis Community of Practice worked collaboratively on designing a version of the algorithm that could be replicated by health services using the hospital’s own dataset. The new algorithm, issued in early 2017, enabled health services to better identify patients using their own patient information systems.

The new algorithm development period posed a number of challenges, particularly for those health services that had begun implementation in 2016; however, enabling health services to operationalise the algorithm at the local level, and to intervene earlier, was enormously valuable and a major implementation achievement for the trial.

* Understanding the patient cohort and developing models of care – early expectations of which types of patients would become enrolled in HealthLinks centred around frail elderly people, though the range of patient types was broader and included:
  + patients with a single chronic disease, complicated by anxiety
  + patients who experience a major health event (for example, a heart attack) and have a range of social issues and some unhealthy lifestyle factors
  + people diagnosed with alcohol and drug and mental health issues (dual diagnosis).

The differences in the characteristics of patients who became enrolled necessitated rethinking some aspects of the HealthLinks intervention models of care and the breadth of services required to best address the needs of enrolled patients, particularly the importance of social support services.

* The Operations Community of Practice provided a supportive environment for information sharing and the exchange of practical strategies on implementing new and quite different models of care for different patient cohorts.

## Evaluation aims

The CSIRO was contracted to undertake a comprehensive mixed-methods evaluation of the HealthLinks trial. Quantitative and qualitative data sources were used to determine the reach, effectiveness, adoption, implementation and maintenance of HealthLinks, as per the RE-AIM framework.[[16]](#endnote-17)

The overall aim of the HealthLinks evaluation was to determine if flexible funding enables health services to develop and implement alternative models (to inpatient acute care) that provide better experiences and outcomes for patients with chronic conditions, at equal or lower cost.

Secondary aims included determining the impact of the flexible funding model on the delivery of care from a system perspective and, where possible, a patient perspective.

System perspective:

* Optimal use of available resources to meet patient needs.
* Care provided is cost-effective.
* Service models are financially sustainable and viable over the longer term.

Patient perspective:

* Integrated care in the right place, at the right time.
* Increased satisfaction with care experiences.
* Improvement in patient-reported outcomes.

# Methods

The evaluation of the HealthLinks trial used the RE-AIM framework16 to assess the reach, effectiveness, adoption, implementation and maintenance of the HealthLinks trial from a systems-level perspective. The CSIRO undertook a comprehensive mixed-methods evaluation including analysis of routinely collected hospital data, a quality of life patient survey, workforce interviews and costings data.

## Quantitative methods

Data prepared by the department for the final report came in two separate versions. The ‘original’ cohort files and new ‘supplementary’ files. The supplementary files were built to generate control health service patients for the period between July 2016 and February 2018 because the algorithm used to identify enrollees was only restarted in February 2018 to support patient survey recruitment. This resulted in some cases in patients who were originally enrolled at a participating health service subsequently being reclassified as a control health service enrollee. Criteria were developed to deal with these potential inconsistencies. The main outcome analyses were carried out using merged ‘original’ and ‘supplementary’ files. However, a linkage limitation meant that only the supplementary files could be used for undertaking ED (Victorian Emergency Minimum Dataset [VEMD]) analyses. This may have a significant impact on inferences made in comparing outcomes from inpatient and ED analyses because disparate datasets were used and the same patient cannot be linked from inpatient data to ED data. Additionally, all analysis using trial period data only was confined to using the original data files. This included WIES, costing and Victorian Integrated Non-Admitted Health (VINAH) datasets.

Cell sizes between 1 and 4 are de-identified and reported as < 5. If only one cell in a column is de-identified and the *n*-value can be computed, the next lowest value in the column is also de-identified and reported to the nearest multiple of 5 (for example, < 10, < 15, < 20).

### HealthLinks enrolments and patient characteristics

Patient enrolment numbers were sourced from the ‘original’ Census table (not containing supplementary control health service patients). Patient characteristics were identified by merging a dataset containing the Census records for enrolled patients with the Staging table. There were 18 patients who did not have Staging table records and were subsequently removed. The record with a Victorian Admitted Episode Dataset (VAED) admission date closest to the patients Status Start Date was selected for analysis.

Analysis were undertaken to summarise: (i) patient enrolment status, by health services and years enrolled, and (ii) patient characteristics.

### The algorithm

To assess how well local applications of the department algorithm agreed with the actual algorithm, sensitivity and positive predictive values were calculated. For each financial participating health service, details of patients listed in their record-keeping spreadsheets, either as intervention or usual care patients (predicted) were compared with HealthLinks-enrolled patients (the department’s list) who had a trial trigger admission (actual).

### Hospital utilisation

#### Capitated funding versus activity-based funding

To study enrolled inpatient episodes, the department provided historical data describing inpatient admissions at five participating health services (Alfred Health, Barwon Health, Monash Health, Northern Health[[17]](#footnote-2) and Western Health) and three control health services (Austin Health, St Vincent’s Hospital Melbourne and The Royal Melbourne Hospital). Separately, a corresponding extract from the VAED was provided, which contained episode level detail for each patient, for admission to any health service in Victoria.

HealthLinks episodes with a status of ‘Enrolled’ or ‘Eligible’ were matched to their episodes in the VAED, using HealthLinks ID and episode start and end dates. Episodes that could not be matched at all to a VAED episode were removed. Duplicate HealthLinks episodes were identified and removed; additional cleaning was performed and variables created.

To investigate capitated funding versus activity-based funding, it was necessary to identify ‘trigger admissions’ in the historical data and then associate (attribute) subsequent enrolled episodes to the health service of the patient’s trigger admission.

To prepare the data for the outcome analyses, datasets were converted into monthly panels where outcomes were summed to a count per patient per month for the period 12 months before the trial start date for participating health services and 1 July 2016 for control health services and for 24 months after. For continuous interval measures associated with a patient’s admission, the mean per month was used; for categorical measures the first occurrence was used. Missing panel data, where a patient had no health service utilisation in a month, was filled with zero observation to make a balanced panel dataset.

To study patient length of stay in an ED, episodes in the VEMD were used from the supplementary files only. Data preparation was largely similar to preparing the VAED data. ED episodes were associated with a HealthLinks-enrolled patient (and the health service of the trigger admission) if the patient’s HealthLinks status was ‘Enrolled’ when the patient presented to the ED. Thus, all ED episodes for each patient were filtered based on this criteria, and ones associated with an ‘Enrolled’ patient were also associated with the health service of the trigger admission. Variables used in the modelling were age group, sex, Socio-Economic Indexes for Areas (SEIFA), Index of Relative Socio-economic Advantage and Disadvantage (IRSAD) decile and triage category.

#### Intervention versus usual care model

To support analysis of health service interventions versus usual care, a matched case-control cohort was created. A cohort was created for each of the five financially participating health services separately, along with one combining patients from all five participating health services. This was necessary because of the way in which usual care patients are divided and associated with intervention patients. Intervention patients were from Alfred Health, Barwon Health, Monash Health, Northern Health and Western Health. Eastern Health was not included because their pilot model was not capitated funded under the HealthLinks funding model.

The matching process entailed matching each intervention patient to usual care patients based on five-year age group, sex and number of comorbidities at the trigger admission.

To prepare the data for the outcome analyses, datasets were converted into monthly panels where outcomes were summed to a count per patient per month for the period 12 months before the patient intervention start date for intervention patients and usual care patients and for 24 months afterwards. Missing panel data, where a patient had no health service use in a month, was filled with zeros to make a balanced panel dataset.

A difference-in-difference (DID) quasi-experimental design was used in this study. In this design, a change in the outcome (if any) for the intervention group is compared with a change in the outcome for the usual care group, between the ‘before’ and ‘after’ periods. This design helps control for before/after changes that are experienced by both groups. A key assumption for this approach is that patient outcomes are assumed to have a common time trend until implementation of intervention, after which the trends are allowed to diverge. To assess whether underlying trends in patient outcomes were similar among controls health services relative to participating health services during the 12 months before the intervention, a ‘parallel trend’ test was performed.

Generalised linear mixed models were employed throughout the DID analysis. Types of models fitted depended on individual model fits and convergence issues (if any). The main model families applied were Poisson, Negative Binomial and zero-inflated Poisson models. Random effects were either patients clustered with health services or alternatively just within patients.

### Patient experience and self-reported outcomes

All patients identified as HealthLinks-enrolled were approached to participate in the HealthLinks evaluation patient survey until defined recruitment quotas were reached. Eligible participants were provided with a survey pack that consisted of a cover letter, participant information and consent form, a paper-based survey (available in English, Arabic, simplified Chinese, Greek, Italian, Turkish and Vietnamese) and a reply paid envelope for survey return. Health services were responsible for participant recruitment and obtaining verbal consent. If verbal consent was not provided, and participants could not be reached to provide consent or they were unable to complete the survey in available languages, they were withdrawn from the survey component of the evaluation. Participants who became ineligible for the HealthLinks trial, as identified by the department, were also withdrawn and notified via a letter.

Surveying began in February 2018, with survey administration dates varying between health services (Table 2). A survey was administered across three time points to assess patients self-reported health state, wellbeing and healthcare experience. It consisted of seven validated survey instruments (EQ-5D-3L, EQ-VAS,[[18]](#endnote-18) SF-12 v2 Health Survey,[[19]](#endnote-19) PHQ-8 [a modified PHQ-9 survey],[[20]](#endnote-20) GAD-7,[[21]](#endnote-21) PACIC[[22]](#endnote-22) and PSQ[[23]](#endnote-23)) as well as a series of background and demographic questions. Health services collated returned baseline surveys and forwarded them to the contracted survey company for processing and data entry. The contracted survey company used personal details provided by participants in the baseline survey to send the six- and 12-month surveys. Participants could withdraw their consent at any time up until the deidentification of data.

Table 2a: Patient survey administration dates – participating health services

| **Health service** | **First baseline survey** | **First 6-month survey** | **First 12-month survey** |
| --- | --- | --- | --- |
| Alfred Health | 30 July 2018 | 6 December 2018 | 6 June 2019 |
| Barwon Health | 6 February 2018 | 9 August 2018 | 9 February 2019 |
| Eastern Health | 3 September 2018 | 3 March 2019 | - |
| Monash Health | 12 February 2018 | 23 August 2018 | 23 March 2019 |
| Northern Health | 12 February 2018 | 8 August 2018 | 23 March 2019 |
| Western Health | 28 May 2018 | 26 November 2018 | 13 June 2019 |

Table 2b: Patient survey administration dates – control health services

| Health service | First baseline survey | First 6-month survey | First 12-month survey |
| --- | --- | --- | --- |
| Austin Health | 5 February 2018 | 6 August 2018 | 12 February 2019 |
| St Vincent’s Hospital | 5 February 2018 | 28 August 2018 | 2 March 2019 |
| The Royal Melbourne Hospital | 15 February 2018 | 9 August 2018 | 14 February 2019 |

Survey data was provided to the CSIRO in a deidentified format with a HealthLinks identifier to facilitate linkage. Scoring metrics for the EQ-5D survey tool were provided as a separate extract. These extracts were merged with the Staging table demographic characteristics and trigger admission details outlined in the VAED. The combined dataset was then cleaned and the SF-12 survey scores were transformed to a t-score normalised using mean and standard deviation of the US general population as outlined in the user manual.

A generalised linear mixed model was constructed to assess whether the difference between the survey scores at wave 1 and wave 2 for each survey score (as a continuous variable) were different across health services. The model was adjusted for admission age, preferred language, gender, health service, diagnosis-related group (DRG) and the presence of a comorbidity.

### Funding utilisation

The department supplied a Census table for all HealthLinks-enrolled patients. This table tracked the time a patient had been enrolled at a health service, along with the amount of WIES accrued. Patients were followed over time by enrolled months, and their annualised WIES was calculated as the sum of HealthLinks WIES plus standard WIES divided by months enrolled. Data from the Staging table was used to calculate predicted versus actual WIES, by financial year. A hierarchical linear model with a random intercept model was used to generate a predicted WIES value and the percentage difference between actual and predicted WIES was calculated.

Each financially participating health service provided costing information detailing recurrent, non-recurrent and in-kind costs that related specifically to the HealthLinks model of care provided to intervention patients. Costs were then compared with the amount of WIES accrued by an intervention patient over the period of the intervention. WIES was converted to a dollar figure by conversion rates provided by the department. Costings were estimated for the 2016–17, 2017–18 and 2018–19 financial years for the four participating health services that provided data on their costs of the intervention. Recurrent and in-kind costs were combined with any non-recurrent costs accrued in each financial year to give total actual costs for the year. For the purposes of this report, annual costs from the previous years were converted into 2018–19 dollars, allowing costs across different years to be compared directly without needing to consider, for example, inflation. Any start-up costs reported previously were included in the initial year of the program for this purpose.

Costs varied widely between health services, as did the level of cost reporting detail; any comparisons between health services should therefore be made with great caution.

## Qualitative methods

### Workforce interviews

Workforce focus groups and interviews were conducted with staff at the participating health services towards the start of implementation (baseline) and again towards the end of the trial period (follow-up). All healthcare managers and healthcare providers involved in the HealthLinks trial were considered eligible for participation in the sessions.

Each participating health service provided a list of eligible staff who could be approached for participation with email invitations sent by the CSIRO research team. At baseline, 75 participants provided consent and participated in a session (46 healthcare managers and 29 healthcare providers; participation rate 52 per cent), while at follow-up 50 participants took part (23 healthcare managers and 27 healthcare providers; participation rate 46 per cent).

At baseline open-ended questions aimed to explore participants perceptions of: (i) the HealthLinks intervention model being implemented at their health service, (ii) the impact or potential impact of the trial, and (iii) implementation barriers, enablers and potential future improvements to the HealthLinks model. At follow-up, questions asked related to: (i) staff satisfaction, (ii) perceptions of the HealthLinks trials impact on enrolled patients, (iii) perceived changes in clinical efficiency, and (iv) barriers and enablers to implementation. The same guiding questions were used across health services with slight adaptions made where necessary. At baseline, 19 focus group sessions lasted between 26 and 75 minutes and 26 individual interviews lasted between 14 and 50 minutes. At follow-up, 11 focus group sessions lasted between 29 and 94 minutes and 21 individual interviews lasted between 12 and 52 minutes. All sessions were audio recorded and transcribed.

Using NVivo 11 Starter software, three members of the research team individually undertook thematic coding of all transcripts. A series of discussions among the three researchers were then used to review and refine the coding and to reach consensus on key themes identified at each health service.

Key themes identified during the baseline sessions have been previously reported in detail[[24]](#endnote-24),[[25]](#endnote-25) and are summarised at an overall level in Appendix 3.

Key themes from the follow-up sessions including the HealthLinks population, the algorithm, patient outcomes, patient experience and costings are described throughout the report with quotes included for illustrative purposes.

# Key intervention characteristics

Participating health services used some of the funds from the capitated funding model to pay for alternative models of care that supported people at home or in the community and aimed to reduce unplanned hospital admissions. Health services had flexibility to design a model of care that suited the needs of their patient population. Intervention models could be continuous improvement of existing services or new models of care, but all aimed to deliver an integrated mix of services. The key characteristics of each model of care are described below with quotes from workforce focus groups included to highlight their perceptions of the intervention models.

## Alfred Health

Alfred Health began active participation in the HealthLinks trial on 1 July 2017. They first started enrolling patients into HealthLinks interventions on 3 August 2017.

### Patient identification

Alfred Health employed the algorithm developed by the department to identify HealthLinks-eligible patients. It was integrated with the CERNER data base to identify patients who met enrolment criteria.

The intervention groups were integrated in the Hospital Admission Risk Program (HARP) model of care, and the department algorithm assisted the HARP team to identify patients who might not otherwise have been referred by the ward and ED staff.

### Intervention model of care

Alfred Health’s approach was to use the HealthLinks trial and its flexible capitated funding model to build on existing services rather than create new services. At the start of Alfred Health’s engagement with the HealthLinks funding model, the organisation’s initial intervention targeted people suffering from chronic respiratory disease, heart failure or both. Throughout the trial, recruitment expanded to include patients who broadly fitted HARP eligibility criteria, such as patients who experienced chronic and complex health conditions, complex psychosocial issues, and those who would benefit from care coordination and complex care management.

Alfred Health implemented a specific intervention for chronic obstructive pulmonary disease (COPD) and heart failure patients that entailed a new structured education program delivered by registered nurses. The nurses were trained in motivational interviewing and their resource for patient education was derived from the heart online and COPDX guidelines. This structured education was coupled with interdisciplinary care provided within the existing HARP model and medical outreach and telemedicine were used as appropriate to patient needs. Patients also had access to an extensive complex care review in the General Medicine clinics.

Heart and lung rehabilitation programs were provided in a traditional centre-based or new home-based model of care. The new home-based intervention involved a centre-based assessment followed by a telephone coaching model of care and concluded with a final visit at the centre for assessment of outcomes following the intervention. The heart failure rehabilitation program ran for 12 weeks, while the pulmonary rehabilitation program ran for eight weeks. Both programs were exercise- and education-focused.

HealthLinks enrollee subtypes at Alfred Health are listed in Table 3.

Table 3: Characteristics of the Alfred Health HealthLinks enrollee patient subtypes

| **Enrolment subtype** | **Inclusion criteria** | **Type of care received** | **Type of service** |
| --- | --- | --- | --- |
| Heart failure | HealthLinks enrollees who had a diagnosis of heart failure on echocardiogram | Intervention | Redesigned existing service |
| COPD | HealthLinks enrollees who had a diagnosis of COPD including spirometry | Intervention | Redesigned existing service |
| HARP complex care | HealthLinks enrollees eligible for HARP services (no diagnosis of heart failure or COPD) | Usual care | Existing service |
| Usual care patient | All other HealthLinks enrollees | Usual care | Existing services |

### Workforce participants perceptions of the intervention characteristics

Participants acknowledged that the HealthLinks intervention model aligned well with HARP. While the implementation of clear frameworks provided consistency in processes, they believed the model of care allowed flexibility to provide patient-centred care that considered the needs of each patient individually.

## Barwon Health

Barwon Health began active participation in the HealthLinks trial on 1 March 2017 and started enrolling HealthLinks patients into redesigned Barwon Health services from this date.

### Patient identification

Barwon Health’s Decision Support Unit was responsible for the replication and implementation of the department patient identification algorithm. The Decision Support Unit did not attempt to replicate the department algorithm that was written with Statistical Analysis System (SAS) code due to anticipated replication and implementation challenges. Once the department had transposed the SAS algorithm into an algorithm written with Structured Query Language (SQL) code, Barwon Health could successfully replicate and implement the SQL algorithm into its local system. The logic ran across Barwon Health’s inpatient and emergency activity nightly. A report that identified newly triggered patients and their admission ward at University Hospital Geelong was generated in real time as of 16 October 2017.

### Intervention model of care

Barwon Health’s approach was to use the HealthLinks trial and its flexible capitated funding model to build on existing services rather than create new services. All HealthLinks enrollees who lived within the Belmont Primary Care boundaries were considered eligible for intervention. Two intake models were used for the two discharging units: University Hospital Geelong and Barwon Health Inpatient Rehabilitation Centre. The University Hospital Geelong intake model required identifying whether the patients were discharged or admitted, while the Inpatient Rehabilitation Centre intake model allowed patients to be tracked electronically using the centre journey board.

Barwon Health implemented a tiered approach to intervention based on a comprehensive assessment of patient needs, their personal circumstances and their goals. Patients identified as having acute and complex needs were linked with HARP services and the Personalised Health Care team for care coordination and coaching. Personalised remote monitoring was available for patients with COPD, diabetes and heart failure in which biometric data was entered by patients daily and, if outside of their usual parameters, the clinical team contacted them directly to support self-management requirements via phone or videoconferencing.

For patients requiring less intensive intervention, key workers assisted with health system navigation and were a link back into the health system. They were able to facilitate escalation of issues such as reduced waiting lists for Belmont Community Health Centre services and early admission to the Belmont Community Rehabilitation Centre. Patients with COPD, diabetes or heart failure also had access to community nursing for support with medication management, disease-specific health literacy and general practitioner (GP) engagement.

HealthLinks enrollee subgroups at Barwon Health are listed in Table 4.

Table 4: Characteristics of the Barwon Health HealthLinks enrollee patient subtypes

| **Enrolment subtype** | **Inclusion criteria** | **Type of care received** | **Type of service** |
| --- | --- | --- | --- |
| Community health | HealthLinks enrollees who live in Belmont Primary Care boundaries | Redesigned usual care | Redesigned existing service |
| Community health key worker | HealthLinks enrollees who live in Belmont Primary Care boundaries | Redesigned usual care | Redesigned existing service |
| Community health key worker –personalised health care | HealthLinks enrollees who live in Belmont Primary Care boundaries | Intervention | Redesigned existing service |
| Community nursing | HealthLinks enrollees who live in Belmont Primary Care boundaries | Redesigned usual care | Redesigned existing service |
| Community rehab centre | HealthLinks enrollees who live in Belmont Primary Care boundaries | Redesigned usual care | Redesigned existing service |
| HARP | HealthLinks enrollees who live in Belmont Primary Care boundaries | Redesigned usual care | Redesigned existing service |
| Other Barwon HealthLinks intervention | HealthLinks enrollees who live in Belmont Primary Care boundaries | Intervention | Redesigned existing service |
| Personalised health care | HealthLinks enrollees who live in Belmont Primary Care boundaries | Intervention | Redesigned existing service |
| Usual care patient | All other HealthLinks enrollees | Usual care | Existing services |

### Workforce participants’ perceptions of the intervention characteristics

Participants acknowledged that the intervention model of care at Barwon Health was a work in progress and that the trial period was primarily being used to identify the target cohort and consider ways to improve referral pathways to existing services. Personalised health care and the use of remote patient monitoring was considered one new model of care implemented during the trial period.

## Eastern Health

Eastern Health began a HealthLinks pilot program on 1 August 2018. Unlike other intervention health services that converted to a capitated funding model for HealthLinks-enrolled patients, the pilot at Eastern Health was grant-funded and enrolled patients received activity-based funding. Patients were first enrolled into the HealthLinks pilot model on 3 October 2018.

### Patient identification

The department patient identification algorithm was integrated into local systems and adapted for local need by the Eastern Health Decision Support Service through the Insight program. Clinicians ran a daily algorithm report (Monday to Saturday) to identify eligible patients whose admission to hospital in the preceding 24 hours was likely to have been a trigger admission. Initial generation of the report post ‘go live’ demonstrated very few patients, likely due to standard health information coding lag. To increase identified patient numbers, on 8 October 2018 a DRG guesser (used to try to counter the lag in data coding) developed by Austin Health was added to the algorithm to improve early identification of new enrollees.

Patients who returned the HealthLinks evaluation baseline survey were assessed for HARP suitability using preset patient and clinician questions.

### Pilot model of care

The Eastern Health pilot model was designed to use data-generated, rather than clinician-generated, referrals to maximise usage of existing HARP services and determine whether community follow-up for case coordination and chronic disease management would reduce hospital use. Patients at risk of multiple unplanned hospital admission as identified using the HealthLinks patient identification algorithm, who completed the HealthLinks evaluation baseline survey and who met HARP eligibility criteria were eligible for participation in the Eastern Health pilot. Those who were appropriate for the pilot were added to the HARP waitlist, with commencement within approximately three weeks.

Patients were initially allocated to the general care coordinator stream of HARP and seen by nursing staff, unless identified as requiring stream specific care (for example, cardiac, diabetes, respiratory) at the time of screening for HARP eligibility. Throughout the trial period, one additional HARP stream was brokered through support service UnitingCare lifeAssist for patients who had social but no medical issues to follow up. Participation in HARP services provided patients with care outside the acute setting as well as general care coordination and chronic disease management. This included nursing and allied health services, education and referrals to additional services if identified as a need by the care coordinator.

HealthLinks enrollee subgroups at Eastern Health are listed in Table 5.

Table 5: Characteristics of the Eastern Health HealthLinks enrollee patient subtypes

| **Enrolment subtype** | **Inclusion criteria** | **Type of care received** | **Type of service** |
| --- | --- | --- | --- |
| HealthLinks – HARP | HealthLinks enrollees who meet HARP eligibility questions and accept the pilot model of care | Redesigned usual care | Existing service, newly offered to patient |
| UC1 – Already HARP active | HealthLinks enrollees already active with HARP | Usual care | Existing service, already receiving |
| UC2 – HARP not explored | HealthLinks enrollees who did not return survey were not followed further to explore role of HARP | Usual care | Potential service not explored |
| UC3 – not HARP suitable | HealthLinks enrollees who were screened and did not meet HARP eligibility questions | Usual care | Not appropriate for service |
| UC4 – HARP suitable, declined | HealthLinks enrollees who met HARP eligibility questions but declined service | Usual care | Appropriate for new service but declined by patient |
| Usual care patient | All other HealthLinks enrollees | Usual care | Existing service |

### Workforce participants’ perceptions of the pilot model characteristics

Participants described participation in the HealthLinks trial as a learning experience for Eastern Health with outcomes from the trial to be used to guide their development of a chronic disease management model moving forward.

## Monash Health

Monash Health began active participation in the HealthLinks trial on 1 November 2016. They first started enrolling patients into HealthLinks interventions on 1 December 2016.

### Patient identification

Monash Health’s Business Intelligence Unit, together with the HealthLinks project team, were responsible for replicating and implementing the department’s patient identification algorithm. The Business Intelligence Unit replicated and implemented the department’s SAS code algorithm into their local SQL-based system. The algorithm was run across Monash Health’s inpatient and emergency activity daily, with a report reflecting identification of newly triggered patients generated in near real time. It was used daily to search for enrolled patients who were in hospital but less frequently to find new patients to offer the intervention.

### Intervention model of care

Monash Health piloted a new model of care known as ‘MonashWatch’. A geographically defined subset of the HealthLinks-enrolled patient cohort were targeted for participation in the MonashWatch intervention (refer to Table 6 for suburbs included). English-speaking patients who became HealthLinks enrolled after 1 September 2016 who lived in the pilot area (based on the local version of the case finding algorithm) were offered MonashWatch via a letter and follow-up telephone call.

MonashWatch used a self-rated health phone and coaching model to keep an eye on vulnerable patients (and their carers) at home. The intent of MonashWatch was to detect health decline early, enabling more timely access to existing health and social services and consequently reducing avoidable hospitalisation. The model reflected patient-centred care and took a holistic view of health determinants. The model of care was grounded in a ‘complexity science view of health’ rather than in disease-based models.

Telecare guides (trained non-clinician operators) telephoned MonashWatch patients one to three times a week and asked a simple set of self-rated health questions. They used a decision support application (the Patient Journey Record, PaJR;),[[26]](#endnote-26) which dynamically rated patients on near-term risk of hospitalisation using the self-rated health call responses. This provided alerts to identify health decline and triggered follow-up. Health coaches, nursing and/or allied health clinicians worked side by side with the telecare guides, responded to alerts and helped as needed. Depending on patient needs, this included home visits, helping to organise medications or medical appointments or providing other support. The patient’s GP remained the conductor of care in the community and was advised of the patient’s enrolment in MonashWatch. MonashWatch operated during regular business hours.

HealthLinks enrollee subgroups at Monash Health are listed in Table 6.

Table 6: Characteristics of the Monash Health HealthLinks enrollee patient subtypes

| **Enrolment subtype** | **Inclusion criteria** | **Type of care received** | **Type of service** |
| --- | --- | --- | --- |
| MonashWatch intervention patient | HealthLinks enrollees who live in Dandenong, Doveton, Keysborough, Eumemmerring, Hallam, Endeavour Hills, Bangholme and Noble Park  Do not live in an aged care facility  English speaking | Intervention | New service |
| MonashWatch comparator patient | HealthLinks enrollees who live in Dandenong, Doveton, Keysborough, Eumemmerring, Hallam, Endeavour Hills, Bangholme and Noble Park  Do not live in an aged care facility  English speaking  (In other words, patients who would otherwise have been offered MonashWatch) | Usual care | Existing services |
| Usual care patient | All other HealthLinks enrollees other than above | Usual care | Existing services |

### Workforce participants’ perceptions of the intervention characteristics

Participants described that the MonashWatch point of difference was the program’s ability to take a holistic view of patient needs and consider not just their clinical diagnosis but also psychosocial determinants of health. Telecare guides were seen to act as ‘a good neighbour’ checking in on patients’ health and wellbeing, while the health coaches intervened from a medical point of view as required. Participants believed taking this approach provided social connection, reduced patients’ anxiety and built resilience.

## Northern Health

Northern Health began active participation in the HealthLinks trial on 1 July 2016 and started enrolling HealthLinks patients into redesigned Northern Health services from this date. From 18 April 2017, Northern Health began enrolling patients from selected geographical locations to Medibank CarePoint services. As of 1 July 2017, Northern Health ceased financial participation in the HealthLinks trial and reverted to the activity-based funding model for the HealthLinks-enrolled cohort.

### Patient identification

The Northern Health Decision Support Unit worked on replicating the department patient identification algorithm written with SAS code, and ran the logic across the VAED database in real time. A ‘potential HealthLinks’ alert was placed on the local patient management system to assist clinicians in the early identification of patients while admitted in the ED or on the wards. Every month, the list was reconciled against the enrolled patient list received from the department. If enrolled, a ‘confirmed HealthLinks’ alert was placed against the patient record in the local patient management system.

Due to algorithm replication issues, Northern Health discontinued implementation of the algorithm in real time in January 2017, and instead relied on patient lists generated by the department’s algorithm. Due to data reporting lags, lists generated by the department were received two months after the patient’s trigger admission preventing the opportunity for intervention during that admission or soon after discharge.

### Intervention model of care

Northern Health focused on identifying eligible patients for redesigned existing services within the Health Independence Program (HIP) and began the Medibank CarePoint program with a subset of the enrolled patients. All HealthLinks patients were screened using an automated LACE (Length of Stay; Acuity of Admission; Comorbidities; Emergency department visits) Index Scoring Tool for Risk Assessment of Hospital Readmission. Patients who scored 10 or above on the LACE were identified as ‘at risk’ and received an initial needs identification assessment by the Discharge Planning Support Service (DPSS).

All HealthLinks-enrolled patients received a comprehensive discharge plan and were offered a follow-up phone call by DPSS. Patients who, as a result of their initial needs identification, were considered likely to benefit from disease-specific education or case management were referred to HIP. This included patients with heart failure, COPD or diabetes and those with frailty or complex social situations. Increasing the participation of HealthLinks enrollees in HIP services was prioritised. As a result of the initial needs identification, patients were referred to appropriate community programs or services and received a follow-up phone call 48 hours following discharge (administered by DPSS). During the follow-up call the team: (i) ensured GP appointments were booked and the patient could attend, (ii) supported the use of the Passport to Wellness, (iii) checked the patient’s Northern Health follow-up appointments had been booked and ensured the patient could attend, (iv) assessed current symptomatology and coping at home, (v) assessed the requirement for additional calls to the patient, (vi) escalated patients to HARP and/or medical review if required, and (vii) submitted new referral to HARP if necessary. Patients identified at high risk of readmission were referred to HIP or to CarePoint.

Patients who lived in Hume and, later in the trial, those in Whittlesea, who had chronic or complex healthcare needs and were not already enrolled in HIP services were offered the CarePoint program. Patients with private health insurance through either Medibank or NIB were offered the CarePoint program. CarePoint was an integrated care program for patients with high-level chronic and complex needs administered by Medibank. The CarePoint team worked closely with the patient’s GP to help patients access the right support and resources they needed. The package included care coordination, care navigation, hospital liaison, 24/7 nurse triage and health coaching, home nursing and community care.

HealthLinks enrollee subgroups at Northern Health are listed in Table 7.

Table 7: Characteristics of the Northern Health HealthLinks enrollee patient subtypes

| **Enrolment subtype** | **Inclusion criteria** | **Type of care received** | **Type of service** |
| --- | --- | --- | --- |
| Medibank (Hume) intervention patient | HealthLinks enrollees residing in the Hume region who had chronic or complex health care needs and were not already enrolled in HIP services as well as patients with Medibank or NIB private health insurance | Intervention | New service |
| Medibank (Whittlesea) intervention patient | HealthLinks enrollees residing in the Whittlesea region who had chronic or complex health care needs and were not already enrolled in HIP services as well as patients with Medibank or NIB private health insurance | Intervention | New service |
| DPSS discharge phone call patient | All HealthLinks patients received a comprehensive discharge plan and were offered a follow-up phone call by DPSS | Redesigned usual care | Redesigned existing service (DPSS, post-acute care, HIP) |
| HARP patient | HARP referral a clinical decision | Redesigned usual care | Redesigned existing service (HARP, HIP) |
| Usual care patient | All other HealthLinks enrollees | Usual care | Existing services |

### Workforce participants’ perceptions of the intervention characteristics

Participants described that the HealthLinks intervention at Northern Health was primarily targeted at patients eligible for HARP services. They believed CarePoint packages were brokered to assist with care coordination for patients ineligible for HARP.

## Western Health

Western Health began active participation in the HealthLinks trial on 1 November 2016. They first started enrolling patients into HealthLinks interventions on 21 November 2016.

### Patient identification

Western Health’s Performance Unit was responsible for patient cohort identification. The local Western Health patient identification algorithm was derived from SAS code and was used to identify patients in real time from 1 May 2017. Before this date, Western Health relied on monthly department-generated lists to identify patients.

All Western Health HealthLinks enrollees were given the opportunity to receive care under the Western Health HealthLinks care interventions.

### Intervention model of care

Western Health collaborated with SilverChain, a not-for-profit community service provider, to deliver the HealthLinks intervention model of care. In addition to the patient identification algorithm, Western Health used a set of nine questions (‘the Western 9’) to stratify the patient’s risk of readmission based on their debility and psychosocial risk factors. Depending on the response to these questions, patients were stratified into either the High, Medium or Low Risk care group, which had varying levels of intervention provided by SilverChain Care Navigators. Patients’ risk of readmission was reviewed during subsequent contacts with SilverChain services, and patients who readmitted to Western Health were automatically stratified in the High Risk care group and reassessed following a home visit.

All consenting patients were supported with access to a 24/7 phone support number, enabling a connection to a registered nurse. Within the hours of 0700–2200 patients also had access to the Priority Response and Assessment (PRA) service. Activating a PRA service resulted in a PRA nurse attending the patient’s home with the support of the patient’s GP and/or the SilverChain Group’s GP. The goal was to work with the patient, clinically intervening if required and supporting the patient to remain in their home. Outside of these hours, the phone-based registered nurse used clinical guidelines to support the patient to make the most appropriate choice regarding their care requirements, including calling Triple Zero (000) if required.

Patients requiring specialist clinical care in their home were supported by Western Health’s Health Independence Program and related partners. Additional care provision to support the patients’ needs with allied health, home-based support and behavioural health support was provided by Western Health’s HIP and Western Health’s community partners.

HealthLinks enrollee subgroups at Western Health are listed in Table 8.

Table 8: Characteristics of the Western Health HealthLinks enrollee patient subtypes

| **Enrolment subtype** | **Inclusion criteria** | **Type of care received** | **Type of service** |
| --- | --- | --- | --- |
| Low Risk intervention patient | HealthLinks enrollees who score low on a readmission risk screening tool | Intervention | New service |
| Medium Risk intervention patient | HealthLinks enrollees who score medium on a readmission risk screening tool | Intervention | New service |
| High Risk intervention patient | HealthLinks enrollees who score high on a readmission risk screening tool | Intervention | New service |
| Usual care patient | All other HealthLinks enrollees | Usual care | Existing service |

### Workforce participants’ perceptions of the intervention characteristics

Participants discussed that the SilverChain care navigators, telephone helpline and PRA provided patients with a personalised service that was an alternative source of information and assistance rather than presentation to the ED. They acknowledged that the intervention model provided longer term care than existing Western Health services (for example, HARP) and took a proactive approach to intervention and referrals.

# Findings

## HealthLinks enrolments and patient characteristics

### Enrolled patients

Overall, 142,667 patients were eligible to participate in the HealthLinks trial, of which approximately one-third (*n* = 49,768, 34.9 per cent) of patients were subsequently enrolled. Patients who became enrolled at health services participating in the HealthLinks funding model became capitated funded on enrolment.

Of the health services participating in the HealthLinks funding model, Monash Health had the most enrolments, while Barwon Health had the least. A very small proportion of patients enrolled in the trial had two enrolments (*n* = 481, 1.0 per cent).

Table 9 shows the number of enrolments by health service, patient status and enrolment duration. Among participating health services, the greatest number of deaths for this acute and highly complex cohort occurred within a patient’s first year of enrolment.

Table 9: Number of enrolments by health service, July 2016 to June 2019

| **Health service** | **1 year enrolled** | **2 years enrolled** | **3 years enrolled** | **Total** | **Deaths in enrolled year 1** | **Deaths in enrolled year 2** | **Deaths in enrolled year 3** | **Deaths after** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Participating health services** | **21,511** | **13,180** | **7,458** | **42,149** | **2,315** | **724** | **148** | **1,547** |
| Alfred Health | 2,901 | 2,389 | 0 | 5,290 | 260 | 69 | 0 | 183 |
| Barwon Health | 2,118 | 1,541 | 527 | 4,186 | 204 | 66 | 8 | 137 |
| Eastern Health | 4,508 | 0 | 0 | 4,508 | 208 | 0 | 0 | 75 |
| Monash Health | 5,657 | 4,481 | 3,417 | 13,555 | 800 | 293 | 72 | 520 |
| Northern Health | 2,749 | 2,047 | 1,757 | 6,553 | 320 | 122 | 34 | 287 |
| Western Health | 3,578 | 2,722 | 1,757 | 8,057 | 523 | 174 | 34 | 345 |
| **Control health services** | **5,515** | **2,104** | **0** | **7,619** | **378** | **21** | **0** | **207** |
| Austin Health | 2,387 | 963 | 0 | 3,350 | 173 | 11 | 0 | 95 |
| The Royal Melbourne Hospital | 2,019 | 725 | 0 | 2,744 | 141 | < 5 | 0 | 62 |
| St Vincent’s Hospital Melbourne | 1,109 | 416 | 0 | 1,525 | 64 | 6 | 0 | 50 |

Notes:

1.Deaths after = death occurred after patient’s enrolment period.

2. Eastern Health did not implement an intervention model of care during the trial period.

3.Control health services only began enrolling patients in the HealthLinks cohort from February 2018.

Compared with patients enrolled at control health services, patients enrolled at participating health services were younger, more likely to be female, identify English as their preferred language, be married and live in areas with relatively more socioeconomic disadvantage (SEIFA IRSAD deciles: 1 to 4, 14.6 per cent versus 38.3 per cent) (refer to

Table 10). The distribution of DRGs and comorbidities also differed among the two groups (

Table 10).

Table 10: Characteristics of enrolled patients, by health service status

| **Characteristics** | **Control health services (***n* **= 7,619)** | **Participating health services (***n* **= 42,149)** | *p***-value** |
| --- | --- | --- | --- |
| Admission age (mean [SD]) | 71.02 (16.67) | 69.20 (17.21) | < 0.001 |
| Gender = female (%) | 3,842 (50.4) | 21,966 (52.1) | 0.007 |
| Preferred language (%) |  |  | < 0.001 |
| English | 6,008 (78.9) | 35,006 (83.1) |  |
| Simplified Chinese | 98 (1.3) | 443 (1.1) |  |
| Arabic | 140 (1.8) | 447 (1.1) |  |
| Greek | 462 (6.1) | 1,462 (3.5) |  |
| Italian | 536 (7.0) | 1,147 (2.7) |  |
| Turkish | 50 (0.7) | 308 (0.7) |  |
| Vietnamese | 59 (0.8) | 456 (1.1) |  |
| Other | 266 (3.5) | 2,880 (6.8) |  |
| Marital status (%) |  |  | < 0.001 |
| De facto | 257 (3.4) | 1,748 (4.1) |  |
| Divorced | 540 (7.1) | 3,278 (7.8) |  |
| Married | 3,685 (48.4) | 21,096 (50.1) |  |
| Never married | 1,376 (18.1) | 6,537 (15.5) |  |
| Not stated | 31 (0.4) | 188 (0.4) |  |
| Separated | 205 (2.7) | 1,267 (3.0) |  |
| Widowed | 1,525 (20.0) | 8,035 (19.1) |  |
| SEIFA IRSAD decile |  |  | < 0.001 |
| 1 | 119 (1.6) | 3,565 (8.5) |  |
| 2 | 127 (1.7) | 4,417 (10.5) |  |
| 3 | 509 (6.7) | 2,887 (6.8) |  |
| 4 | 350 (4.6) | 5,255 (12.5) |  |
| 5 | 127 (1.7) | 2,010 (4.8) |  |
| 6 | 339 (4.4) | 7,283 (17.3) |  |
| 7 | 668 (8.8) | 671 (1.6) |  |
| 8 | 609 (8.0) | 3,498 (8.3) |  |
| 9 | 161 (2.1) | 3,300 (7.8) |  |
| 10 | 964 (12.7) | 3,448 (8.2) |  |
| Missing | 3,646 (47.9) | 5,815 (13.8) |  |
| Australian Refined (AR)-DRG (%) |  |  | < 0.001 |
| Other | 4,961 (65.1) | 26,888 (63.8) |  |
| E62: Respiratory Infections and Inflammations | 258 (3.4) | 1,517 (3.6) |  |
| E65: Chronic Obstructive Airways Disease | 236 (3.1) | 1,600 (3.8) |  |
| F62: Heart Failure and Shock | 423 (5.6) | 1,678 (4.0) |  |
| F74: Chest Pain | 471 (6.2) | 3,091 (7.3) |  |
| F76: Arrhythmia, Cardiac Arrest and Conduction Disorders | 260 (3.4) | 1,507 (3.6) |  |
| G66: Abdominal Pain and Mesenteric Adenitis | 241 (3.2) | 1,717 (4.1) |  |
| G67: Oesophagitis and Gastroenteritis | 168 (2.2) | 1,026 (2.4) |  |
| G70: Other Digestive System Disorders | 438 (5.7) | 2,075 (4.9) |  |
| X60: Injuries | 163 (2.1) | 1,050 (2.5) |  |
| Comorbidity (%) |  |  | < 0.001 |
| Other | 5,269 (69.2) | 28,404 (67.4) |  |
| Asthma | 59 (0.8) | 528 (1.3) |  |
| Atrial fibrillation | 197 (2.6) | 1,102 (2.6) |  |
| Chest pain | 486 (6.4) | 3,152 (7.5) |  |
| Chronic pain | < 10 (0.0) | 14 (0.0) |  |
| Cirrhosis | 17 (0.2) | 56 (0.1) |  |
| COPD | 231 (3.0) | 1,668 (4.0) |  |
| Coronary disease | 584 (7.7) | 2,784 (6.6) |  |
| Diabetes | 116 (1.5) | 605 (1.4) |  |
| Digestive system | 345 (4.5) | 2,261 (5.4) |  |
| Kidney disease | 177 (2.3) | 903 (2.1) |  |
| Non-infectious enteritis | 75 (1.0) | 202 (0.5) |  |
| Pancreatitis | 53 (0.7) | 429 (1.0) |  |
| Rheumatoid arthritis | < 10 (0.1) | 41 (0.1) |  |

### Excluded patients

A total of 5,547 patients were excluded from the HealthLinks trial, most of whom were from participating health services (88.5 per cent). Mental health, cancer and haematology were the most common reasons for exclusion.

At participating health services, compared with patients who were not excluded, patients who were excluded were younger, less likely to be female, identify English as their preferred language, be married and live in the most disadvantaged areas. Patients also differed by DRG and comorbidities.

Patients at control health services who were excluded from the trial were less likely to be female compared with patients who were not excluded. There were no other differences.

### Intervention patients

A total of 2,429 HealthLinks enrollees received an intervention model of care during the trial period, of which most were enrolled at Western Health (*n* = 1,505, Table 11).

Table 11: Patient status of HealthLinks enrollees, by health service

| Health service | 1 year enrolled in usual care | 2 years enrolled in usual care | 3 years enrolled in usual care | 1 year enrolled in intervention | 2 years enrolled in intervention | 3 years enrolled in intervention |
| --- | --- | --- | --- | --- | --- | --- |
| **Participating health services** | **20,836** | **12,125** | **6,706** | **630** | **1,049** | **750** |
| Alfred Health | 2,789 | 2,292 | 0 | 111 | 97 | 0 |
| Barwon Health | 2,072 | 1,450 | 496 | 32 | 91 | 31 |
| Eastern Health | 4,508 | 0 | 0 | – | – | – |
| Monash Health | 5,540 | 4,391 | 3,237 | 112 | 90 | 180 |
| Northern Health | 2,688 | 1,993 | 1,675 | 50 | 50 | 80 |
| Western Health | 3,239 | 1,999 | 1,298 | 325 | 721 | 459 |
| **Control health services** | **5,515** | **2,104** | **0** | **–** | **–** | **–** |
| Austin Health | 2,387 | 963 | 0 | – | – | – |
| The Royal Melbourne Hospital | 2,019 | 725 | 0 | – | – | – |
| St Vincent’s Hospital Melbourne | 1,109 | 416 | 0 | – | – | – |

Notes:

1.Intervention excludes 53 patients whose intervention start date was after enrolment period.

2. Eastern Health did not implement an intervention model of care during the trial period.

3. Control health services only began enrolling patients in the HealthLinks cohort from February 2018. All enrollees at control health services received usual care.

Table 12 shows a comparison of the demographic and clinical characteristics of patients at participating health services by patient status. Compared with patients who received usual care, patients who received an intervention model of care were older, less likely to identify English as their preferred language, be married and live in the most disadvantaged areas (SEIFA IRSAD deciles: 1 to 4, 38.3 per cent versus 37.1 per cent). The distribution of DRGs and comorbidities also differed among the two groups.

Table 12: Characteristics of patients enrolled at participating health services, by patient status

| **Characteristics** | **Intervention (*n* = 2,429)** | **Usual care (*n* = 39,667)** | *p***-value** |
| --- | --- | --- | --- |
| Admission age (mean [SD]) | 72.11 (14.79) | 69.03 (17.33) | *<* 0.001 |
| Gender = female (%) | 1,249 (51.4) | 20,696 (52.2) | 0.483 |
| Preferred language (%) |  |  | < 0.001 |
| English | 1,981 (81.6) | 32,983 (83.1) |  |
| Simplified Chinese | 11 (0.5) | 432 (1.1) |  |
| Arabic | 25 (1.0) | 422 (1.1) |  |
| Greek | 88 (3.6) | 1,370 (3.5) |  |
| Italian | 78 (3.2) | 1,069 (2.7) |  |
| Turkish | 14 (0.6) | 293 (0.7) |  |
| Vietnamese | 47 (1.9) | 409 (1.0) |  |
| Other | 185 (7.6) | 2,689 (6.8) |  |
| Marital status (%) |  |  | < 0.001 |
| De facto | < 80 | 1,670 (4.2) |  |
| Divorced | 229 (9.4) | 3,042 (7.7) |  |
| Married | 1,125 (46.3) | 19,945 (50.3) |  |
| Never married | 352 (14.5) | 6,179 (15.6) |  |
| Separated | 84 (3.5) | 1,180 (3.0) |  |
| Widowed | 560 (23.1) | 7,466 (18.8) |  |
| Not stated | < 5 | 185 (0.5) |  |
| SEIFA IRSAD decile |  |  | < 0.001 |
| 1 | 358 (14.7) | 3,202 (8.1) |  |
| 2 | 95 (3.9) | 4,318 (10.9) |  |
| 3 | 65 (2.7) | 2,822 (7.1) |  |
| 4 | 383 (15.8) | 4,859 (12.2) |  |
| 5 | 5 (0.2) | 2,005 (5.1) |  |
| 6 | 777 (32.0) | 6,491 (16.4) |  |
| 7 | 5 (0.2) | 665 (1.7) |  |
| 8 | 173 (7.1) | 3,323 (8.4) |  |
| 9 | 45 (1.9) | 3,254 (8.2) |  |
| 10 | 278 (11.4) | 3,170 (8.0) |  |
| Missing | 245 (10.1) | 5,558 (14.0) |  |
| AR-DRG (%) |  |  | < 0.001 |
| Other | 1,364 (56.2) | 25,496 (64.3) |  |
| E62: Respiratory Infections and Inflammations | 112 (4.6) | 1,401 (3.5) |  |
| E65: Chronic Obstructive Airways Disease | 193 (7.9) | 1,403 (3.5) |  |
| F62: Heart Failure and Shock | 170 (7.0) | 1,505 (3.8) |  |
| F74: Chest Pain | 234 (9.6) | 2,850 (7.2) |  |
| F76: Arrhythmia, Cardiac Arrest and Conduction Disorders | 85 (3.5) | 1,422 (3.6) |  |
| G66: Abdominal Pain and Mesenteric Adenitis | 75 (3.1) | 1,641 (4.1) |  |
| G67: Oesophagitis and Gastroenteritis | 65 (2.7) | 960 (2.4) |  |
| G70: Other Digestive System Disorders | 91 (3.7) | 1,980 (5.0) |  |
| X60: Injuries | 40 (1.6) | 1,009 (2.5) |  |
| Comorbidity (%) |  |  | < 0.001 |
| Other | 1,397 (57.5) | 26,972 (68.0) |  |
| Asthma | 48 (2.0) | 480 (1.2) |  |
| Atrial fibrillation | 57 (2.3) | 1,045 (2.6) |  |
| Chest pain | 240 (9.9) | 2,905 (7.3) |  |
| Chronic pain | < 5 | 12 (0.0) |  |
| Cirrhosis | 5 (0.2) | 50 (0.1) |  |
| COPD | 201 (8.3) | 1,463 (3.7) |  |
| Coronary disease | 261 (10.7) | 2,520 (6.4) |  |
| Diabetes | 39 (1.6) | 565 (1.4) |  |
| Digestive system | 105 (4.3) | 2,155 (5.4) |  |
| Kidney disease | 39 (1.6) | 864 (2.2) |  |
| Non-infectious enteritis | 5 (0.2) | 196 (0.5) |  |
| Pancreatitis | 28 (1.2) | 401 (1.0) |  |
| Rheumatoid arthritis | < 5 | 39 (0.1) |  |

#### Patient groups not engaged by the intervention model of care

In general, workforce participants who took part in the HealthLinks evaluation acknowledged barriers to adequately engaging patients with psychosocial comorbidities and those from culturally and linguistically diverse backgrounds in the HealthLinks intervention models of care.

##### Mental health

Participants believed a lack of expertise to address patients’ mental health concerns and limited services available for referral meant this cohort was challenging to engage in the intervention.

‘So the big group is the group with significant mental illness but not significant enough to warrant a psychiatric admission … So there’s that psychiatrically unwell people who re-present because of … a symptom that’s not primarily related to their mental illness, and I think they probably are captured in the algorithm, but we can’t and don’t service them very well.’

‘The one pathway we still struggle with is the mental health pathway. We’ve worked really hard and it might not be high level mental health, but some of the other issues that are affecting people in their day-to-day life and how we actually improve that pathway so we’re working on it but that’s still a challenge.’

##### Migrant, refugees and culturally and linguistically diverse groups

While some participants believed migrants, refugees and patients from culturally and linguistically diverse backgrounds benefitted from care coordination and system navigation, others acknowledged barriers to engaging this cohort during the trial due to a lack of culturally appropriate services and a lack of interpreter services for patients with a preferred language other than English.

‘It's probably a significant problem around here … they have a lot of refugees, and people from, you know, the Middle East who have significant war related trauma and PTSD and getting services for those people is very difficult.’

‘Yeah, the ones that can’t speak English because they’re not so good at getting interpreters and if you ring and say you haven’t seen this patient they say, oh, we couldn’t get an interpreter …’

### Patient survey participants

In total, 6,962 enrolled patients were sent surveys. In addition, 1,464 patients who were incorrectly identified as HealthLinks enrolled were sent at least one survey.

Across all participating and control health services, 3,052 enrolled patients consented to participate in the HealthLinks evaluation patient survey (43.8 per cent), of whom just over half returned a survey at baseline survey (*n* = 1,857, 61 per cent). Survey completion dropped off across the survey waves (*n* = 1,083 at six months and *n* = 280 at 12 months). Survey participants were mostly from control health services and received usual care throughout the HealthLinks trial.

Table 13 outlines the number of enrolled patients, by health service and patient status, who were sent a survey(s), subsequently consented to participate and the number of patients who returned at least one survey at each survey wave.

Table 13: Number of enrolled patients who were sent surveys, consented and returned surveys, by health service and patient status

| **Health service** | **Sent: Int** | **Sent: U/care** | **Consented: Int** | **Consented: U/care** | **Returned**  **baseline: Int** | **Returned**  **baseline: U/care** | **Returned**  **6 mths: Int** | **Returned**  **6 mths: U/care** | **Returned**  **12 mths: Int** | **Returned**  **12 mths: U/care** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Participating health services | 137 | 4,038 | 61 | 1,739 | 31 | 1,005 | 15 | 592 | < 5 | 137 |
| Alfred Health | 16 | 78 | < 10 | 36 | 5 | 29 | 5 | 19 | 0 | 0 |
| Barwon Health | 11 | 448 | < 10 | 274 | < 5 | 173 | 0 | 105 | 0 | 22 |
| Eastern Health | 0 | 305 | 0 | 155 | 0 | 113 | 0 | 70 | 0 | 0 |
| Monash Health | 50 | 1,947 | 18 | 682 | < 5 | 369 | < 5 | 231 | 0 | 54 |
| Northern Health | 9 | 561 | < 5 | 269 | < 5 | 170 | < 5 | 98 | < 5 | 57 |
| Western Health | 51 | 699 | 28 | 323 | 21 | 151 | 8 | 69 | < 5 | < 5 |
| Control health services | – | 2,787 | – | 1,252 | – | 821 | – | 476 | – | 141 |
| Austin Health | – | 1,212 | – | 450 | – | 352 | – | 237 | – | 65 |
| Melbourne Health | – | 629 | – | 358 | – | 206 | – | 91 | – | 33 |
| St Vincent’s Hospital Melbourne | – | 946 | – | 444 | – | 263 | – | 148 | – | 43 |

Note: Eastern Health did not implement an intervention model of care during the trial period.

Int = intervention; U/care = usual care.

Compared with participating health services, more patients at control sites consented to participate (44.9 per cent control health services versus 43.1 per cent participating health services) and subsequently returned their surveys (baseline: 65.6 per cent versus 57.6 per cent; six months: 38.0 per cent versus 33.7 per cent; 12 months: 11.3 per cent versus 7.7 per cent).

Most patients who returned their surveys received usual care (*n*[baseline]=1,826, 98.3 per cent). In total, 31 intervention patients returned survey(s) at baseline, most of whom were enrolled at one participating health service (*n* = 21, 67.7 per cent). Only 15 intervention patients continued to participate in the evaluation survey at six months and two patients at 12 months.

Enrolled patients who completed a survey differed demographically to enrolled patients who did not. Patients who completed a survey were on average older (72 years versus 69 years, *p* < 0.001), more likely to be male (51.7 per cent versus 48.0 per cent, *p* = 0.002), married (54.0 per cent versus 49.6 per cent, *p* < 0.001), identified English as their preferred language (91.3 per cent versus 82.1 per cent, *p* < 0.001) and live in areas with relatively less socioeconomic disadvantage (SEIFA IRSAD deciles 5 to 10: 32.0 per cent versus 40.3 per cent, *p* < 0.001). The distribution of DRGs and comorbidities also differed among the two groups.

The characteristics of the patients who completed a survey only at baseline (wave 1), at baseline and six months (wave 1 + wave 2) or at baseline, six and 12 months (all waves) are presented in Table 14. Compared with patients who only completed 1 or 2 survey waves, almost all patients who completed all three survey waves identified English as their preferred language. Patients who completed all three survey were less likely to live in areas with relatively more socioeconomic disadvantage (SEIFA IRSAD decile: 1 to 4). Patients did not differ by age, gender, marital status, AR-DRGs or comorbidities.

Table 14: Baseline characteristics of enrolled patients by the number of survey waves completed

| Characteristics | Baseline only  (*n =* 774) | Baseline + 6  months  (*n =* 803) | All waves  (*n =* 280) | *p*-value |
| --- | --- | --- | --- | --- |
| **Admission age (mean [SD])** | 70.75 (15.37) | 72.24 (12.56) | 71.57 (11.95) | 0.097 |
| **Gender = female (%)** | 383 (49.5) | 372 (46.3) | 142 (50.7) | 0.31 |
| **Preferred language (%)** |  |  |  | **0.001** |
| English | 676 (87.3) | 752 (93.6) | 267 (95.4) |  |
| Simplified Chinese | < 10 | < 5 | 0 (0.0) |  |
| Arabic | < 5 | < 5 | < 5 |  |
| Greek | 34 (4.4) | 16 (2.0) | 5 (1.8) |  |
| Italian | 18 (2.3) | 16 (2.0) | 5 (1.8) |  |
| Turkish | 7 (0.9) | < 5 | < 5 |  |
| Vietnamese | 12 (1.6) | < 5 | 0 (0.0) |  |
| Other | 18 (2.3) | 11 (1.4) | < 5 |  |
| **Marital status (%)** |  |  |  | **0.403** |
| De facto | 32 (4.1) | 34 (4.2) | 6 (2.1) |  |
| Divorced | 70 (9.0) | 70 (8.7) | 23 (8.2) |  |
| Married | 394 (50.9) | 445 (55.4) | 164 (58.6) |  |
| Never married | 113 (14.6) | 114 (14.2) | 36 (12.9) |  |
| Not stated | < 5 | < 5 | 0 (0.0) |  |
| Separated | < 25 | < 25 | 9 (3.2) |  |
| Widowed | 142 (18.3) | 113 (14.1) | 42 (15.0) |  |
| **SEIFA IRSAD decile (%)** |  |  |  | **0.007** |
| 1 | 25 (3.2) | 17 (2.1) | < 5 |  |
| 2 | 31 (4.0) | 37 (4.6) | 5 (1.8) |  |
| 3 | 77 (9.9) | 98 (12.2) | 20 (7.1) |  |
| 4 | 115 (14.9) | 107 (13.3) | 36 (12.9) |  |
| 5 | 50 (6.5) | 69 (8.6) | 22 (7.9) |  |
| 6 | 73 (9.4) | 76 (9.5) | 23 (8.2) |  |
| 7 | 50 (6.5) | 38 (4.7) | 15 (5.4) |  |
| 8 | 57 (7.4) | 69 (8.6) | 26 (9.3) |  |
| 9 | 15 (1.9) | 16 (2.0) | < 5 |  |
| 10 | 60 (7.8) | 61 (7.6) | 15 (5.4) |  |
| Not stated | 221 (28.6) | 215 (26.8) | 113 (40.4) |  |
| **AR-DRGs (%)** |  |  |  | **0.636** |
| Abdominal Pain | 27 (3.5) | 34 (4.2) | 12 (4.3) |  |
| Arrhythmia, Cardiac Arrest | 32 (4.1) | 43 (5.4) | 17 (6.1) |  |
| Chest Pain | 48 (6.2) | 63 (7.8) | 21 (7.5) |  |
| COPD | 36 (4.7) | 39 (4.9) | 14 (5.0) |  |
| Heart Failure | 33 (4.3) | 46 (5.7) | 11 (3.9) |  |
| Injuries | 15 (1.9) | 17 (2.1) | < 10 |  |
| Oesophagitis & Gastroenteritis | 15 (1.9) | 18 (2.2) | 7 (2.5) |  |
| Other Digestive System Disorders | 43 (5.6) | 36 (4.5) | 12 (4.3) |  |
| Respiratory Infection | 32 (4.1) | 30 (3.7) | < 5 |  |
| Other | 493 (63.7) | 477 (59.4) | 178 (63.6) |  |
| **Comorbidities within HealthLinks score (%)** |  |  |  | **0.054** |
| Asthma | < 5 | 9 (1.1) | < 5 |  |
| Atrial fibrillation | 29 (3.7) | 33 (4.1) | 14 (5.0) |  |
| Chest pain | 49 (6.3) | 63 (7.8) | 22 (7.9) |  |
| Chronic pain | < 5 | 0 (0.0) | 0 (0.0) |  |
| Cirrhosis | < 5 | < 5 | 0 (0.0) |  |
| COPD | 38 (4.9) | 39 (4.9) | 13 (4.6) |  |
| Coronary disease | 52 (6.7) | 70 (8.7) | 15 (5.4) |  |
| Diabetes | 17 (2.2) | < 5 | < 5 |  |
| Digestive system | 37 (4.8) | 43 (5.4) | 15 (5.4) |  |
| Kidney disease | 16 (2.1) | 12 (1.5) | 8 (2.9) |  |
| Non-infective enteritis | 6 (0.8) | 6 (0.7) | 5 (1.8) |  |
| Pancreas | 12 (1.6) | < 5 | < 5 |  |
| Rheumatoid arthritis | < 5 | 0 (0.0) | 0 (0.0) |  |
| Other | 510 (65.9) | 520 (64.8) | 182 (65.0) |  |

Table 15 provides a comparison of demographic and clinical characteristics among usual care and intervention patients who returned a survey at baseline. Compared with usual care patients who completed a survey at baseline, intervention patients were less likely to identify English as their preferred language, more likely to live in areas with relatively more socioeconomic disadvantage (SEIFA IRSAD decile: 1 to 4) and were over three times more likely to have a DRG of heart failure. Usual care and intervention patients at baseline did not differ by age, gender, marital status or comorbidities.

Table 15: Baseline characteristics of patients who completed survey(s), by patient status

| Characteristics | Usual care  patient  (*n =* 1,826) | Intervention  patient  (*n =* 31) | *p*-value |
| --- | --- | --- | --- |
| **Admission age (mean [SD])** | 71.53 (13.75) | 70.94 (12.75) | 0.812 |
| **Gender = female (%)** | 879 (48.1) | 18 (58.1) | 0.360 |
| **Preferred language (%)** |  |  | **0.034** |
| English | 1,669 (91.4) | 26 (83.9) |  |
| Simplified Chinese | 8 (0.4) | 0 (0.0) |  |
| Arabic | 7 (0.4) | 0 (0.0) |  |
| Greek | 51 (2.8) | < 5 |  |
| Italian | 39 (2.1) | 0 (0.0) |  |
| Turkish | 10 (0.5) | 0 (0.0) |  |
| Vietnamese | 12 (0.7) | < 5 |  |
| Other | 30 (1.6) | 0 (0.0) |  |
| **Marital status (%)** |  |  | **0.421** |
| Married | 990 (54.2) | 13 (41.9) |  |
| Widowed | 288 (15.8) | 9 (29.0) |  |
| Never married | 258 (14.1) | 5 (16.1) |  |
| Divorced | 161 (8.8) | < 5 |  |
| De facto | 70 (3.8) | < 5 |  |
| Separated | <60 | 0 (0.0) |  |
| Not stated | < 5 | 0 (0.0) |  |
| **SEIFA IRSAD decile (%)** |  |  | **0.013** |
| 1 | 44 (2.4) | < 5 |  |
| 2 | 70 (3.8) | < 5 |  |
| 3 | 190 (10.4) | 5 (16.1) |  |
| 4 | 248 (13.6) | 10 (32.3) |  |
| 5 | 138 (7.6) | < 5 |  |
| 6 | 170 (9.3) | < 5 |  |
| 7 | 103 (5.6) | 0 (0.0) |  |
| 8 | 151 (8.3) | < 5 |  |
| 9 | 31 (1.7) | < 5 |  |
| 10 | 134 (7.3) | < 5 |  |
| Not stated | 547 (30.0) | < 5 |  |
| **DRG (%)** |  |  | **0.024** |
| Abdominal Pain | 72 (3.9) | < 5 |  |
| Arrhythmia, Cardiac Arrest | 92 (5.0) | 0 (0.0) |  |
| Chest Pain | 126 (6.9) | 6 (19.4) |  |
| COPD | 88 (4.8) | < 5 |  |
| Heart Failure | 85 (4.7) | 5 (16.1) |  |
| Injuries | 37 (2.0) | 0 (0.0) |  |
| Oesophagitis & Gastroenteritis | 40 (2.2) | 0 (0.0) |  |
| Other | 1,133 (62.0) | 15 (48.4) |  |
| Other Digestive System Disorders | 89 (4.9) | < 5 |  |
| Respiratory Infection | 64 (3.5) | < 5 |  |
| **Comorbidities (%)** |  |  | **0.059** |
| Other | 1,198 (65.6) | 14 (45.2) |  |
| Asthma | 13 (0.7) | 0 (0.0) |  |
| Atrial fibrillation | 76 (4.2) | 0 (0.0) |  |
| Chest pain | 128 (7.0) | 6 (19.4) |  |
| Chronic pain | < 5 | 0 (0.0) |  |
| Cirrhosis | < 5 | 0 (0.0) |  |
| COPD | 88 (4.8) | < 5 |  |
| Coronary disease | 130 (7.1) | 7 (22.6) |  |
| Diabetes | 22 (1.2) | 0 (0.0) |  |
| Digestive system | 93 (5.1) | < 5 |  |
| Kidney disease | 36 (2.0) | 0 (0.0) |  |
| Non-infective enteritis | 17 (0.9) | 0 (0.0) |  |
| Pancreas | 18 (1.0) | 0 (0.0) |  |
| Rheumatoid arthritis | < 5 | 0 (0.0) |  |

## The algorithm

### Patient identification

The department’s algorithm set a patient’s status as *Enrolled* once they had an eligible unplanned hospital medical episode (trigger admission), the patient has not had an episode in the past 365 days that meets the exclusion criteria, and the current eligible unplanned medical episode achieves a total score of 11 or more under the HealthLinks algorithm.

Across financially participating health services, the local application of the patient identification algorithm did not pick up close to 16,000 trigger admissions (sensitivity = 0.41). It did, however, accurately capture most patients who had a valid trigger admission (positive predictive value = 0.78).

Workforce participants described considerable challenges integrating the patient identification algorithm into local systems and producing a patient list that aligned with the department’s list, particularly as the original SAS-based algorithm was converted to a SQL-based algorithm in early 2017.

‘… at the start … the ever changing of the model, for a long time we didn’t know which list was the right list to go with …’

However, they believed using an algorithm removed potential bias in previous referral processes and could identify patients who might benefit from the HealthLinks intervention models of care. They did, however, believe that the algorithm excluded several cohorts who they thought could potentially have benefitted from a similar integrated model of care (for example, renal disease and diabetes,[[27]](#footnote-3) cancer patients, younger age cohorts including children and adolescents, rehabilitation and residential aged care).

‘Getting this algorithm and getting the patient list each day means that we can actually find the patients … I think it’s definitely positive.’

‘… it’s this active recruitment that’s really helped because we’re not having to rely on people referring.’

‘Giving those patients that may have been missed before … the opportunity to actually get referred to a service where they’re getting extra supports to keep them out …’

Using the algorithm was also seen by workforce participants to raise awareness of a cohort of frequent presenters who were previously not identified and assisted health services to understand what services are required to fill gaps in patient care needs.

‘I think some of the good that has come about, or the gains that we’ve achieved have maybe even been just through greater awareness and identification …’

Most workforce participants believed the cohort being identified by the algorithm was too large and did not align with intervention resources available.

‘… it was oversensitive, it definitely highlighted too many patients …’

However, it should be noted that the creation of the capitated funding model was defined on a cohort that had a positive predictive value of approximately a third to provide sufficient flexibility in the funding model, and that health services were encouraged to focus interventions on a subset of the total HealthLinks-enrolled cohort.

Health services implemented some local screening measures to triage the cohort, but workforce participants believed the HealthLinks algorithm needs refinement moving forward to reduce the number of patients being identified. They also suggested potential benefits of adapting the algorithm to identify patients before their needs became acute or highly complex as they believed there would be greater opportunities for behaviour change for these patients who would potentially require less resource intensive intervention models of care.

‘I think [the algorithm] doesn’t capture some factors right some determinants of health for instance you know like psychosocial factors.’

#### Western 9 questionnaire

Western Health implemented a set of nine questions to assess the risk of readmission to hospital in parallel with the department’s algorithm. The aim was to see if the Western 9 questions were suitable for profiling patients at risk of readmission. By design, the questions were meant to focus more on the psychosocial aspects of a patient’s perceived health state. Table 16 lists the questions and the scoring for each patient. If patients scored 3 or more, they were assessed as being in the High Risk group, if they have a score of between 1 and 2 they are classed as Medium Risk and a score of one or less as LowRisk.

Table 16: Debility, psychosocial screening questions for Western Health (the Western 9)

| Question |
| --- |
| 1. Does the patient experience difficulty walking (for example, unable to walk 5 metres in 5 seconds), or had a slip, trip or fall in the past six months? |
| 2. Does the patient have memory problems or confusion? |
| 3. Is the patient being treated for anxiety, depression or other mental illness? |
| 4. Will the patient experience any homelessness for the month after they leave the hospital? |
| 5. Does the patient have inadequate food available in their home? |
| 6. Does the patient have inadequate heating and cooling in their home? |
| 7. Will the patient experience difficulty caring for themselves or have inadequate carer support for the 30 days after they leave hospital? |
| 8. Does the patient or carer believe the patient might unexpectedly return back to a hospital bed in the 30 days after they leave the hospital? |
| 9. Do you (Navigator) believe the patient might unexpectedly return back to an inpatient bed in the 30 days after the patient leaves the hospital? |

Analysis found that the odds of readmission to hospital within 30 days of discharge were significantly higher if patients were in the High Risk group compared with the Low Risk group. However, there was not significant difference in the odds of readmission if they were in the Medium Risk group compared with the Low Risk group.

Differences in predictive power for individual questions were also explored. The three questions Patient Return (Q8), Navigator return (Q9) and Carer (Q7) are positively correlated with readmission in 30 days. Housing (Q4), Food (Q5) and Heat/cool (Q6) are negatively correlated with readmission in 30 days, and Walking(Q1), Mental health (Q3) and Memory (Q2) seem to be uncorrelated.

The analysis suggests that there may be scope to further improve the predictive power of the Western 9 questions by including an appropriate weighting to each item to build an aggregate score. This could then be used to further refine the definition of the risk groups.

### Patient groups not captured by the algorithm

Workforce participants described cohorts that they believed were outside the scope of the algorithm who they considered would have benefitted from the HealthLinks intervention model of care. These included patients with renal disease and diabetes,[[28]](#footnote-4) cancer patients, children and adolescents, patients undergoing rehabilitation, those living in residential aged care facilities and patients with a chronic mental health diagnosis.

‘… I think we only necessarily focus on what we can see that the algorithm’s driving … it makes me wonder who’s not there.’

‘Well at the moment the algorithm excludes you if you’ve gone to subacute care and had rehab. So you're under scoring on the frail, impaired cognition, multiple chronic disease group, socially isolated.’

Participants also acknowledged that patients with chronic mental health conditions were excluded from the trial. While some believed this excluded a large cohort of patients who frequently presented to the ED, others explained that patients with mental health conditions require qualified professionals to engage with them and it was therefore appropriate for this cohort to be excluded from the program in its current structure.

‘… you’d find a lot of people with mental health would keep re-presenting to hospital for an array of reasons … I know it was excluded obviously for a reason but … that might’ve been something to capture.’

The lack of inclusion of social determinants of health that were often the cause of readmission were discussed by some participants.

‘… we’ve never captured nicely with readmission prevention is the social aspect. And that’s actually huge. And there's no easy way around it or easy solution because you cannot substitute somebody to actually sit there when the person feels lonely and wants to call an ambulance. There’s no service for that …’

Participants also discussed the benefits the HealthLinks intervention model would have for patients earlier in their disease trajectory and not just those who most frequently present to an ED.

‘… we’re always identifying those that are already at the admission to hospital spot. We’ve got to bring it back to those that aren’t quite there yet ...’

‘… we have the top 2 per cent, what about the next 10, 15 per cent, what can we put in that will capture [them]?’

## Patient outcomes

### Hospital utilisation – participating compared with control health services

#### Emergency department presentations

After accounting for before trial differences at participating and control health services, patients at participating health services had significantly fewer ED presentations per month – on average 0.1 fewer ED presentations per month compared with control health services after one year into the trial.

For patients followed up for two years, the difference was an average of 0.07 fewer ED presentations per month.

#### Emergency department length of stay

After accounting for before trial differences at participating and control health services, patients at participating health services had significantly shorter lengths of stay in ED per month – they spent on average 40 minutes less per month in ED per month compared with control health services after one year into the trial.

Patients followed up for two years spent on average 22 minutes less in ED per month than before joining the trial.

#### Readmission within 30 days

After accounting for before trial differences at participating and control health services, patients at participating health services had significantly more 30-day readmissions per month – on average 0.003 more readmissions per month compared with control health services after one year into the trial.

For patients followed up for two years, the number of readmissions remained the same as before the trial.

#### Hospital admissions

After accounting for before trial differences at participating and control health services, patients at participating health services had significantly more hospital admissions per month – on average 0.03 more hospital admissions per month compared with control health services after one year into the trial.

Patients followed up for two years had an average of 0.02 more admissions per month.

#### Inpatient length of stay

After accounting for before trial differences at participating and control health services, patients at participating health services had significantly longer inpatient lengths of per month – they spent on average 0.2 more days per month in hospital compared with control health services after one year into the trial.

Patients followed up for two years spent on average 0.1 more days per month in hospital than before joining the trial.

Although the findings were statistically significant, the magnitude of change per patient per month may not be operationally meaningful. Furthermore, as the parallel trend assumption failed at the broad health service level it is not possible to reliably infer that flexible funding contributed to the differences in patient outcomes. A summary of the above results is included in

Table 17.

Table 17: Hospital use for participating health services compared with control health services, by years of enrolment

| **Health service** | **ED presentations:**  **1 year** | **ED presentations:**  **2 years** | **ED length of stay:**  **1 year** | **ED length of stay:**  **2 years** | **30-day readmission:**  **1 year** | **30-day readmission:**  **2 years** | **Hospital admission:**  **1 year** | **Hospital admission:**  **2 years** | **Inpatient length of stay:**  **1 year** | **Inpatient length of stay:**  **2 years** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Participating health services | –0.1 | –0.07 | –40 mins | –22 mins | +0.003 | No change | +0.03 | +0.02 | +0.2 days | +0.1 days |
| Health service A | –0.09 | –0.07 | –27 mins | –9 mins | No change | –0.003 | +0.008 | No change | +0.06 days | +0.06 days |
| Health service B | –0.1 | –0.09 | –76 mins | –71 mins | +0.007 | +0.006 | +0.06 | +0.06 | +0.2 days | +0.1 days |
| Health service C | –0.1 | –0.07 | –56 mins | –42 mins | No change | No change | +0.03 | +0.03 | +0.1 days | +0.1 days |
| Health service D | –0.2 | –0.03 | –85 mins | –15 mins | No change | +0.02 | +0.06 | +0.2 | +0.3 days | +0.6 days |

Note: The ‘Participating health services’ row does not include Eastern Health because this health service did not implement an intervention model of care during the trial period. It does include Northern Health, though the health service is not represented separately in the table.

### 

### Hospital utilisation – intervention compared with usual care patients

As participating health services implemented a variety of intervention models of care and focused on specific patient populations, analysis was undertaken to assess the impact of intervention models at each participating health service separately. Patterns of hospital use varied by health service for intervention patients compared with usual care patients. Descriptions below exclude Northern Health because intervention data was only available for one year of the trial period.

#### Emergency department presentations

After accounting for before trial differences in ED presentations for intervention patients compared with usual care patients, there was no significant change in ED presentations per month for intervention patients at the health services which implemented a HealthLinks model of care one and two years into the trial.

#### Emergency department length of stay

After accounting for before trial differences in ED length of stay for intervention patients compared with usual care patients, there were significant increases for intervention patients after one year into the trial at all health services.

Intervention patients followed up for two years spent significantly more time in ED per month than before joining the trial at three health services, and less time at one health service (–20 minutes).

#### Readmission within 30 days

After accounting for before trial differences in 30-day readmissions for intervention patients compared with usual care patients, intervention patients had significantly fewer readmissions per month (–0.004 readmissions) at one health service one and two years into the trial than before joining. No significant change in 30-day readmissions was found at other health services for intervention patients followed for either one or two years.

#### Hospital admissions

After accounting for before trial differences in hospital admissions for intervention patients compared with usual care patients, no change in hospital admissions per month was found for intervention patients at two health services one year into the trial than prior to joining. At two health services, intervention patients had significantly more hospital admissions per month (+0.09 and +0.2 admissions) one year into the trial than prior to joining.

For patients followed up for two years, intervention patients at three health services had significantly more admissions per month than before joining the trial.

#### Inpatient length of stay

After accounting for before trial differences in inpatient length of stay for intervention patients compared with usual care patients, there was no significant change in inpatient length of stay one year into the trial for intervention patients at two health services, a decrease at one health service   
(–2 days) and an increase at one health service (+0.5 days).

Intervention patients followed up for two years spent more days per month in hospital at one health service (+0.3 days) and fewer days per month in hospital at two health services (–0.01 and –0.8 days) than before joining the trial.

A summary of the above results are included in Table 18.

Table 18: Hospital use for intervention patients compared with usual care patients, by years of enrolment

| **Health service** | **ED presentations:**  **1 year** | **ED presentations:**  **2 years** | **ED length of stay:**  **1 year** | **ED length of stay:**  **2 years** | **30-day readmission:**  **1 year** | **30-day readmission:**  **2 years** | **Hospital admission:**  **1 year** | **Hospital admission:**  **2 years** | **Inpatient length of stay:**  **1 year** | **Inpatient length of stay:**  **2 years** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Health service A | No change | No change | +154 mins | +132 mins | No change | No change | No change | No change | No change | No change |
| Health service B | No change | No change | +3 mins | –20 mins | No change | No change | +0.2 | +0.1 | –2 days | –0.8 days |
| Health service C | No change | No change | +23 mins | +38 mins | –0.004 | –0.004 | +0.09 | +0.1 | No change | +0.3 days |
| Health service D | No change | No change | +62 mins | +89 mins | No change | No change | No change | +0.2 | +0.5 days | –0.01 days |

Note: The ‘Health service’ column does not include Eastern Health because this health service did not implement an intervention model of care during the trial period. It does not include Northern Health because intervention data is only available for one year.

Workforce participants believed it was difficult to determine the impact of the trial on patients’ hospital use. Some believed there were early signs of fewer ED presentations, especially at health services that implemented interventions for an extended period.

‘… we’re actually working with a highly complex cohort and we’re managing to do things well enough to keep them out of hospital for at least three months – which is pretty good.’

‘Because they’re getting the education and they’ve got the support in the community they’re not presenting to hospital as much, which is really good.’

Workforce participants also described some evidence, often anecdotal, that there had been a reduction in readmissions, particularly at two health services. Only a couple of participants believed there may have been a reduction in patient length of stay as a result of the trial.

‘I think that’s hard to tell. There are anecdotal reports that the people who ended up on [the intervention] some of them did reasonably well … it’s hard to say how much HealthLinks had to do with that.’

‘… it’s having early encouraging signs on hospitalisation, and we’ve seen that …’

‘Look through our reports we’re seeing that we are keeping patients outside the hospitals for a lot longer than we were previously.’

Very few participants were aware of any impact of the HealthLinks trial on patients’ length of stay, with only a couple of participants believing it had led to a reduction.

‘… I think we do reduce avoidable readmissions. We don’t know that we reduce readmissions because we encourage planned and maybe length of stay is sort of squashed a little.’

‘… my understanding is that it’s reduced hospital … readmissions … and length of stays, maybe, but that’s just from what I hear, not what I know.’

#### Non-admitted services and care outside the hospital

Non-admitted service use analysis is specifically targeted at comparing the changes in use for intervention versus usual care patients at each participating health service over the trial period. Participating health services implemented a variety of intervention models of care and focused on specific patient populations. As such, an overall analysis would not provide any clear patterns in service use, apart from over-representation from larger health service patient populations.

In general, analysis of patients’ non-admitted service use indicated that the patient journey of an intervention patient at four of the participating health services during the trial was less complex compared with usual care patients. At the fifth participating health service, analysis of patients’ non-admitted service use indicated the patient journey for intervention patients was just as complex as those who received usual care.

The Sankey flow diagrams (Figure 1) below illustrate an example of where the intervention patient journey appears less complex compared with usual care patients at one participating health service. They can be interpreted as follows:

* The grey lines represent patient movement from left to right, while the purple lines represent movement from right to left.
* Each vertical coloured bar represents a non-admitted service that enrolled patients use.
* The length of the bars is proportional to the number of patients who used each service; that is, smaller bars represent fewer patients pass through this destination, longer bars represent more patients.

Figure 1: Non-admitted services used by patients receiving an intervention model of care at one participating health service

Usual care patients have a complex pattern of non-admitted service use.
Intervention patients have a less complex pattern of non-admitted service use. 

Some workforce participants believed there had been little impact of the trial on the types of services with which HealthLinks patients were engaging.

‘I won’t say no impact; I’ll say an undefinable amount of impact at this point in time.’

However, others described that the trial had been successful in providing patients with care outside the hospital, streaming patients into community services and assisting them with care coordination and system navigation. There was also discussion among workforce participants at some health services that their model of care took a holistic view of patients and tailored referrals and care plans to patients’ individual needs. Participants discussed the use of the patient identification algorithm assisted health services to identify more patients eligible for services and at times provide proactive rather than reactive referrals. Some participants believed rather than the trial having an impact on increasing the number of referrals, it had assisted more patients to attend appointments they had previously been missing. However, it was noted that failure to attend remained an issue for many. Each of these themes are discussed in turn below.

##### Care outside hospital

Participants discussed that the intervention model of care provided opportunities for patients to be cared for outside the hospital, often in their own homes.

‘… they know how to manage their disease at home, they know what to do when they’re feeling a little bit unwell to see their doctor and do this, this and this. They nip everything in the bud so they don’t have to come to hospital; they can manage it better at home.’

‘… it focuses on what it is that the patient needs at home in their own environment to stay well and to optimise that. That’s something that we can’t provide from here. You know what we provide is based in our services here, but if you get here then we’ve got problems with trying to manage patients in the hospital environment, the way we’re going to unlock so much more capability is to be able to address them in their own environment …’

‘I really like the fact that we can provide care and try and keep people at home I think trying to facilitate all the supports in keeping patients safe with their families is fantastic …’

Some participants acknowledged that it was often uncertainty and anxiety that led patients to re-present to hospital and the intervention models provisions of education and resources assisted patients’ confidence in self-managing their condition at home.

‘… if you’re giving them the resources and the education to manage their disease or whatever it is at home a bit more independently rather than having to rely on, I’m a bit not sure, I’m just going to go to hospital.’

‘Very often patients are very anxious about going home. We’re needing beds, we’re sending patients home sicker, we’re sending them home earlier and that confidence that they might have a support service or someone that they can call is really good …’

##### Streaming into community services and GP connection

Some participants discussed an increase in referrals to community services; however, tight eligibility criteria and long waitlists for many services were discussed as barriers to accessing community services more frequently. Participants believed some of the biggest improvements made throughout the trial period involved assisting patients to engage with their GP.

‘… it’s more about getting the right services to the right patient … these patients used to be interacting with the hospital via the emergency department. But now they’re … interacting less with the emergency department, and interacting more with community services, case management and all those sorts of things which are more appropriate.’

‘… the GPs to be honest with you do the lion’s share of the pulling, which is exactly what should’ve happened, encouraging people to get to GPs, transporting them to GPs, helping them after they get the advice from the GP and do what they were told to do.’

##### Care coordination and system navigation

Workforce participants acknowledged that patients with chronic and complex conditions often have trouble comprehending their condition and find the health system overwhelming. They believed intervention models that incorporated care coordination assisted patients to navigate the system more effectively. The care coordinators’ ability to manage patients’ follow-up appointments was discussed as specifically valuable because it stopped patients who would have previously been discharged from services due to failure to attend from getting lost in the system.

‘So from my point of view traditionally in a self-management sort of role we would’ve pushed the patient to do everything – but with HealthLinks it acknowledged that some patients are just not capable of organising their appointments … so we were taking on a bit more of a carer role in terms of … encouraging them to go to appointments and … that sort of thing. So I think it changed the role a little bit from what I saw.’

‘… they won’t know their discharge plan because on day of discharge they get bombarded from every discipline. So I suppose we just put it together for them and we call them, just to reinforce things and they’ll go, *Oh, no I don’t have any appointments, what are you talking about?*, and I’m like you’re meant to come in tomorrow …’

‘… the person does a lot better if there’s someone navigating the health system for them … they’re unwell and they’re not often health literate, so just knowing where to go, what to do next, what’s the best thing … what do they want from their health care I think that’s been the greatest part.’

Some participants, in particular those at one health service, highlighted the benefit of the model of care in being able to take a holistic view of patients’ needs and to develop a care plan that was tailored to all their needs, not just their presenting condition.

‘… we don’t do the same thing with each patient too. A lot of services are very prescriptive with we can’t do this, we can’t do that.’

‘… trying to take a true holistic approach as well, so not just health issues but also looking at their social determinants of health that impact on their health and different things.’

‘I like the concept … that patients can go home with the phone number and … if they’re not sure about their health they can call someone but that person actually has the history and can talk more specifically than say a nurse on call or someone who’s just trying to work out what to do based on their symptoms or what they’re saying …’

##### Patient identification and proactive referrals

Workforce participants discussed that the patient identification algorithm flagged a cohort of patients who may have previously been missed or considered ineligible for services.

‘… for the outpatient load we have to rely on people referring to us and they often don’t … getting this algorithm and getting the patient list each day means that we can actually find the patients.’

‘I think again it really identifies that vulnerable group of clients who would certainly benefit from coordinated, responsive, interdisciplinary care … Linking with existing community-based services. I think it does that well. It’s just that next step.’

Some participants believed that earlier identification was associated with referring patients to services earlier in their disease trajectory and this had the potential to impact favourably on patient outcomes.

‘… more the low-hanging fruit that people wouldn’t think to refer to HARP because they always think *oh you’ve got to be super complex*, but you know just someone who’s come in a couple of times with heart failure and you know the ward might not have referred them until they come in 10 times, whereas we’re getting them on the second. So I think it’s positive for the patients …’

##### Attending appointments

Some participants were unsure whether the HealthLinks trial had led to an increase in patient referrals or whether it had just assisted more patients to attend appointments they had previously been missing.

‘… there’s certainly better levels of engagement with people who have gone to HealthLinks.’

While some participants discussed a reduction in the number of patients failing to attend appointments, others highlighted that missing follow-up appointments was still an issue for many patients due to siloed systems, disjointed appointment schedules and difficulty accessing transport.

‘I think we’re seeing disjointed outpatient follow-up offered and then that further puts the patients at risk because they’re not going to turn up for an appointment this week and then next week and then next Friday …’

#### Discharge to nursing homes or palliative care

Overall, 825 patients had discharges to nursing homes, of which only 10 were enrolled in an intervention. Some patients had multiple discharges to a nursing home and this was captured similarly to other outcome data by summing the number of discharges to nursing homes per patient per month of enrolment. No intervention patients had a discharge to a nursing home in the 12 months before their intervention start date. There were no differences in discharge rate between intervention and usual care patients. No statistics were calculated for individual health services due to such small numbers in the intervention group.

Only 23 (0.06 per cent) of the 33,891 enrolled patients were excluded from the trial for palliative reasons, and only one of these patients was enrolled in and intervention.

### Patient subgroups

#### Utilisation patterns

Additional investigations were conducted to look for patterns of use not apparent in the baseline models. These additional investigations included: emergency versus elective admissions; disease groupings based on the patient’s diagnoses at the time of their enrolment; and risk groupings based on the HealthLinks score at the time of enrolment (patients with a score at trigger admission of more than the 90th percentile – that is, 16 and above, were assigned to the High Risk group). Mortality rates over time were also assessed.

No significant effect was found for emergency versus elective admissions over time among intervention and usual care patients. Disease group was not associated with 30-day readmissions or hospital admissions. However, the disease grouping ‘Other’ accounted for 60 per cent of admissions.

There was a significant effect due to the addition of risk group to 30-day readmission and hospital admissions base model interactions for one health service only. The number of hospital admissions for the High Risk group at the health service were on average 0.18 per month lower in the first year of the intervention start date and 0.20 per month lower in the second year after the intervention start date compared with the Low Risk group.

The main disease group by risk group interaction was not significant due mainly to the high proportion of ‘Other’ in the patient casemix. However, 37 per cent of intervention patients in the High Risk group had a COPD trigger admission compared with only 9 per cent in the Low Risk group.

For the trial period, mortality rates for intervention patients remained relatively consistent over time and the same pattern was apparent for usual care patients. The difference in absolute rates is due to the different number of patients in each group (many more usual care patients than intervention patients).

Key themes from the follow-up workforce focus groups relating to subgroups differentially impacted by the intervention model of care outlined below.

#### Intervention impact for subgroups

Participants of the workforce focus groups and interviews were asked to describe any subgroups they believed were differentially impacted by the intervention model of care implemented at their health service or if there were any subgroups they believed were resistant to the intervention. Key themes commonly described across participating health services are outlined below.

While participants at some health services had difficulty determining cohorts who benefitted the most from the HealthLinks intervention, others believed the intervention model of care led to different outcomes for patients based on their clinical condition(s), their social situation and demographic characteristics. Each of these themes are discussed in turn below.

##### Clinical diagnosis

Participants across all health services believed patients with COPD and heart failure were the clinical group who benefitted the most from the intervention model of care. They believed this was due to strong existing referral pathways available for these two groups.

‘… heart failure and probably your COPD your respiratory group are the ones that flag to me as really beneficial because we’ve got stock standard things we can be reinforcing to them.’

Participants also discussed a number of other clinical cohorts who they believed benefitted from the alternative model of care, including patients with multimorbid conditions, patients with an undiagnosed condition, those prescribed multiple medications, patients suffering from neurological conditions, those with gastroenteritis conditions and a small proportion of undeclared palliative patients.

‘And then there was a group of people who flung in and out of the emergency department and the short stay units rapidly, and they’re actually in the process of getting a diagnosis … hadn’t actually had a diagnosis made on the initial presentations …’

‘… patients that are just at risk of all sorts of side effects from polypharmacy and medications et cetera, these are commonly emerging themes.’

‘… small but meaningful number of patients who actually were undeclared palliative patients … they hadn’t been excluded from HealthLinks because they’d been coded in a way that didn’t indicate they were palliative and the likelihood is the clinicians hadn’t named them as palliative and the patient therefore didn’t know that that was the state of their health … some of these patients were within days of dying and if they hadn’t been picked up would have died without an advanced care plan, without good pain relief, they probably would have been brought to the hospital when they actually wanted to die at home and so that’s why I say it was a small but meaningful number of patients.’

Some participants acknowledged that given many intervention models were aligned with the HARP program, the general cohort of patients eligible for HARP services would benefit from an intervention like HealthLinks.

‘So if they’re HARP-type patients definitely, but there’s just a whole lot of people that aren’t suitable for HARP for a variety of reasons and we’re not really doing anything with them.’

‘I guess put simply the cohort of HealthLinks should be identical to the cohort for HARP, so if you’re asking the question of who we’re missing out, it’s the people who are in HARP but not in HealthLinks.’

One participant raised concern about looking at DRG to determine cohorts who benefitted from intervention and highlighted a need to consider demographic and social determinants within disease streams when assessing impact.

‘And the other thing is too we’re conscious that in fact you know probably the evidence suggests that assessing by DRG is not the best way to go anyway, that there’s a whole lot of other factors you know whether it’s age, whether it’s frailty.’

##### Psychosocial comorbidities

Participants believed patients with psychosocial issues that compounded their chronic disease benefitted from the HealthLinks intervention, especially those with mental health concerns and those who were isolated.

‘I think it’s those clients with complex psychosocial situations that compound their chronic diseases … I mean to me they’re the ones that require our responsive support in terms of supporting them in the community.’

‘We’ve got some as I said who are quite isolated with their health issues, with their mental health issues, and again they hold themselves so tightly because they don’t want the exterior world to see that they’re not coping, especially the younger ones … So I tend to think rather than elderly in the group, it would be the people who are isolated for me.’

There were some conflicting opinions among participants of the impact for patients based on their available support structures. While some participants acknowledged the benefit for patients living alone or without a carer, others believed there was significant benefit for patients who had a caregiver as there was scope to educate them as well as the patient and they assisted patients to engage with services.

‘… if they’ve got family that can help them through the health process, then it’s not usually a big problem. But if they’re by themselves, then obviously that’s going to be a failing.’

‘… the people that generally respond well … or seem to have a great benefit from [the HealthLinks intervention], are usually people who are socially isolated or have minimal support close by, and it doesn’t matter on age, and I think they’re often socially isolated and reduced in terms of their capacity to get to appointments and services.’

‘I mean they all benefit … if you want to divide things there’s the cohort with a carer at home and the cohort without, so that people living alone … the people living alone benefit more because they probably feel more scared for want of a better word for chronic illness. But I think the cohort with a partner or the carer … benefits because the learning is shared between two people, and in some ways some cases the carer takes on more of the learning than the patient.’

##### Demographic

Participants acknowledged that the HealthLinks cohort was typically the elderly who were often overwhelmed by their care needs and could easily fall through the cracks if they had limited support structures.

‘So I think the emerging group over time will be poor elderly women … 35 per cent of Australians over the age of 65 live in poverty …’

‘The older ones have got less insight very often into their own failing health needs or don’t want to address their own failing health needs at that time. Sometimes it’s a matter of actually just waiting and perhaps suggesting that you talk to their daughter or son when they come in and we’ll have another discussion because it’s a selling point sometimes it’s not for the patient as much as for the patient’s family and when they look at it that way and think they’re doing it for their family then they’re more agreeable fairly often.’

However, many participants also discussed the benefits the trial had for younger cohorts who often had psychosocial issues compounding their chronic conditions and may have been previously overlooked by the system as requiring intervention.

‘And probably challenging some of our preconceived ideas and misconceptions, so the age … I think everyone thinks everyone that comes in a lot is old, and there is a group … I’d describe them as kind of 30s 40s, 50s … coming in, not staying long but churning around the system a lot. I think because of their age we’ve never really thought of them as potentially high-frequency users. So I think it’s challenging paradigms.’

‘… previous to that we were seeing mainly 65 and above or chronic diseases and a lot of these were a lot younger … they were patients that we may not have caught up with previously ...’

‘… these younger ones with pain and things like that, that we wouldn’t normally have thought to refer to HARP.’

Participants believed patients from low socioeconomic backgrounds, migrants, those with refugee status and patients from culturally and linguistically diverse backgrounds benefitted from the intervention, especially receiving assistance with care coordination and system navigation.

‘… especially the socioeconomic [factors], like they don’t have money … they’re calling the ambulance and going to hospital for something that they should’ve gone to the doctor for a simple thing … they don’t drive … they can’t walk … they can’t afford it, they literally can’t afford it … they can’t afford their medication …’

‘I wonder about refugees and asylum seekers in that space … there’ll be members of that population that vulnerability group that would benefit from some of this sort of intense touch.’

‘I think it targeted low literacy and [culturally and linguistically diverse] clients as well because I think they’re the ones that really do keep coming in.’

Ultimately, some participants believed the opportunity for the intervention model to have an impact on patients came down to their willingness and ability to learn. They discussed that many patients frequently presenting to the ED had poor health literacy and could have benefitted from care coordination and system navigation. However, some participants acknowledged that there may have been bias in patients with higher education consenting to the intervention because they had the ability to comprehend what was being offered to them and were more likely to understand its benefits.

‘… there’s no particular demographic or age or even culture … is someone willing to learn, are they capable to learn, do they want to change something. But I don’t know if you can pick a demographic.’

‘… low health literacy and just really struggling to work out what they should do and how they should go about it, what appointments they’re supposed to be attending, their medications have run out, like all those clients that are really struggling in that area are probably the ones that would benefit the most.’

‘… it’s a bit biased, but the ones that are reasonably well educated in their own health care will quickly take it on because they see the point.’

#### Subgroups resistant to interventions

Workforce participants discussed challenges engaging patients with mental health comorbidities such as anxiety and depression, especially those with a history of trauma and chronic pain due to limited services available for referral. They acknowledge there were insufficient resources within the health service to address enrollees mental health needs and few external referral pathways available.

‘The one pathway we still struggle with is the mental health pathway. We’ve worked really hard and it might not be high level mental health but some of the other issues that are affecting people in their day-to-day life and how we actually improve that pathway so we’re working on it but that’s still a challenge.’

‘… have got some form of trauma in their past … significant trauma … domestic violence … refugee-type status … they just never seem to get on top of where they need to be. They’ll make small gains because that’s what they want to do and then things slip back again.’

‘… that hybrid approach between medical and mental health, psychosocial that requires a different way of thinking. And it requires you to actually rise above the chaos and work in a different way with that client group.’

Participants believed patients who had previous negative experiences with the health service were a difficult cohort to engage as they often did not trust what was being offered to them and were sceptical of the trials aims and objectives. One participant acknowledged many patients within their cohort refused the intervention on first offer but after being offered it on subsequent readmissions, they could begin to see its benefit and considered consenting to the alternative model of care on offer.

‘There's always a personal choice component, but some of these people also experience over very long periods failed systems, so they’re not happy about the care they’ve had and often layered in there are all sorts of background trauma things that have been going on …’

‘… when you think you’re offering a good program, you think patients will trust you but the reality for this group of patients is they’ve been trusting people for a long time with a great program and it hasn’t actually helped them …’

‘Initially I was finding that many of them would refuse in the early days and the initial contact that you made with them, as they came back into hospital for presentations after that they could see the point in having someone that they could then refer to …’

Ultimately participants discussed that there will always be a group of patients with fixed coping strategies who refuse to engage with interventions no matter how hard the health services try.

‘… they developed fairly fixed coping strategies and … they’re very resistant ...’

Workforce participants described that finding culturally appropriate services that address specific cultural needs of migrant, refugee and culturally and linguistically diverse groups were challenging, especially given the lack of interpreter services available for patients who had a preferred language other than English.

‘… where there’s … low health literacy, low socioeconomics, people don’t often speak English you need to adapt it for the local population …’

### Ceasing an intervention

Only three health services documented in their record-keeping spreadsheets the reasons why patients did not complete an intervention.

The following summary is based on raw unvalidated data provided by the health services. It is meant as summary from the health services’ perspective. Very few patients at the first health service refused or ceased an intervention once enrolled (~1 per cent), with the median duration of their interventions being around 50 days.

The second health service also had very few patients declining an intervention (~3 per cent). The median duration of the health service’s intervention model of care was approximately one year.

At the third health service 3.3 per cent of patients declined an intervention. The overall median duration for an intervention at the health service was approximately 150 days, although more than 80 per cent of patients with an intervention start date did not have an end date.

Patients who received an intervention model of care that involved care/contact outside of a hospital setting had the longest duration of participation. Because this analysis is based on patients who had a defined period start and end date, these findings may not be generalisable to the whole HealthLinks cohort.

There was limited discussion among workforce participants of the best time to cease an intervention. Some participants at one health service discussed a rapid review process they undertook during the trial period to determine who could be graduated from the program. They acknowledged challenges with undertaking sudden assessment and highlighted a need to conduct regular evaluations of patient status moving forward to determine their ability to self-manage and readiness for intervention cessation.

‘… we need to look at them and see if they’re being … well managed enough to move them on, so all of a sudden there was a mass exit from the program … every three months they will review them again and if need be they will graduate, so it will just be an ongoing process, therefore we won’t have this massive drop again.’

One participant at another health service acknowledged intervention cessation is something the health service is mindful of, especially considering what happens to patients enrolled in the intervention once the trial and its associated funding ends.

‘I guess our greatest concern now is what’s happening next. We’d be very reluctant to withdraw the group of patients that we’ve got from anything and really we’re just trying to work out then what does that look like, what can we do while we are waiting on whatever the next model from the department what the financing around that model is …’

### Self-reported patient outcomes

There was limited variation in survey participant self-reported outcomes across the survey waves. For the most part, survey participants at both participating and control health services self-reported below average physical and mental health outcomes.

In general, mobility, pain/discomfort and usual activities dimensions of the EQ-5D showed the greatest impairment for survey participants. Survey respondents at participating health services rated their overall health slightly better than those at control health services and reported fewer depressive symptoms.

Given the poor participation rate in the HealthLinks patient evaluation survey for enrollees who received an intervention model of care, analysis to assess whether these differences can be attributed to the HealthLinks intervention model of care could not be undertaken.

#### SF-12

The SF-12 is a generic measure of health status. Respondents complete 12 questions by placing a mark in the box of the three/five-point scales provided that best describes their answer. Responses are used to generate a Physical Component Summary (PCS) and Mental Component Summary (MCS). Very low scores on the PCS measure indicates limitations in physical functioning, while very high scores indicate little or no measured physical limitations. Similarly, very low scores on the MCS indicate frequent psychological distress and very high scores indicate little or no psychological distress. The SF-12 also comprises eight domain scores: Physical Functioning (‘PF’), Role-Physical (‘RP’), Bodily Pain (‘BP’), General Health (‘GH’), Vitality (‘V’), Social Functioning (‘SF’), Role-Emotional (‘RE’) and Mental Health (‘MH’).

Most mean t-scores for participating and control health services fell below the normal range, indicating patients who participated in the HealthLinks patient evaluation survey, irrespective of site, generally had poor physical and mental health outcomes and overall poorer health.

Compared with patients at control health services, survey participants at participating health services reported higher PS (*p =* 0.025) and MS (*p =* 0.009) mean t-scores at each survey wave. Survey participants at participating sites also reported higher RP (p*< 0*.001), GH (*p =* 0.049), V (p*< 0*.001), SF (p*< 0*.001) and MH (*p* = 0.018) mean t-scores at each wave. Although statistically significant, the magnitude in mean t-score difference was very small (for PS at 12 months: control health service mean t-score = 32.9 [sd = 10.0] versus participating health service mean t-score = 35.1 [sd = 10.8]).

After accounting for patient casemix, there was no difference in the change of SF-12 PS or MS from baseline to six months for survey participants at each participating health services (all *p* > 0.05) when compared with participants at control health services.

#### EQ-5D and EQ-VAS

The EQ-5D-3L is a standardised measure of a respondent’s health status on the day of completing the survey. The tool comprises two parts: (i) the EQ-5D descriptive system, and (ii) the EQ visual analogue scale. The EQ descriptive system assesses five dimensions: (i) mobility, (ii) personal-care, (iii) usual activities, (iv) pain/discomfort and (v) anxiety/depression. For each of these dimensions respondents are asked to indicate their health state by selecting one of three levels that is most appropriate for them: (i) no problems, (ii) some problems, (iii) extreme problems. The EQ visual analogue scale asks respondents to rate their overall health state on a 100-point scale where 0 indicates the ‘worst imaginable health state’ and 100 indicates the ‘best imaginable health state’.

In general, the mobility, pain/discomfort and usual activities dimensions showed the greatest impairment, with at least 50 per cent of survey participants self-reporting some problems. There was no difference between EQ-5D dimensions for survey participants at participating (all *p* > 0.05) or control (all *p* > 0.05) health services over time or between participating and control health services over time (all *p* > 0.05).

The mean EQ-VAS differed for survey participants across participating and control health services, with those at participating health services rating their health slightly better than survey participants at control health services (*p* = 0.002).

After accounting for patient casemix, survey participants at one health service reported on average higher EQ-VAS scores at baseline compared with six months (*p* = 0.022) when compared with control health services. There was no difference among responses from survey participants at other participating health services when compared with those at control health services (all *p* > 0.05).

#### Personal Health Questionnaire Depression Scale (PHQ-8)

The PHQ-8 is an assessment of respondent’s depression level. Respondents are asked to consider how they’ve been feeling during the past two weeks and answer a series of eight questions. For each item, respondents indicate whether they were bothered ‘not at all’, ‘several days’, ‘more than half the days’ or ‘nearly every day’. If they indicate a problem with any of the items, they are asked one additional question to assess how difficult these problems make it for them to do their general day-to-day activities: ‘not difficult at all’, ‘somewhat difficult’, ‘very difficult’ or ‘extremely difficult’.

Over time, survey participants at participating health services reported fewer depressive symptoms and consequently the proportion of respondents with PHQ-8 score indicative of major depression and serve major depression decreased (*p* = 0.003). At control health services, there was no association between participants PHQ-8 score and survey wave (*p* = 0.860). The proportion of survey participants at control health services with PHQ-8 score indicative of major depression and serve major depression remained relatively stable over time.

There was no difference in PHQ-8 scores between survey participants at participating and control health services over time (*p* = 0.051).

After accounting for patient casemix, there was no difference in the change in PHQ-8 score from baseline to six months for survey participants at each participating health services (all *p* > 0.05) when compared with those at control health services.

#### Generalised Anxiety Disorder Scale (GAD-7)

The GAD-7 is a measure for assessing general anxiety disorder. Respondents are asked to consider how they’ve been feeling during the past two weeks and answer a series of seven questions. For each item, respondents indicate whether they were bothered ‘not at all’, ‘several days’, ‘more than half the days’ or ‘nearly every day’. If they indicate a problem with any of the items, they are asked one additional question to assess how difficult these problems make it for them to do their general day-to-day activities: ‘not difficult at all’, ‘somewhat difficult’, ‘very difficult’ or ‘extremely difficult’.

Over time there was no difference in the number of anxiety symptoms survey participants reported at participating (*p* = 0.208) or control health services (*p* = 0.668). There was also no difference between GAD-7 scores for survey participants at participating and control health services (*p* = 0.458).

After accounting for patient casemix, there was no difference in GAD-7 score from baseline to six months for survey participants at each participating health services (all *p* > 0.05) when compared with those from control health services.

## Patient experience

In general, survey participants’ satisfaction of care received did not change over time and perceptions of the quality of care received and patients’ self-management was similar irrespective of whether survey participants were enrolled at a participating or control health service. The lack of intervention patients participating in the HealthLinks patient evaluation survey limits the use of objective data to assess patient experience and the trials promotion of chronic disease self-management.

### Patient Satisfaction Questionnaire (PSQ)

The PSQ is a measure of patient satisfaction with their medical care. Respondents are asked to consider the medical care they are receiving and complete four questions. Each item is completed using the rating scale: ‘strongly agree’, ‘agree’, ‘not sure’, ‘disagree’ or ‘strongly disagree’.

Overall, survey participants reported the same level of satisfaction with their health care, as assessed by the PSQ, irrespective of whether they were enrolled at a participating or control health service (*p =* 0.672). At participating health services, over time there was no difference in how satisfied survey participants were with their care (baseline mean [sd] = 3.31 (0.76), six months mean [sd] = 3.30 (0.74), 12 months mean [sd] = 3.33 (0.68); *p =* 0.917). Similarly, overtime survey participants at control health services also did not report a difference with the satisfaction of their care (baseline mean [sd] = 3.33 (0.81), six months mean [sd] = 3.33 (0.77), 12 months mean [sd] =3.22 (0.82); *p =* 0.917).

After accounting for patient casemix, there was no difference in PSQ scores from baseline to six months for survey participants at each participating health services (all *p* > 0.05) when compared with those at control health services.

### Patients Assessment of Chronic Illness Care (PACIC 14)

PACIC 14 is a series of questions designed to measure chronic care delivery. PACIC 14 asks respondents to consider the care they have received for their chronic illness in the past six months and answer 14 questions. Each item is completed using the rating scale: ‘almost never’, ‘generally not’, ‘sometimes’, ‘most of the time’ or ‘almost always’. Responses are used to generate five subscales (patient activation, delivery system design, goal setting, problem solving, follow-up) as well as an overall measure.

Overall, survey participants perceived the quality of their care, as assessed by the PACIC 14, as the same irrespective of whether they were enrolled at a participating or control health service (all *p* > 0.05).

At participating health services, over time there was no significant difference in how survey participants perceived the quality of their care (median ranged from 2.0 to 2.5, all *p* > 0.05). In contrast, at control health services, in general (with the exception of goal setting), survey participants perceived the quality of care as generally worse over time (*p* [total] = 0.020; *p* [goal setting] = 0.218; *p* [problem solving] = 0.047; *p* [follow-up] = 0.040).

After accounting for patient casemix, survey participants at one health service reported on average a higher PACIC 14 total score at six months compared with baseline (*p =* 0.022) when held up against survey participants at control health services. There was no difference among participants at other participating health services when compared with those at control health service (all *p* > 0.05).

From the perspective of staff who participated in the follow-up workforce focus groups, there was a belief that patients who received an intervention model of care found the trial a positive experience. These perceptions were generally based on anecdotes, although some based their perceptions on data from Net Promoter scores, locally conducted evaluation surveys and direct feedback from HealthLinks intervention patients.

‘Our colleagues are constantly trying to refer into the program, so that’s always a good sign that’s it well received, and they can see the benefit … there would be very few patients who haven’t expressed some benefit. Most express extreme gratitude and lots of benefits.’

‘They’re not all positive but they’re mostly positive … you can see their satisfaction is improving over time … it’s definitely improved the quality of life and the way they see the health system as well.’

Workforce focus group participants described intervention patients having improved trust and belief in the health system and that the holistic approach to care made them feel cared about. Participants at one health service highlighted improved social connection for their intervention patients and that providing ongoing education and support helped reduce patients’ anxiety and build resilience.

‘And suddenly they go, *oh, the hospital cares about me*, and suddenly their behaviour is different too because I think it's fair to say people go into a different relationship with the team once they see the kindness and generosity that can be provided.’

‘Because we’re not as quick to discharge with HealthLinks, especially if they’re in that time been going back into hospital, one of the benefits would be that you establish a better relationship with them because you hang onto them a little bit and they get to trust you.’

Regarding the HealthLinks trials promotion of self-management, workforce perceptions varied. Some focus group participants believed the impact was limited or they were unaware of any impact. A couple of focus group participants questioned if self-management was the main goal for this cohort or if they required a more paternalistic approach to care through ongoing care coordination and assistance navigating the health system. Alternatively, others believed the trial had a significant impact on self-care efficacy, health literacy, medication management and early detection of deterioration for participants receiving an intervention model of care.

‘… they’ve got a bit more education behind them to know well if I’m starting to get sick instead of going straight to the hospital I can maybe go and see my doctor a bit earlier, and potentially follow it through that way so they’re not always going into hospital …’

‘People that we see coming into the program that have had HealthLinks tend to have improved levels of health literacy. Understanding things like … monitoring changes in their condition that would alert them to seek early intervention to prevent a re-presentation to hospital.’

‘… that self-management model whilst it’s great it just didn’t work for everyone. And so I think it broadened our philosophy about how to think about caring for patients, and to be okay with a model where we’re a bit more interventionist …’

### Consent and enrolment processes

Some workforce participants acknowledged the burden of consent and enrolment processes on intervention patients throughout the trial. At one health service this related to patients feeling hassled by recruitment phone calls; at another health service it was the difficulty explaining the concept of intervention eligibility because of an identification algorithm; and at another health service some discussed the long consent process for intervention patients and the burden of administering two evaluation surveys because the system-level survey activity coincided with local evaluation survey activities. In addition, some workforce participants questioned whether patients clearly understood what they were being enrolled in, especially when they were already receiving a similar model of care from the health service to what the HealthLinks intervention provided. Each of these themes are discussed in turn below.

A couple of participants discussed the potential negative impacts of the consent and recruitment processes on patient engagement with intervention models of care. Two participants at one health service acknowledged that a few patients had described feeling hassled by recruitment phone calls once they had been discharged from hospital.

‘… sometimes when you speak to clients they don’t want anything to do with HealthLinks or with HARP and then they feel like you’ve kind of annoyed them because they’ve been discharged from hospital and why are you calling me, even though they’ve met [a team member] on the ward and they know the people are going to call them, but maybe sometimes they’re being hassled more than they would like to.’

One participant at another health service also highlighted the challenges of recruiting patients over the phone and the difficulty patients had understanding why they were considered eligible for a service because of an algorithm.

‘It’s a hard thing to explain to somebody … It was a very hard sell.’

At one health service some participants acknowledge that the enrolment and consent process was onerous for both staff and patients and questioned when the best time was to approach patients. One participant also discussed the burden of the HealthLinks patient evaluation surveys and the challenges of explaining to patients the multiple evaluation activities being undertaken by some health services.

‘… so it was a bit confusing for the patient as well so you know a lot of time spent on the phone clarifying the purpose of both evaluations which was for the same purpose in a way ...’

Participants at three health services questioned whether patients clearly understood they were enrolled in the HealthLinks trial. This was especially true for patients who were already receiving care from the health service (for example, HARP services) because the care they received may not have appeared any different to their usual care. The implications this had for provisions of informed consent was discussed.

‘All I can suggest is … at the time they’re identified as HealthLinks and they should be notified that yes you’ve been identified as this. You know and explained what HealthLinks is at that point – not when we get to them.’

## Health service experience

### Organisational supports required

Workforce participants at all six health services discussed a need for a fundamental shift in mindset of chronic disease management and acknowledgement that the acute setting has a significant role to play in the care of this cohort. For the intervention model of care to be successful, participants highlighted a need for long-term commitment to funding and resources. However, they also acknowledged the difficulties health services faced implementing a new funding model within a challenging financial environment and the trepidation executives had to commit to a capitated funding model given its apparent risks.

Participants believed that if the department made the funding model mandatory and set key performance indicators (KPIs) for health services to report against, that this may assist with obtaining executive engagement. Participants also discussed the importance of staff champions to drive the initiative within the health service. They believed champions were required not only at the executive level but at multiple levels of the health service including clinical champions, passionate healthcare providers and a dedicated project team. Each of these themes are discussed in turn below.

#### Change in mindset of chronic disease management

Across all health services, workforce participants discussed a need for health services to have a change in mindset of how patients with chronic and complex conditions are cared for. They believed health services need to accept that they have a role to play and care for this cohort and that it is not the sole responsibility of community and social services.

‘… you know most of them don’t believe in this kind of health care, they don’t see it as health care, they see it as social care.’

‘… our very senior leadership is very medical nursing inpatient traditional kind of behaviours … so trying to get them to think differently is a broader issue not just about HealthLinks as it were.’

Some participants believed participation in the HealthLinks trial was the push their health service needed to generate discussions about taking a long-term outlook of health care models for chronic disease management.

‘So I think it really helped start a conversation if it wasn’t happening already. I think everyone knows that we need to divert more people from hospital and keep them out, but it kind of put, I think it proved a really good intermediate step to start conversations and really create some focus …’

They believed health services need to improve collaboration with community services and there needs to be a shift away from episodic care models to taking a holistic view of patient needs.

‘I think everyone is beginning to understand that there is a need to increase our community resource and presence … that’s the way forward. It’s not about making the hospital bigger …’

Given the care of patients with chronic and complex conditions spans multiple departments within health services, participants believed change should ultimately be implemented at the organisational level. While they acknowledged this would come with collaboration, communication and awareness challenges, participants believed implementation across the health service level would break down funding barriers in the siloed system and show departments the health service is committed to making change.

‘… it does need ongoing executive support … because it spans so many services, and somewhere like <health service> is such a massive organisation as well, you’ve got to have the buy in from acute and emergency department and people there knowing what's happening in the community ...’

‘… because the funding model was just a very specific cohort of patients … because it's just a wedge of people it doesn’t give the organisation an opportunity to completely rethink how we go about our business.’

#### Commitment to funding and resources

Workforce participants highlighted health service executives’ commitment to funding and resources is fundamental for the successful implementation an intervention model like HealthLinks.

‘… you know someone from executive needs to be brave and say right we’re going to invest more dollars in this …’

‘… if your board and your CEO are not interested in this and your finance director, don’t think you’re going to be able to get it up … We’ve had amazing support from our Board Chair and our CEO ...’

They acknowledged the difficulty for health services to implement a significant funding change when they are operating under difficult financial environments and budgets are in the red.

‘I think the fact that the executive can see that there’s potential for savings here, and that’s very helpful when you’ve got a bottom line that’s in the red.’

‘… this notion of redistribution of funds from one place to another is quite foreign to health because there’s usually new funds pumped out to do it. And it also came during a period where a lot of people were struggling with their global budgets.’

Participants discussed that the underlying funding model is a difficult concept to understand and it goes against the current funding system that rewards health services for having a sick population. Health services often perceived the capitated funding model to be a significant financial risk and as such participants believed to obtain finance teams support, time needs to be taken to adequately explain it.

‘I’m thinking we’re actually rewarded for having a sick population, we’re incentivised to have sickness.’

Participants described that the lack of funding clarity and short-term timelines created uncertainty for health service executive teams and this lack of trust and perceived risk impacted their commitment to the trial. They believed longer-term funding periods of three to five years may counter these concerns.

‘And what they saw was funding insecurity ongoing and a lack of clarity about the more than one-year time frame. Well they can’t turn the Queen Mary around on a sixpence, they’ve got to know that there's security and safety financially for them to commit to building over a three- to five-year period.’

‘Yeah not just year by year, but you know maybe it could be a five-year plan or a three-year plan. So at the moment I think the uncertainties are definitely … there's a financial risk involved … so then people might say no we can’t get too involved … finance people talking with the clinical side and making sure that they come to a common ground.’

Participants believed greater push from the department to engage health services was required. They discussed the potential of providing health services with initial seed funding to help get programs off the ground, making the funding model mandatory at a state level and setting KPIs that health services need to report against to help health service executives engage with the trial and provide their support for its implementation.

‘I really would like it if the department would make this a mandatory program with some notice … not deciding that two months out but … if they declared next month … as of 2021 this is actually how it’s going to work it would actually galvanise the very senior leadership into starting to engage with it …’

‘… so from a department perspective … it’s just about continued commitment to it, and what they can do to support it from their end. So you know around engagement of CEOs and maybe even expectations or KPIs.’

#### Staff champions

Workforce participants discussed a need for staff champions across multiple levels of the organisation to drive the project within the health service.

‘… it’s this small group of champions if you like that keep pushing this barrow and saying this is a good thing, this is a good thing.’

They believed buy-in from clinical leaders was especially important.

‘And what really helps is … physician buy-in, like you need a little bit of doctor time, not a lot, and you need the right doctors … so that they can be on the ground all the time … problem solving essentially …’

Passionate healthcare providers on the ground providing care to the HealthLinks cohort also made a difference.

‘I think you’ve got a really highly motivated and dedicated group of staff that really want to change outcomes for patients and are believers in the public health system and care coordination and actually putting in the right packages for patients …’

Participants discussed the need for a dedicated project team to lead implementation and ensuring they had sufficient time allocated to the project so they can champion the work within the health service.

‘I think the person that led the project did the best job that [they] could, but [they were] wearing that hat amongst a number of other priorities at the same time. So I think having someone who could have dedicated time to lead this work and communicate goals and objectives and develop referral pathways and resources would be helpful.’

‘They had a project manager which was good … she really was the driving force behind it, so I guess without her there wouldn’t have been a project.’

### Adoption experience

There were diverse discussions among workforce participants about the impact the trial had on participants workloads. Some participants reported an increase in workload, particularly for healthcare providers at the start of the trial, but for others there was no impact. Except for participants who took on a completely new roll for the trial, there were no significant impacts on duties; some healthcare providers discussed greater flexibility and increase in problem solving for HealthLinks patients.

Overall, participants believed participating in the HealthLinks trial was a positive experience. It allowed flexibility and creativity, and provided learning opportunities. For healthcare providers seeing the valuable contribution to improving patients’ care was rewarding. However, for some participants, especially at three health services, participation in the trial was a negative experience. Participants described disappointment that their initial expectations of the trial were not met, increased stress and pressure to find solutions for the HealthLinks cohort and some participants raised ethical concerns about preferential treatment. At one health service, participants also discussed the burden of evaluation patient survey administration and the negative impact this had on staff morale.

While most healthcare providers indicated the trial did not significantly change the way they provided care to their patients, participants discussed the benefits of more detailed referrals to specialist services and others highlighted the flexible capitated funding model allowed them to consider alternative care approaches. It was also acknowledged the model of care assisted healthcare providers to take a holistic view of patient needs rather than focusing on their presenting condition. Each of these themes are discussed in turn below.

#### Impact on staff workload and duties

Some workforce participants reported an additional workload during the HealthLinks trial. Healthcare providers discussed an influx of referrals as a result of using the algorithm for patient identification, and for most this had the greatest impact at the start of the trial as health services refined their algorithm integration. Some healthcare managers also discussed an increase in workload and that their contribution to HealthLinks was in addition to their existing portfolio of work.

‘I suppose our workload changed because maybe the algorithms were sensitive, and we had a big influx of patients to see that we probably would not have identified previously …’

‘I’d say it got a fair bit of my time … And there’s a lot of stable areas that I was looking after by then too and they probably just got a little bit less attention.’

For others, they believed HealthLinks had no significant impact on their workload. For healthcare providers, they described always having a full clinical load while for healthcare managers, they believed the aims of the HealthLinks trial fit well with their existing portfolio.

‘Yeah, that’s right, so the clinical load I think it was always there and we’re just looking at them differently but doing similar things.’

‘It hasn’t made any difference to my workload at all. It’s been a resource for me rather than contributing to my workload.’

‘So I actually think it hasn’t impacted unfavourably at all because it’s very much aligned to what we’re trying to do in the hospital admission risk program anyway …’

Most participants believed their work duties did not significantly change during the HealthLinks trial. However, some described specifically taking on a new role during the trial that was associated with a complete change of duties from their previous role.

‘So our role is completely new and new to the organisation …’

‘Yeah, it’s a significant role change … it wouldn’t really compare to any other sort of allied health discipline.’

Others described a requirement for greater flexibility and more problem solving for HealthLinks patients and that the trial increased the scope of when it was acceptable for them to intervene.

‘… traditionally in a self-management sort of role we would’ve pushed the patient to do everything – but with HealthLinks it acknowledged that some patients are just not capable of organising their appointments … so we were taking on a bit more of a carer role … encouraging them to go to appointments and you know that sort of thing.’

#### Job satisfaction

Overall, workforce participants believed participation in the HealthLinks trial was a positive experience. They reported being passionate about improving chronic care models and were excited to play a role in shaping and implementing change.

‘I actually found it quite exciting because it’s an opportunity to actually influence what it looks like in the organisation as well.’

‘I’m quite passionate about you know seeing the pilot through, keeping working on it, keeping trying to modify it, trying to support the staff who are involved in it. It’s hard work and so I think we probably have to stay pretty passionate about it and we’ve had a few obstacles to get over which we’ve had to keep energising and being optimistic ourselves to get through.’

Participants spoke favourably of the flexibility and creativity the capitated funding model provided and for those who had a role change for the trial they reported enjoyment in being able to do something different.

‘So to be able to be flexible and creative in that space and to have money to do that, is pretty unique in today’s sort of health systems. So I think that’s really valuable.’

‘So for me it was very nice to do something different with my brain for a while.’

Participants believed the HealthLinks trial provided learning opportunities for individuals as well as the health service more broadly and the opportunities to collaborate with other HealthLinks health services and learn from others who are facing the same challenges was discussed positively.

‘I learnt a lot from it don’t get me wrong I really did so overall I think it’s positive. It was just hard. But you learn from hard things.’

‘… it’s certainly opened my eyes … I’ve got even better understanding I’d like to think of you know the sort of things that are out there in terms of vulnerable populations … I still don’t think I have a full grasp of it, but I probably understand a little bit better the challenges that they have to go through …’

Healthcare providers described their role was rewarding and they appreciated being able to make a valuable contribution to improving patient outcomes. They believed the use of the algorithm provided an opportunity to identify more patients who can benefit from intervention.

‘… knowing you’re making a difference to people, that you’re able to help them with things … and from … totally stupid tiny little things, to quite major things.’

‘… seeing those patients stay out and accept those services … just think that you made a difference in someone else’s life.’

However, for some participants, participation in the trial was a negative experience. Participants described disappointment that their expectations of what the intervention model could provide to patients were not met, and what was considered at the outset of the trial had not been implemented.

‘It’s been quite disappointing … there was all this excitement at the start and this kind of promise that … we’d be able to give these people who needed the most help extra help, and we haven’t been able to do that, so it’s been quite disappointing and frustrating.’

‘Yeah, so I guess the promise of money when we first started HealthLinks … then when that didn’t materialise … it was really quite disappointing, felt like the teams had worked really hard to try and help these patients.’

Healthcare providers discussed increased stress and pressure to find solutions for their HealthLinks patients even after they believed they had done all they could to address their needs. They also raised ethical concerns about preferential treatment for HealthLinks patients over existing patient loads and that they could not provide the same care options to patients who on paper looked to have similar concerns to those enrolled but were not identified as enrolled by the algorithm.

‘And I guess there's a bit more of that pressure on you as a clinician when they have the HealthLinks flag and what else are you doing, what else can I do, you may have exhausted all your options, but … you’ve got to go back again because they’re HealthLinks you rack your brains to what else there is. So it does add a little bit of pressure sometimes …’

‘… so when you can see that there’s a bunch of HealthLinks clients in there but you can also see all the other clients that have been waiting in excess of six months for your service, it does create additional angst …’

At one health service specifically, participants discussed that time required to conduct the HealthLinks patient evaluation surveys took time away from clinical duties and the survey burden significantly impacted staff morale.

‘So from a personal point of view I actually found it really laborious and frustrating … I didn’t find it a positive experience at all.’

#### Care delivery

For many healthcare providers who took part in the workforce focus groups there was no significant change in how they provided care to their patients; it was business as usual. However, some believed there was improved patient engagement and the intervention model of care provided clearer care plans and more detailed referrals to specialist services.

‘… the direction is easier for want of a better word because they come more prepared; they’ve been better counselled on self-management before they even turn up to see a doctor.’

‘… when they refer to me it’s a very comprehensive referral, they’ve done all the back work, and that makes life a lot easier … it’s a very, very detailed I guess handover of referral.’

Participants described the flexibility of the funding model opened up new avenues of referral and allowed for alternative care approaches that were of significant value to patients (for example, purchasing equipment).

‘… things that we’ve done on this role that we just wouldn’t have done in our previous roles, but if you think about it, they could’ve been five-minute things that added … 100 per cent value to a patient … it’s about again having that permission to do these kinds of things.’

‘… now we can just refer to care coordination but before you had to have care coordination plus physio or social work or something, you couldn’t just have care coordination …’

Participants acknowledged that the intervention model of care helped them take a holistic view of patient needs and gave them a greater appreciation of broader issues that may be affecting their ability to deal with their presenting health conditions.

‘… I have a bit more understanding … they’re people as well … they need some personalised care, they need compassion …’

‘… yes, they might’ve come in only with their heart failure but … they’ve got all these other things that are impacting on their abilities and function at home as well, so I think … trying to address some of their other needs whilst they’re an inpatient.’

### New services required

While workforce participants described the potential of adding some new services, discussions focused more strongly on improving access to current services, refining the model of care and a need for increased resources going forward.

Participants discussed patients often facing barriers accessing care in a timely and coordinated manner. A potential solution for this may be to implement multidisciplinary chronic disease clinics that would allow patients to access all their healthcare providers in one location via one referral. Participants believed significant improvements could be made in collaboration between health services and GP clinics to streamline patient care plans, and some participants suggested having GPs specialising in chronic disease would be beneficial. The addition of mental health and remote monitoring services were discussed as valuable future additions to care models.

There were considerable discussions across all health services of a need to refine the patient identification algorithm moving forward. However, there were conflicting views of whether the scope should be narrowed or broadened. Participants questioned which patient cohort has the greatest potential to benefit from intervention. While they acknowledged benefits in changes to quality of life for patients frequently presenting, many participants believed targeting patients earlier in their disease trajectory would allow greater opportunities for behaviour change. Some participants also discussed the importance of including an element of clinical judgement and triage alongside the algorithm to ensure the patients most in need received care first.

Participants frequently discussed a need for commitment to funding and resources over a longer period, potentially five to 10 years, to account for the sufficient time it takes to observe behaviour change. Participants highlighted the need for sufficient staffing resources to meet demand, particularly for specialist clinics, allied health services and services outside traditional working hours. Participants at some health services discussed the need for a clearly defined and communicated model of care in future to ensure the workforce clearly understands its underlying aims and objectives. The importance of resources for implementation and a dedicated project team to lead the change process were also discussed.

Overall, the trial period was viewed as a key learning experience, and participants believed future adaptations should be based on data and evaluation results. They also highlighted the importance of embedding collection of quality data metrics into systems to enable ongoing evaluation. Each of these themes are discussed in turn below.

#### Access

Workforce participants believed timely and coordinated access to services remains a significant issue for patients with chronic and complex conditions, especially access to specialist services. They also discussed challenges with the health services ability to effectively engage with GPs and highlighted that improved collaboration should be an area for future improvement.

‘I think we’re seeing disjointed outpatient follow-up offered and then that further puts the patients at risk because they’re not going to turn up for an appointment this week and then next week and then next Friday …’

‘… I’m still probably in the belief that what I do could sit alongside the GP and then I’d still work in association with a hospital, one main hospital, but we dip into the hospital more than where we sit now with the hospital and dip into the GP … I think it would work better. Because they’re going to be their primary carer, not the hospital.’

Given these service access barriers, participants acknowledged that the ED often remains the best solution for many patients with chronic and complex conditions. They suggested the solution to improving access may be to develop chronic disease multidisciplinary care teams where patients are referred once and have access to all the healthcare providers they need in a single location.

‘… ED is unfortunately still the solution for some stuff it shouldn’t be the solution for, because we can’t get other things to happen, or there’s long waits.’

‘… could you imagine if they had a team of say the nurse, the OT, the physio, the dietician, the psychologist, instead of them writing thousands of referrals …’

Discussions were also had about developing chronic disease as a specialty. For example, having GPs who have a patient load of only patients with chronic and complex conditions or the potential of a chronic disease inpatient ward in the acute setting as they currently do for cardiac or gastrointestinal conditions.

‘… you would employ super specialised GPs who just do chronic disease five days a week, or as much as they work. So that the throughput for them … they just become very familiar and comfortable with it.’

#### Additions to the intervention model of care

Workforce participants discussed the potential addition of two services to future models of care. They highlighted a need for dedicated support from mental health services to address social and psychological needs of the patient cohort. They also believed an increase in remote monitoring services could be beneficial to enable early identification of patient deterioration. Participants also acknowledged telemonitoring could allow patients who require a less intensive intervention to keep in contact with health services rather than ceasing intervention altogether.

‘… at that hybrid approach between medical and mental health psychosocial that requires a different way of thinking. And it requires you to actually rise above the chaos and work in a different way with that client group.’

‘… we haven’t been able to really get a proper tele health monitoring set up arranged so I think that’s one of the areas that we could certainly look at improving in the future.’

‘… but getting it down to a sustainable price and that includes ongoing refinement of who we target initially and how long we keep working with people, but I’m quite against this idea of sort of setting people adrift who’ve got chronic disease because they’ve had a good run of stability – I’m more interested in saying okay you're in a lull, that’s fantastic, how do we keep an eye on you and get you back into more intensive stuff the minute things begin to go wrong, but not after you’ve had a crash.’

#### Future improvements

Workforce participants across all health services frequently discussed potential future improvements to the patient identification algorithm. For some, they believed the algorithm was oversensitive and identifying too many patients for the available resources. Alternatively, others discussed the potential of broadening the scope of the algorithm to include a wider patient cohort.

‘I think you know there’s a wider population who would benefit from a similar sort of service.’

Participants also discussed a need to consider which cohort of patients would receive the greatest impact from an intervention. They believed it may be too late to significantly change the behaviour of frequent presenters and the intervention models may generate greater change in disease trajectory for patients who have not as yet become acute or highly complex.

‘… start with those patients that are a high utiliser of hospitalisation – you’re not probably going to change their trajectory, it’s too late. What you can do is improve the quality of their life by reducing their hospitalisation in and out. The real benefit, and the real value, comes down the track, which I’m sure is the vision for this program is that 9 or 10 per cent that sit beneath in whom you can actually change the trajectory of their disease.’

Healthcare providers discussed the need for an element of clinical judgement in referrals for the program and believed there needs to be a component of stratification or triage going forward.

‘… the algorithm as well too I feel like the selection of the clients could be improved, and I wonder whether too there could be some sort of medical presence in terms of triaging clients. Because very honestly sometimes your medical gut feeling overcomes all these algorithms, and I say that with all humility, but sometimes it honestly does. Because we often see clients and we say, *oh actually they’d be good to be followed up*, but they don’t meet the criteria for whatever reason, so they’re not part of the program. But we actually know that these are the people that will come back.’

‘… there is just so much about the screening process that is the human equation and you know the amount of referrals we get through that look terrible on paper and you actually may see them once and then they’re actually sorted.’

Participants at some health services believed their organisation had a poorly defined model of care during the trial period and this needs to be addressed. They also highlighted the need for the model of care to be effectively communicated across different levels of the organisation to ensure those involved clearly understand its underlying aims and objectives.

‘A clear model of how it will link in with not only HARP but all the hospital services … because they may not be for HARP, but they may need other things, so you know a direct model of care that flows properly. Also education at the sites at the hospitals … most of the sites have junior medical staff, junior nursing staff, the medical staff rotate every three months and if you want sustainability in a project or program like this you’d need to put a lot of education and training into it to have it as a long-term sustainable project or service.’

Participants discussed a need for a longer term commitment to funding and resources for a program like HealthLinks to account for the considerable time it takes to observe behaviour change. They suggested commitment for five to 10 years without changing protocols should be considered to give health services greater certainty during implementation and allow time to assess patient outcomes.

‘… [you’d like the department] to have an algorithm that lasts for 10 years and committed that you weren’t going to mess around with it because, as I said, it’s such a long gestation on some of these things, give it 10 years, accept that it could be better, but just give everyone certainty for a longer period of time, not year to year …’

Participants acknowledged a significant shortfall in staffing resources to meet the demand of patients enrolled in the HealthLinks trial. They discussed for intervention models to be successful health services need to ensure adequate staffing resources are allocated to allow services to respond to patient needs in a timely manner. Without additional resources, they believed the intervention models simply expand the waiting lists of services that are often already at high capacity.

‘I feel that we have the right inter-professional team to support this, both within primary care but also with access to HARP and mental health and other services. But I don’t believe in primary care we have the appropriate resources, the manpower to be able to deliver. So the model’s good and sits there okay, but we just can’t be responsive.’

Ensuring timely access to specialist clinics and allied health services was highlighted as an important future improvement. Participants believed it was particularly important to improve access to these services outside regular weekday hours and weekends.

‘My concern is that the team is predominantly made up of nursing staff and there’s not a lot of allied health. I think the inclusion of a range of allied health would give you a better scope … to learn a lot off each other in terms of responses and … tailoring responses to clients that fit better for their needs.’

Participants described that in some cases resources were not adequately allocated for HealthLinks implementation. This meant staff participated when they could around other priorities rather than having specific time dedicated to the trial. As such, participants highlighted a need for dedicated resources going forward for all roles required for implementation, including not only clinical roles but also implementation project teams and decision support allocation for data analysis and algorithm integration. There was also some discussion of the potential benefit an upfront funding boost would have to assist commencement of implementation and help health services transition to capitated funding models.

‘There’s a lack of decision support business analysis EFT within the organisation, and in fact we struggled to get them to support us with the algorithm even during the pilot. They certainly wouldn’t have helped us with data.’

‘I think there needs to potentially be an upfront payment in the first six months that actually enables the work to kick off the ground and then they flick to the capitation system. I don’t think just doing the switch from WIESs to capitation works without some kind of front-end injection.’

#### Learning experience for future adaptations

Workforce participants believed health services see the trial period as a key learning experience and will implement future adaptations and new services based on data and the findings of the HealthLinks evaluation. They believed ongoing evaluation and collection of quality data metrics to assess meaningful outcomes of intervention success are important going forward.

‘This is why I’m so wary of just counting stuff because you can go … and get very excited with counting and doing a lot of things, that actually mean absolutely nothing to the patient, but it looks terrific and government can say look at all the extra money we pumped in doing all these extra activities … I’m just super wary of value. I think [it] should underpin absolutely everything and it’s the toughest gig to measure.’

### Impact of context on implementation

Workforce participants identified several contextual factors that impacted on intervention implementation. Inconsistent and patchy communication within health services was seen to result in an overall lack of detailed awareness of the HealthLinks trial, and this was especially true among healthcare providers. However, participants acknowledged the difficulty health services faced in gaining awareness given the significant number of change projects that happened in parallel with the HealthLinks trial, the impact of frequent staff rotation and the operation of siloed systems. Some participants specifically questioned whether it was realistic to expect everyone within an organisation to have a deep understanding of all projects going on within the health service and suggested dissemination on a need to know basis was a better approach to take. Participants also discussed the balance of communicating with patients to ensure they are given enough information to provide informed consent while not overwhelming them at vulnerable times.

Given chronic care plans often involve multiple services, some participants described the HealthLinks trial providing positive collaboration opportunities. However, for the most part participants believed the siloed systems create significant barriers to collaboration with internal and external services. Incompatible funding sources, unlinked IT systems, differing goals and objectives were factors discussed by participants.

Participants highlighted CEO support as a vital factor for implementation success, and many participants believed there was a lack of support from leadership at their health service resulting in a lack of clear direction throughout the trial period. Varied approaches to plan intervention models of care before implementation resulted in different adaptation requirements throughout the trial period and insufficient staffing resources to meet demand caused delays between patient enrolment in the trial and commencement of an intervention. Each of these themes are discussed in turn below.

#### Communication and awareness

Some workforce participants discussed good awareness of HealthLinks within their health service and there was acknowledgement the trial may have helped boost the visibility of community services at some sites.

‘… that was promoted to the medical staff, to the wards …’

‘I think it actually helped put our community services on the map too. People started to notice a bit more about how community services work and what the work is that we do.’

However, many believed there was a lack of awareness of HealthLinks, especially among healthcare providers. While they may have been able to identify a patient as HealthLinks enrolled, participants believed there was a lack of deeper understanding of the underlying care model associated with the trial and how that translated to the care patients received.

‘So I hear a lot, *oh, that patient is HealthLinks, that patient is HealthLinks.* I probably don’t always get a good sense of what it means to the patient to be a HealthLinks patient.’

Participants discussed circumstances of inconsistent messaging within health services of the key HealthLinks aims and this led to confusion for healthcare providers on the most appropriate care approach for their enrolled patients.

‘So probably when they first started appearing on our waitlists, we didn’t have a lot of information about it, so I was quite heavily involved in trying to understand what we were supposed to do, try and get some information about if they were supposed to be treated any differently because some people said yes, some people said no …’

Participants highlighted the difficulties health services faced with communicating the HealthLinks trial throughout their organisation. They discussed difficulties gaining awareness against other change programs, the challenge of frequent staff rotation and trouble engaging with varied audiences across the organisation and at multiple sites. To potentially address some of these barriers, participants discussed a need for an ongoing communication strategy.

‘Well we’ve been disappointed when we’ve done the surveys about how knowledgeable the health service is … because we just thought we were flogging it you know, just out there all the time so it demonstrates to you there are so many programs, there are so many projects going on in the health service that it’s quite difficult to get something really fixed in people’s minds.’

‘… there’s new staff and everything so it will always be an ongoing thing you can’t do it once and walk away.’

However, there was also debate of who within an organisation needed to have in-depth knowledge of the trial. Some participants believed it was unrealistic to have organisation-wide awareness and a better approach to communication was one based on a need-to-know basis, focusing on those with close involvement. Difficulties communicating a pilot program across an organisation when its long-term funding is uncertain was also acknowledged.

‘I don’t think everybody knows about it, and I don’t think everybody needs to know about it, but in the community space I think it would’ve been beneficial for more to have known about it, particularly with where we want to go with it strategically …’

‘… you're not sure if you’re extending, so what’s the point in marketing a program if you’re not going to be around …’

Participants also discussed difficulties the health services had communicating with external services as a result of siloed systems and fragmented IT infrastructure.

‘And I think that communication extends to the other providers involved in the care, so I think there was barriers to communicating the project at the start and ongoing as patients are enrolled I don’t think everyone else is getting notified.’

Some participants also raised discussions of how the trial should be communicated to patients. While some believed it was important for patients to be provided with a rationale for why they were being provided services to ensure they could provide informed consent, others believed additional information and specific branding was confusing for patients and should be avoided where possible. Whichever approach, participants highlighted a need to ensure communication materials accounted for low health literacy and culturally and linguistically diverse groups who were often captured in the HealthLinks cohort.

‘… the client themselves don’t know that they are HealthLinks clients … and that’s a big barrier because you ring someone up and they say hey this is what’s going on, and they say well what’s that.’

‘… patients don’t care, they just don’t want to know who HARP is, they don’t want to know that you’re post-acute care, they just want to know that you’re a [health service] nurse or a [health service] whatever because they can relate to that …’

#### Collaboration

Workforce participants believed the HealthLinks trial provided some positive opportunities for collaboration. For example, between allied health and community services and between decision support teams and healthcare providers.

‘… being able to think about people in a different way, and at least have some sort of way of identifying people out of the data … it seemed to bring the people that … look after the data in contact with clinicians more, so that we could use their data to inform our decisions.’

However, they discussed the siloed system was a significant barrier to collaboration with internal and external services. Separate and often incompatible funding sources, systems, goals and objectives were seen to affect the ability to collaborate.

‘… they’re all on different systems, they all use different metrics, they’re all funded independently, they're all different workforces.’

Participants specifically highlighted difficulties health services faced collaborating with GP clinics and other external providers and that this led to confusion for patients who received inconsistent advice from multiple sources.

‘… it’s not for the want of trying on either side or wanting to participate – people’s workflows and how you integrate them is a really difficult bit of work.’

‘… there’s a big gap between hospitals and community services and it’s not just us … many health services around the world are trying to fix those gaps …’

#### Staffing

Workforce participants discussed that insufficient staffing resources meant health services could not efficiently respond to the demand of the HealthLinks cohort and there were often delays between enrolment in the trial and starting an intervention. Difficulties hiring and retaining staff with the right skill set was also acknowledged as a challenge by some participants.

‘… there are a lot of people doing tasks within HealthLinks that were appropriate for their skill set but not funded so it was easy when their roles got busy to just ring and say … we can’t do this.’

‘… because of staffing issues that we had at that time there was a reasonably long period of time between these patients being identified and their HARP treatment actually commencing.’

#### Wider organisational change

Workforce participants acknowledged that significant organisational changes occurring in parallel with the HealthLinks trial affected implementation. They discussed that changes to key leadership roles had an impact on support for the trial and the challenges associated with new leaders understanding the underlying aims of the funding model often generated resistance. Participants also believed the addition of a new program created confusion for some healthcare providers of the best care plan for their patients and investment in the trial often needed to compete with meeting other demands and KPIs.

‘And people are rejecting it; we don’t understand it therefore we don’t want it – so there’s always resistance when anything new is introduced, and there’s been a huge amount of resistance.’

‘… there’s so much other change happening in that space it’s also hard to keep track of what’s happening and what can you refer to with patients and so probably for chronic disease management I actually … I know less now of what would be best for my patient from that point of view than probably what I did two years ago … It just probably gets a bit muddled …’

#### Executive support

Workforce participants discussed that CEO support for the HealthLinks trial was vital to successful implementation as well as having an executive-level champion to drive the project.

‘… we have so much time every week with our Exec on a weekly basis three years into the program … continually looking to how we can improve it so their position has been incredibly valuable.’

Many participants believed there was a lack of support from leadership at their health service and this resulted in a lack of clear direction for the intervention model of care.

‘… CEO saying, you know, well, why would we want all that to work because that’s how we get funded …’

‘… when you think about major organisational strategies, they’ve normally got an exec who leads them and who is intimately involved with them and I don’t know that we had that, someone who was in the corner batting for this program specifically to be able to move it forward.’

#### Planning

Workforce participants across intervention sites described varied amounts of time taken to plan implementation models of care before the HealthLinks trial began. Participants at one health service discussed that their health service took a long time to plan the fundamental components of their intervention model and it remained relatively unchanged throughout the trial period.

‘I think having a good plan to start … there was a lot of planning and making sure that we’ve got the right model, we’ve got the right platform … and we have the right team. And making sure that … all of our decisions were based on data, data and evidence.’

A participant at another health service discussed their health service began implementation before finalising their plan, and this approach led to adaptations being made during the trial period.

‘… ideally on that should be decided before go live. But I know we’ve kind of done it the other way around; we went live and then we kept changing as we went along and then there were a lot of manual things that needed to be done, and just didn’t feel like it was the right sequence of things.’

A participant at another health service believed conflicting opinions of the best approach to take hindered their health service’s ability to reach a consistent implementation plan and discussions were still being had to determine their plan going forward.

‘I hope that the project allows the opportunity for some implementation … there’s a whole raft of strategies that could just pretty much start to be implemented, but I’m just concerned that we’ll still be doing this in 12 months’ time.’

Participants across all health services viewed the trial period as an important learning experience. Participants at one health service believed early stages of implementation will provide the direction for designing their intervention model of care and it will take time to understand what intervention is required to suit the needs of their specific patient cohort.

‘I’d describe HealthLinks as a bit like turning the *Titanic*, and you don’t do that quickly, so it’s still in very much the kind of embryonic stage of the chain because you’re … dealing with a really complex beast.’

#### IT systems and data capture

Workforce participants believed inadequate IT systems hindered health services’ ability to capture data in a complete, consistent and timely manner and this contributed to significant delays in their ability to undertake impact analysis.

‘I think really being able to improve the reporting loop from when we submit data to [the] department and finalising and coding, somehow trying to speed that up.’

### Intervention adaptations

Workforce participants described only a few adaptations were made to the intervention models of care and processes during the trial period, and these were generally unique to specific health services circumstances and their intervention models. Participants at one health service highlighted that other than some minor fine-grained process changes and fluctuation in intervention cohort numbers, their underlying model of care remain unchanged as they had taken a long time to plan their intervention model before its implementation.

‘… if I gave you a copy of the original principles, the design criteria we developed before we did the detailed design, you’d be surprised just how many of these things we had down pat …’

Participants from some health services discussed that their organisation elected to cease implementing intervention models of care rather than make adaptations once it was evident their systems could not support their HealthLinks intervention model of care.

‘What became obvious really quickly when we started to actually move into the intervention phase is that our current systems couldn’t support what was being proposed … So whilst we thought initially we’d be able to be reactive and manage these clients quickly, the reality was quite different because we weren’t given additional resources to be able to treat those clients responsively.’

Each of these themes are discussed in turn below.

#### Algorithm integration and patient identification

Workforce participants described refinements being made to the algorithm as the health service integrated it into local systems. Some participants also discussed their health service altered the size of their intervention cohort throughout the trial, with some expanding it to capture additional disease cohorts and others reducing it to account for funding uncertainties.

‘So we started off … quite targeted … going to look at COPD and then heart failure … but then it just seemed ridiculous; we were getting these patients through this spreadsheet every day and we were saying we could do something for that, that, that and that. So very soon we were saying look let’s just see what we can do, if there’s somebody we can help … let’s just do that – and we did, we just expanded it out.’

#### Staffing

Workforce participants at some health services discussed the recruitment of additional staff to address increased demand for services during the trial period. Others described their health service recruited for new roles that were created to fill gaps identified during implementation.

‘But in terms of how it works in HARP, I mean it’s been fantastic, it’s enabled us to have a broader staffing profile and you know. So our service has just come ahead in leaps and bounds.’

#### Process changes

Workforce participants described some changes to processes throughout implementation. At one health service they discussed the development of clearly defined care pathways for patients with COPD and heart failure to ensure a consistent and structured approach to care.

‘… what I’ve noticed is the flow of care is a little bit more I guess structured in terms of this one is for COPD, so they need a care bundle; they need HARP follow-up or some education or pulmonary rehab or whatnot.’

At another health service, participants described the inclusion of rapid review consultations. Adaptations to the cohort of patients receiving intervention were also implemented as a result of the high volume of eligible patients and finite resources available.

‘… originally if you were HealthLinks you couldn’t be HARP. Very definite. Now it doesn’t matter. You can have HARP first and then go on HealthLinks, so there has been an adaptation about the level of care …’

Participants at another health service discussed the brokerage of additional and/or alternative services for patients who did not require the clinical intervention of HARP services. They described the health service also adapted the criteria for HARP referrals and implemented post-discharge follow-up phone calls to patients enrolled in HealthLinks throughout the trial period.

### Intervention integration

Workforce participants acknowledged that although the concept of HealthLinks fits well with other organisational changes underway or planned, there were considerable barriers to intervention integration. Competing funding structures, difficulties making referrals and the difficultly observing a full patient history when IT systems do not communicate were discussed as barriers to integration of an intervention model of care that spans multiple departments within a siloed system. There was debate among participants of whether internal or external services produced optimal foundations for intervention integration and whether it is better to improve existing or integrate new services when the availability of resources are limited. Each of these themes are discussed in turn below.

#### Fit within the wider system

Overall, workforce participants believed a model of care like HealthLinks integrates within their health system and has the potential to fit well with other organisational changes underway or planned. However, participants acknowledged overlap between the intervention models of care implemented in the trial and other existing services, especially HARP services, and the confusion this caused for healthcare providers and patients.

‘… we’re talking through a redesign process around how we minimise the need for hospitalisation and make a dent in the trajectory of chronic disease in the ageing population. And this is a beautiful lead-out piece …’

‘… it is another arm I suppose to all the things we’ve done to try and get people discharged who are ready to be discharged and try and hold them at home.’

There were discussions among participants of the pros and cons of having the intervention model of care sit within or external to existing health service structures. Some believed that if the model of care is external to the health service it acts as an additional community service for referral rather than being truly integrated into the health system. Alternatively, others believed if the model of care sits externally to existing structures there are greater opportunities for flexibility, innovation and adaptability. Participants also discussed a combined approach of keeping the model of care separate during development before integrating it back within existing structures once developed and tested.

‘… is it something that you’re sort of sitting on the side as an adjunct, as another community service or is it actually something that’s part of what all of us are trying to do and we’re all clearly working together for our patients.’

‘… and innovation within existing organisations, I think is incredibly difficult. And I will argue you don’t do this inside an existing structure …’

There were conflicting opinions of whether it was better for health services to design intervention models of care that improved existing services or if designing new additions was the best approach. For the most part, participants believed there were several services being underutilised within their health service and as such they were in favour of making improvements to existing services, especially given limited resources available for implementation.

‘… for me it’s about looking what we’re already doing, what we know works, and then enhancing that as we can.’

‘I think it just helped identify clients to be fed into existing services, so we actually didn’t get funding to create new services; it was working within the structure that we had.’

#### Funding

Workforce participants highlighted that different funding structures across the health services create barriers to integrating a capitated funding model like HealthLinks. They discussed that patients with chronic and complex conditions often receive care across multiple departments of the health services and when a change is not implemented at a systems level, the full impact of the capitated funding model cannot be observed due to competing priorities.

‘… the idea of it is to break down those barriers, those funding barriers, and at the moment we still can’t do that because it hasn’t infiltrated the rest of the hospital.’

#### Referrals

Workforce participants believed the siloed systems that exist within their health service and in primary care was a barrier to patient referral and prevented effective integration of the intervention model of care.

‘I guess a suite of services that aren’t really integrated, probably don’t have a great awareness of each other, and yet still … that siloed kind of healthcare delivery.’

While participants at one health service reported participation in the HealthLinks trial started progress to break down some of those barriers, especially between HARP and acute to community services, participants at other health services highlighted challenges with patient referrals given differing priorities and funding structures.

‘There has been a lot of work here to try to break down the silos between the disease-specific HARP and the more general care coordination HARP, and I think that’s working reasonably well.’

#### IT systems and data capture

Workforce participants discussed inadequate IT systems as a significant barrier to integration of the intervention models of care. Specifically, having multiple internal systems that are not connected and an inability to communicate with the infrastructure of external service providers was discussed as a barrier to being able to see a full picture of a patient’s history.

‘I don’t think IT is anywhere near where it needs to be to support these things when we’ve got [multiple] systems that don’t talk and we’re working on a predictive diagnosis rather than actually a true diagnosis.’

‘… I don’t think we’ve got our connectivity of services, we don’t have a single platform for data exchange and referrals, we don’t have a single source of truth or point of visibility, so you know it's holding a torch up to that for us, which is a good thing …’

Some participants also acknowledge the difficulty health services faced capturing, analysing and interpreting data in a timely manner to determine the impact of the trial on key outcome measures. They believed a lack of evidence of progress created a barrier for the program team’s ability to promote the trial and push for commitment to funding and resources.

‘… the hardest bit has been to get some outcome data … We are spending so much time and energy looking at data where we think we’ve got it only tomorrow to say you know what we still haven’t got it, we still don’t know where we are with this … if you can’t get data back in a timely way or analysis back in a timely way it’s not … going to promote it.’

### Barriers and enablers of intervention implementation

During the baseline workforce focus group sessions, common themes across participating health services were observed as key barriers or enablers of intervention implementation (refer to Appendix 3). These themes were used to develop nine questions posed to participants during follow-up focus group/interview sessions. Participants verbally answered the questions and some of them added their explanations. As shown in Table 19, responses for each question were coded as: (i) yes, (ii) no, or (iii) ambiguous response/not sure. Findings are not reported separately for each participating health services due to small sample sizes; however, general variations in perceptions between participating health services are described in text below.

Table 19: Workforce perceptions of key barriers and enablers to intervention implementation

| **Question** | **Yes** | **No** | **Ambiguous/ not sure** |
| --- | --- | --- | --- |
| Do you think the use of an algorithm is an effective way to identify patients for a trial like HealthLinks? | 84% | 10% | 6% |
| Overall, would you say staff at <insert health service> were supportive of HealthLinks? | 71% | 6% | 22% |
| Do you think the <insert health service> executive team are supportive of initiatives like HealthLinks? | 65% | 8% | 27% |
| Do you think you had the right mix of staff to meet the requirements of the intervention model of care at <insert health service>? | 59% | 22% | 18% |
| Do you think patients were engaged with the trial? | 57% | 6% | 37% |
| Do you think staff were adequately consulted with throughout the HealthLinks trial? | 33% | 39% | 29% |
| Would you say IT systems at <insert health service> were adequate to meet the needs of the HealthLinks trial? | 33% | 53% | 14% |
| Do you think adequate resources were allocated to HealthLinks at <insert health service>? | 27% | 57% | 16% |
| Would you agree staff have a good understanding of the HealthLinks intervention model of care at <insert health service>? | 10% | 67% | 22% |

Notes:

1. A response was coded as ambiguous if the respondent answered both ‘Yes’ and ‘No’.

2. Overall *n* = 49, though one participant was not asked the questions due to time constraints.

3. Responses for each participating health service are not reported individually due to small sample sizes.

4. Rows may sum to more than 100% due to rounding.

#### Patient identification processes

Most participants at all participating health services, especially those at two health services, viewed the use of an algorithm favourably with 84 per cent in agreement that an algorithm is an effective way to identify patients for a trial like HealthLinks. However, there was discussion that the scope of the algorithm used for the trial identified too many patients for intervention and needs refinement.

#### Workforce engagement

Participants believed staff support for the trial was strong, with 71 per cent agreeing that staff at their health service were supportive the HealthLinks trial. Some participants acknowledged that staff could only support the trial if they were aware of it. Participant responses tended to be more favourable at four health services, with mixed perceptions at two health services.

#### Executive support

Overall, 65 per cent of participants believed the executive team at their health service were supportive of initiatives like HealthLinks, and only 8 per cent of participants held perceptions to the contrary. Perceptions of executive support were more favourable at three health services, with mixed perceptions held at the other participating health services.

#### Staffing resources

Fifty-nine per cent of participants agreed that their health service had the right mix of staffing resources to meet the requirements of the intervention model of care at their health service. However, they acknowledged the additional need for psychology resources and a general increase in staffing resources to meet demand for services. Perceptions of having adequate staffing resources were more favourable at three health services, less favourable at one, and mixed at the remaining two health services.

#### Patient engagement

More than half of participants (57 per cent) agreed that patients were engaged with the trial with many participants questioning whether patients knew they were enrolled in the trial. Favourable perceptions of patient engagement were held at two health services and to a lesser extent at a further two health services, with those at the remaining two health services unsure whether patients were engaged in the trial at their health service.

#### Communication

Participants’ perceptions of staff consultation were mixed. One-third of participants (33 per cent) agreed that staff were adequately consulted throughout the HealthLinks trial, while 39 per cent disagreed and 29 per cent were not sure or provided an ambiguous response. Some staff clarified their response by suggesting staff directly involved in the trial were consulted but staff more broadly across the health service were not. Perceptions were generally more favourable at two health services and less favourable at one health service.

#### IT systems

Approximately half (53 per cent) of participants believed IT systems at their health service were inadequate to meet the needs of the HealthLinks trial. Many participants highlighted that inadequacies were not unique to the HealthLinks trial and IT systems within the health service in general are not adequate. Perceptions of IT systems were generally more favourable at two health services, not favourable at three health services, and mixed at the remaining health service.

#### Resources

More than half of participants (57 per cent) believed insufficient resources were allocated to the HealthLinks trial at their health service, with these perceptions more common at three health services. Participants at one health service held more favourable perceptions, with most participants believing resources were adequately allocated to the trial at their health service, while views were mixed at two health services.

#### Awareness

Approximately two-thirds (67 per cent) of participants believed staff did not have good awareness of the HealthLinks intervention model of care at their health service. Some participants indicated that while those working directly with the trial may have good understanding, that was not the case more broadly across the health service. Perceptions of staff awareness of the trial were generally unfavourable at four health services and those at two health services had mixed beliefs.

## Funding utilisation

Workforce participants discussed that the capitated funding model was a challenging concept to understand. It was often perceived as a financial risk and, given the challenging financial environment health services were operating within during the trial period, most participating health services took a risk-averse approach to participation. Some workforce participants believed an upfront funding boost may have assisted the transition from activity-based to capitated funding and could be something to consider moving forward.

‘If we didn’t have the funding model, imperfect or difficult as it is to do changes in funding in health care, I don’t think we’d still be running. So I think it's been absolutely hugely impactful. The only thing I’d say is that, is our finance guys and our CEOs et cetera, I think this is quite wide … a complicated model to understand, and this notion of redistribution of funds from one place to another is quite foreign to health because there’s usually new funds pumped out to do it. And it also came during a period where a lot of people were struggling with their global budgets … that side of it has been really complex to manage. But for us in the end it’s been the fuel flowing into the system that’s let us do the work.’

‘I think there needs to potentially be an upfront payment in the first six months that actually enables the work to kick off the ground and then they flick to the capitation system. I don’t think just doing the switch from WIESs to capitation works without some kind of front-end injection.’

During the trial period, Alfred Health, Barwon Health and Northern Health used the capitated funding model to adapt and boost the capacity of existing services, while Monash Health and Western Health implemented a new model of care. Despite the varied approaches to intervention, workforce participants across all health services believed providing integrated models of care to a larger cohort would require greater resource investment and the development of less resource intensive care models that were agile to patient needs.

‘I understand that … we have very finite resources … the next step would be to try to come up with a less resource intensive [model of care] for the next at-risk group … we have the top 2 per cent, what about the next 10, 15 per cent ... We could potentially manage patients that are in that next band with a lighter more cost-effective touch …’

HealthLinks was associated with increased WIES activity. It is possible that this reflects a lack of randomisation in assigning patients to the intervention groups (patients with more complex needs being preferentially assigned to the intervention group). The increase in WIES could also reflect the intervention picking up conditions that were previously not being treated, which incurs more health system costs in the short term but should bring benefits through improved patient outcomes over time. In the absence of data on intervention patients’ quality of life outcomes, it is not clear whether this is the case and limits the ability to assess the cost-effectiveness of the intervention. The initial year of the program appears relatively expensive in terms of patients treated as health services were gradually enrolling patients. In the most recent year for which data are available, costs per patient for the intervention appear to have stabilised.

With the exception of patients enrolled for longer than 24 months, there was a steady decline in WIES accrual depending on how long a patient was enrolled (Figure 2). By year of enrolment, the average WIES accrued was less than their respective WIES conversion rates (patients enrolled for one to 12 months = 2.2 WIES, 13 to 24 months = 2.0 WIES and 25 to 36 months = 1.5 WIES conversion rate).

Figure 2: WIES accumulated at participating health services, by months enrolled and year cohort, 2016–17 to 2018–19

Use of WIES declined over 12 months for patients enrolled for one or two years.
Use of WIES increased over 12 months for patients enrolled for three years.
WIES use is below the WIES conversion rates for all patients.

Intervention patients on average used more WIES than the WIES conversion rates, which were based on an average of the entire enrolled cohort for each patient enrolment year.

The ‘actual’ and ‘predicted’ WIES serves as a measure of how well a health service is performing relative to its peers after adjusting for a range of patient demographic and clinical characteristics. After adjustment, the difference in actual versus predicted WIES accrual varied across the three years of the trial. Although there were some large differences in the first year, when adjusted for casemix and demographics there was not a large difference in predicted WIES between intervention and usual care patients for the later years of the trial. While the evaluation found that intervention patients used more WIES than usual care patients, it was not more than expected considering the patients’ casemix and demographic profile (Figure 3).

Figure 3: Percentage difference between actual and predicted WIES accumulated, by patient group and health service, 2016–17 to 2018–19

In 2016–17 there were some large differences in predicted WIES between intervention and usual care patients.
In 2017–18 and 2018–19 there was not a large difference n predicted WIES between intervention and usual care patients.

In 2018–19 the average WIES per patient year was 2.48 in the intervention group compared with 3.25 (–23 per cent) in 2017–18; the average WIES per patient year in the usual care group also declined to 1.53 in 2018–19 compared with 1.73 (–11 per cent) in the previous year.

Overall, there was limited discussion among workforce participants of the trials impact on patient WIES utilisation. Some workforce participants at three health services discussed reduced WIES utilisation as a result of reduced readmissions.

‘… we’re reasonably agreed, and we would say it’s been positive financially as well as positive in a lot of other ways.’

Some participants described a lack of clarity about the funding model and that the implementation of the capitated funding model for providing services to the HealthLinks intervention patient cohort did not occur as they had initially expected at their health service.

‘But I guess it was kind of touted at the start that there was all this extra funding and EFT and nothing eventuated, so there was a bit of frustration around that.’

In general, workforce participants believed participation in the HealthLinks trial quantified the true demand for services and highlighted the importance of funding community-based care for chronic disease management. They described that it provided an opportunity for health services to observe service gaps and think about how to shape services and allocate funding to more effectively address patient needs.

‘There’s been a massive shift to appreciating that community-based care … shifted dramatically over the last years that we’ve been working on it, from it being almost just like a thing that people will pay lip service to, but do nothing on, to something that’s deeply embedded. That doesn’t mean it's easy; it just means there’s a recognition.’

Participants also highlighted a need to consider non-financial measures in determining intervention effectiveness such as patient outcomes, quality of life and value-based care.

‘The other thing about the model is it’s not necessarily incentivised to do anything but save money, it’s not specific … brute measures are not necessarily about clinical outcomes … but if hospital re-presentation is the only measure it’s probably not enough to tell us exactly whether it's producing clinical outcomes for the patient.’

# Evaluation limitations

## Overall

Different health services implemented different intervention models of care and began active participation at different times throughout the trial period. Health services that started earlier would potentially have more teething problems, and this may be reflected in patient outcomes being not as predicted early in the trial period.

## The algorithm

The change over from the SAS to the SQL-based algorithm in early 2017 resulted in differences in patient cohorts selected by health services and subsequent department-identified patients. This would have had an impact on the early recruitment of intervention patients and generating a valid patient ID for them going forward and potential bias in the WIES analysis especially. At this stage, it is not possible to quantify the level of bias this has generated.

## Patient outcomes

The VINAH and Victorian Death Index datasets only covered the trial period in any detail. This meant that the DID approach could not be applied to these datasets. Only trial period differences between patient groups were undertaken.

Data from two different sources were used to undertake ED and inpatient results. Establishing inferences between them was not encouraged due to potential biases.

The lack of appropriate control patients in this study is a potential weakness. While the parallel trends held for most intervention versus usual care models, it failed at the system-wide level due to inherent differences between the patient groups. Even after undertaking greedy matching of usual care to intervention patients, there were potential differences between the two groups. In future, to reduce bias, a randomised stepped-wedge design would be an appropriate alternative. A finite availability of resources and targeted models of care meant that health services tended to focus more on the high-needs patients, compounding differences.

In the generation of the final tranche of data, an issue in linkage of the VEMD data resulted in a loss of VEMD data in the pre-trial period. Therefore, a ‘supplementary’ VEMD dataset that contains pre-trial data was used for analysis. This may have a significant impact on inferences made regarding comparing outcomes from inpatient and ED analyses as we are using disparate datasets.

## Patient surveys

In conducting patient surveys it was not guaranteed that baseline surveys were true baseline because health services began survey recruitment activities at different dates due to delays in securing local ethics approvals. Survey recruitment activities at participating health services also began after the health services had implemented their intervention models of care.

There may be bias and lack of generalisability associated with the low response rate and high dropout over time. Indeed, we found that there were significant differences in demographics between waves. There was also a lack of sufficient intervention patients who completed the evaluation survey. This meant analysis to assess whether changes in self-reported outcomes are attributable to the intervention model of care cannot be undertaken and that cost-benefit analysis was not possible. Most survey responders also identified English as their preferred language and results are therefore not representative of culturally and linguistically diverse groups.

The SF-12 survey tool normalises patient survey responses to the 2009 US general population. The characteristics of the US population may differ to those of HealthLinks cohort. Furthermore, the US population mean and standard deviations do not account for the age and/or gender.

Data quality of demographic survey responses was generally poor due to the open-ended nature of questions (for example, there were no tick boxes for race and patients could enter a free-text response). As a result, demographics were based on VAED data where available.

## Focus group surveys and interviews

Most workplace roles were covered in the sessions, but low participation rates may be a potential bias and affect the generalisability of findings, although key themes were consistent across all health services.

Baseline sessions were not conducted at baseline for some health services so before and after inferences for intervention-based questions may be of limited value.

## Costings data

The participating health services and the evaluation team have worked hard to capture the costs of the intervention. However, it should be noted that this is a very difficult exercise within an existing health system. It requires additional costs associated with the intervention to be identified and distinguished from those that would have occurred without it. In practice this is always difficult to do, which means the cost estimates here are subject to considerable uncertainty.

# Conclusion

The department sought to investigate if flexible funding enables health services to develop and implement alternative models (to inpatient acute care) that provide better experiences and outcomes for patients with chronic conditions, at equal or lower cost.

This was in response to the growing population of older people with multiple health needs as evidenced by national increases in hospital-admitted patient expenditure of 45 per cent from 2004 to 2012,2 and the cost of treating chronic diseases being 36 per cent of all healthcare spending.3

Considerable research has been invested in the implementation and evaluation of models of care for people living with chronic conditions. Wagner et al.5 first described the Chronic Care Model and ways it can be applied in managing chronic illness. However, a recent systematic review of the literature examining the implementation of different models of care found limited evidence of their overall effectiveness in reducing patients’ use of health services.6 Benefits from interventions were mainly confined to patient satisfaction measures.

A recent randomised control trial looked at the effect of an intensive intervention for 800 patients with a very high use of health services. For these patients there was no difference between 180-day readmission rates for intervention and usual care groups.7

Some studies have found a reduction in the hospital utilisation rates, but many have not conducted rigorous analysis and patient selection methods are likely to be heavily biased (for example, Bird et al.8). Chronic care models that do seem to improve patient outcomes are those specifically set up to deal with specific diseases such as diabetes,5 congestive heart failure9 and asthma.10 The perceived weakness of these studies, however, is that the programs were generally provided under research conditions and that the cost-benefit of these temporary programs was short-lived.

The evaluation of the HealthLinks trial found that most outcomes measured showed little effect for those patients directly involved in an intervention apart from hospital and ED length of stay measures for one health service. Patients from flexibly funded health services seemed to have fewer ED presentations and reduced length of stay in EDs; however, it is unclear whether this is due to the effects of flexible funding or differences in outcome trajectories before flexible funding began. Although some workforce participants believed that there were early signs of reduced ED presentations, especially at health services that implemented interventions for extended periods.

Outcomes for intervention patients assigned a High Risk status did not differ from Low Risk patients for most health services apart from one health service where High Risk patients had fewer hospital admissions over time compared with Low Risk patients. These findings counter what Stokes et al.4 discovered in their High Risk group but agree with the author’s initial hypothesis that High Risk patients benefit more from intensive interventions than Low Risk patients. Perhaps the targeted strategies employed by the health service for the High Risk patients, a higher proportion of which were treated for a single specific condition, had a positive effect.

There is an emerging view that the effects on patient outcomes from chronic disease models of care may be more apparent in the longer term. A recent evaluation of an integrated care program in England looked at the long-term impact of a range of interventions within the program.11 It found that patient outcomes, such as ED visits, initially increased for two years consecutively after introducing the intervention; however, by year 6, ED visits were significantly lower compared with a matched control group. Similar patterns were found for emergency hospital admission, inpatient length of stay and 30-day readmissions. The authors hypothesised that the long-term pattern of impacts may be consistent with better care management, and with developing more responsive, coordinated and streamlined care. They also suggested that the initial increase in ED visits may be due to identifying unmet needs or patients being more aware of their healthcare needs in the short term. A similar study by Morciano et al.12 found the intervention slowed rises in ED admissions but only after about three years. This view has been mirrored by workforce participants who took part in the HealthLinks evaluation. They frequently discussed a need for commitment to funding and resources over a longer period of time, potentially five to 10 years, in order to account for the sufficient time it takes to observe behaviour change.

While some workforce participants believed HealthLinks interventions had little impact on streaming patients to appropriate services outside acute care, analysis of patterns of non-admitted service use suggested intervention patients care pathways focused on more individual specialist services, unlike usual care patients who tended to access a much wider range of services. This suggests that patients may be getting the most appropriate care for their health needs.

There were no objective measures of patient care satisfaction for inclusion in the evaluation; however, anecdotal evidence from workforce participants and internal health service surveys suggested that most patients found the HealthLinks interventions a positive experience. Intervention patients developed trust with care providers because they felt the holistic approach focused on their needs and ongoing support tended to reduce anxiety and build resilience. Workforce perceptions on the trial’s promotion of self-management varied. Some believed the impact was limited while others believed the trial had a significant impact on self-care efficacy, health literacy, medication management and early detection of deterioration for participants receiving an intervention model of care. In general, workforce participants acknowledged barriers to adequately engaging patients with psychosocial comorbidities and those from culturally and linguistically diverse backgrounds in the HealthLinks intervention models of care. This was due to a lack of expertise within medically based teams to address mental health concerns, lack of culturally appropriate services or interpreter services and limited services for referral.

The implementation of the department’s algorithm was problematic in the early phases of the trial, mainly due to poor integration into local systems and the ability to replicate the same patient lists as those provided by the department. This also effects inferences that could be made from testing the sensitivity of patient selection. The algorithm identified a broad patient group and this resulted in a number of flow-on effects at the health service level. There was pressure to treat patients whatever their health problems were, while at the same time some health services were not set up to deal with such a diverse group. Conversely, there were perceived equity of care issues where patients were not picked up by the algorithm but were well suited to a HealthLinks model of care.

However, the widespread implementation of the algorithm has enabled health services to look across the system more collaboratively to identify care gaps generally in their own and other health services. The algorithm has enabled health workers to identify patients who would benefit from HealthLinks intervention models of care and highlight high frequency users and allow health services to develop appropriate care plans accordingly. Future refinements to the algorithm were suggested so that it identified a more targeted cohort to ensure care is being provided to those who would benefit the most, especially at the individual health service level. The integration of aspects of the Western 9 questionnaire to stratify the patient’s risk of readmission based on their debility and psychosocial risk factors, for example, into the algorithm may provide an additional filter. Workforce participants also suggested potential benefits of adapting the algorithm to identify patients before their needs became acute or highly complex because they believed there would be greater opportunities for behaviour change for these patients who would potentially require less resource intensive intervention models of care. A more appropriate cohort to target would warrant further investigation into algorithm refinements.

There was an overall view from workforce participants that for an intervention model like HealthLinks to succeed there needs to be a change in mindset of chronic disease management and acknowledgement that the acute setting has a significant role to play in the care of patients with chronic and complex care needs. Some participants also believed participation in the HealthLinks trial was the push their health service needed to generate discussions about taking a long-term outlook of healthcare models for chronic disease management. Given the care of patients with chronic and complex conditions spans multiple departments within health services, participants believed change should ultimately be implemented at the organisational level and that this would break down funding barriers in the siloed system and show departments the health service is committed to making change. Common themes such as the need for CEO support, commitment to funding and resources, staff champions and staff education were prevalent throughout health services. These enablers are widespread in the literature as well13 and are much of the focus of delivering successful implementations of models of care.14

Overall, participants believed participating in the HealthLinks trial was a positive experience. It allowed flexibility and creativity, and provided learning opportunities. For healthcare providers, seeing the valuable contribution to improving patients’ care was rewarding. There were, however, diverse discussions among workforce participants about the impact the trial had on workloads. Some participants reported an increase in workload, particularly for healthcare providers at the start of the trial.

Some health services found the capitated funding model a challenging concept to understand and it was often seen as a financial risk, especially in a challenging financial environment faced during the trial period. Most participating health services took a risk-averse approach to participation. Some workforce participants believed an upfront funding boost may have better facilitated the transition to a capitated funding model. Workforce participants across all health services believed that providing integrated models of care to a larger cohort would require greater resource investment and the development of less resource intensive care models that were agile to patient needs.

While the evaluation found that intervention patients used more WIES than usual care patients, it was not more than expected considering the patients’ casemix and demographic profile. Without a rigorous randomised control trial it is not possible to separate intervention patients with potentially more complex needs than is measured through activity data and usual care patients. In parallel with the increase in healthcare utilisation reflected in patient outcomes, the increase in WIES may reflect additional unmet needs in the intervention group, which incurs more health system costs in the short term but should bring benefits through improved patient outcomes over time. In the absence of data on intervention patients’ quality of life outcomes, it is not clear whether this is the case and limits the ability to assess the cost-effectiveness of the intervention. Although the initial year appears relatively expensive in terms of patients treated as health services were gradually enrolling patients, in the most recent year for which data are available, costs per patient for the intervention appear to have stabilised.

In general, workforce participants across health services believed participation in the HealthLinks trial quantified the true demand for services and highlighted the importance of funding community-based care for chronic disease management. They described that it provided an opportunity for health services to observe service gaps and think about how to shape services and allocate funding to more effectively address patient needs. They also highlighted a need to consider non-financial measures in determining intervention effectiveness such as patient outcomes, quality of life and value-based care.

# Appendix 1: Patient enrolment eligibility criteria

A patient becomes enrolled upon an eligible[[29]](#footnote-5) unplanned medical episode,[[30]](#footnote-6) if all of the following conditions are met:

* The patient has not had an episode in the past 365 days that meets the exclusion criteria.[[31]](#footnote-7)
* The current eligible unplanned medical episode achieves a total score of 11 or more.[[32]](#footnote-8)

Variable: Patient age group as at the current unplanned medical episode

| Parameter | Assigned score |
| --- | --- |
| 30–39 vs 18–29 | 1 |
| 40–49 vs 18–29 | 2 |
| 50–59 vs 18–29 | 3 |
| 60–69 vs 18–29 | 5 |
| 70–79 vs 18–29 | 6 |
| 80+ vs 18–29 | 6 |

Variable: Number of unplanned admissions in the 183 days before the end of the current unplanned medical episode

| Parameter | Assigned score |
| --- | --- |
| 1 vs 0 | 3 |
| 2 vs 0 | 5 |
| 3 vs 0 | 8 |
| 4+ vs 0 | 11 |

Variable: Emergency department visits in the 90 days before the start of the current unplanned medical episode

| Parameter | Assigned score |
| --- | --- |
| 1+ vs 0 | 2 |

Variable: An acute inpatient separation in the 183 days before the end of the current unplanned medical episode that included a principal diagnosis for selected conditions

| Parameter | Assigned score |
| --- | --- |
| Symptom/sign of digestive system: Tdiag1 = R10x-19x  Asthma: Tdiag1 = J45x-46x or J82x  Kidney disease: Tdiag1 = I12x, N00x-N19x, I131-32, I139  Diabetes: Tdiag1 = E10x-14x  Disorder of pancreas: Tdiag1 = K85x-86x  COPD: Tdiag1 = J40x-44x | 3 |
| Non-infective enteritis and colitis: Tdiag1 = K50x-52x  Rheumatoid arthritis: Tdiag1 = M05x-06x, M45x, M080  Cirrhosis/alcoholic hepatitis: Tdiag1 = K701, K703, K746 | 8 |

Variable: Smoking status as at the current unplanned medical admission

| Parameter | Assigned score |
| --- | --- |
| Current/ex-smoker last month vs non-smoker: TDiag{x} = Z720x or Z8643x | 1 |
| Tobacco dependent vs non-smoker: TDiag{x} = F17x | 2 |

Variable: Patient residence as at the current unplanned medical admission

| Parameter | Assigned score |
| --- | --- |
| Aged care vs other | -3 |

Notes:

1. Diagnosis codes exclude the period (‘.’).

2. TDiag 1 represents the principal diagnosis.

3. ‘x’ at the end of a diagnosis or VicDRG code is a wildcard (can be any value).

4. TDiag{x} reflects a diagnosis code that can be present anywhere in the code string.

# Appendix 2: Patient ineligibility (exclusion) criteria

Episode-level exclusions: Episodes excluded from consideration for the (enrolment) trigger admission and subsequent WIES utilisation

| Parameter | Definition |
| --- | --- |
| Private hospitals | Private hospital VAED file |
| Compensable patients – TAC/DVA/WorkCover | Patient type = S or V  Account class = JN, JP, V-, W-, T-, A-, S-, C-, O- |
| Medicare ineligible | Patient type = X  Account class = ME, MF, XX, XN |
| Renal dialysis | ARDRG = ‘L61x’ or ‘L68x’  Note: Renal dialysis treatment is excluded from the algorithm. However, a patient is not excluded by virtue of receiving renal dialysis treatment. |

Patient-level exclusions: These exclusions are applied to the 12 calendar months of data before the enrolment month

| Parameter | Definition |
| --- | --- |
| Children | Age ≤ 17 years in any episode in the previous 12 months |
| Maternity | ARDRG = O0x, O6x |
| Cancer | ARDRG = J62, R62-R64  or TDiag{x} = Cxx, D0x, D37-D48 |
| Haematology | VicDRG 'Q60', 'Q61', 'Q62', 'R60', 'R61' |
| Palliative care | Caretype = 8 or TDiag{x} = Z515 |
| Trauma patients:  Acquired brain injury (ABI)  Burns | Injury and poisoning as principal diagnosis = S00-T98 with > 1 hour of mechanical ventilation  VicDRG = Wxx or Y00 to Y62 |
| Mental health interventions | Caretype = 5, or  VicDRG = B63-64, U40, U60-68, V60-64 |
| Human immunodeficiency virus (HIV) | TDiag{x} = B20–B24 |
| Poliomyelitis | TDiag{x} = A80x |
| Victorian respiratory support service (VRSS) | VicDRG = A06 |
| Spinal cord injury (SCI) | VicDRG = B60-B61 |
| Cystic fibrosis (CF) | TDiag{x} = E84x or ARDRG = E60 |
| Thalassaemia | TDiag{x} = D560–D569 or TDiag{x} = D572 |
| Transplant patients | VicDRG = A01, A03, A05, A07, A08 or A09 |
| Rehabilitation in acute care | DRG is ‘Z60’ and care type ‘0’, ‘4’ or ‘U’ |
| Inpatient death | Sepmode = ‘D’ |

Notes:

1. Diagnosis codes exclude the period (‘.’).

2. ‘x’ at the end of a diagnosis or VicDRG code is a wildcard (can be any value).

3. TDiag{x} reflects a diagnosis code that can be present anywhere in the code string.

# Appendix 3: Baseline focus groups – summary of implementation key barriers and enablers

Baseline transcripts from workforce focus group discussions with 75 eligible participants (participation rate 52 per cent) at participating health services could be classified into 10 key themes and considered as either an enabler or barrier to intervention implementation. These key themes are summarised in turn below with quotes included for illustrative purposes. A more detailed summary for each participating health service has been reported previously.23,24

While every attempt was made to capture perceptions from staff with a range of roles in the HealthLinks intervention at each participating health service, it should be noted the beliefs and opinions expressed in this summary are from a subset of healthcare managers and healthcare providers and may not reflect the views of all staff involved in the HealthLinks trial.

## Communication and awareness

Having a clear communication strategy that was consistent, transparent and able to engage services and departments across the organisation was described as an enabler of intervention implementation. Effective branding was also seen to be important for raising awareness of the HealthLinks trial, internally and externally. For some health services, awareness of HealthLinks facilitated greater awareness of HARP services within the organisation and the importance of its role in caring for patients with chronic and complex conditions.

‘In some ways it’s really communication between the services as much as anything, to make sure that we’ve got really clear pathways that we know we’re talking to the right people, we know we’ve got the right services involved, that we’re able to update each other really well, efficiently, so that we’re not duplicating things as well.’

‘… it’s really transparent, so it’s weekly meetings, emails, advice you know process, a lot of – this is the process now, this is the update just give me a ring any time, and that real open door policy around phoning people …’

‘… we’ve got a different profile, because of the risk of HealthLinks, it was more, had more effectively oversight. Which sat in well with our redesign, so it gave us more visibility within the organisation. And more leverage strategically about how we place ourselves ...’

On the other hand, participants described a lack of communication, or communication messages that were inconsistent as barriers to implementation. Challenges developing communication strategies to effectively engage clinical staff were raised with some healthcare providers discussing limited awareness of the trial and how it affected the care they provided to their patients. An overall lack of awareness of the HealthLinks trial, within acute and primary care settings, was perceived to be a barrier to workforce and patient engagement for some participants.

‘I think that there’s still some confusion about what HealthLinks is, you know I think often you’re explaining it to the medical teams or ... the Allied Health teams know because they’ve had some education and we discuss in our multidisciplinary team meetings so these are HealthLinks patients, so I think that, yeah, I’m not sure that there’s a lot of knowledge out in the community still about HealthLinks, in the wider medical community.’

‘… I feel like right from the start … the communication could’ve been better … there were very limited education sessions for staff to know what HealthLinks was all about.’

## Executive support and leadership

Participants believed CEO support and confidence in the HealthLinks trial was vital to successful implementation. Leadership from the department to facilitate the trial was also discussed as an enabler by some participants.

‘Our CEO is very supportive of HealthLinks and was very keen to sign up, and that’s why we were able to enrol patients really quickly, and we got on board and – so I think that organisation is very supportive of HealthLinks.’

‘… we say that to the other participating players, or the ones who are wanting to come on board … to say you’ve got to get this at the board level, at the CEO level and then work down from there.’

‘None of that would’ve been possible without the health department of Victoria making some changes that have enabled us to invest some of the existing inpatient revenue in the pilot, so that funding model shift and the collaboration we’re having with them has been fundamental …’

In contrast, executive teams with a short-term view and who were risk averse were discussed as a barrier to implementation.

‘I mean, we know what our risk is, we’ve taken the risk, we’ve all agreed on the risk, we’re working to that risk, financial risk.’

## Funding and resources

Participants described the flexibility of the capitated funding model and the freedom to control the budget at the local level as enablers to intervention implementation as it allowed health services to trial new ideas and provide more timely care for the patient with chronic and complex conditions.

‘… we have a free budget … so we can actually respond a lot quicker to our patients than some of the other services that have multiple layers of jurisdiction for sign off …’

‘I think the flexible funding has been what's made the pilot possible … I think that it’s fundamental really, without the changing to the funding rules then it wouldn’t have been possible ...’

However, budget constraints, a lack of adequate resources, a perceived financial risk associated with the capitated funding model and uncertainty of long-term funding were discussed as barriers to implementation of the HealthLinks trial.

‘… but the volumes are such that it's often not possible just with the budget constraints to actually have enough [staff] to really catch people.’

## Staffing

Having knowledgeable and skilled clinicians with a range of expertise was considered an enabler to intervention implementation. Having funding for additional staffing resources was also discussed favourably.

‘… they were chosen for having the right skill set to engage with somebody really well on the telephone, somebody that they’d never met before who they may know a little bit about, but not a lot, and they were to provide that supportive role, but also have the capacity to identify when things were changing or when they weren’t so good. And they are superb at doing that.’

‘I think there’s a couple of definite structural changes that resulted from HealthLinks that would not have happened without it … the funding model which has allowed a greater flexibility of spending, so that’s a structural thing.’

Alternatively, inadequate staffing resources to meet demand for services was discussed as a significant barrier to implementation – for the pressures of higher workloads for healthcare providers and the limited number of patients able to receive intervention. Difficulties hiring staff with a multidisciplinary skill set and challenges with staff retention were discussed. Participants at some health services raised safety concerns for staff visiting patients in the community given data generated referrals do not provide the same screening process that are in place for traditional referral pathways.

‘I mean obviously it’s generated a higher workload, but that doesn’t affect the clients; they still get the same care whether we’ve got a higher workload or not ...’

‘The other thing is workforce most definitely … when we have advertised in recent times it is hard to find people with the level of experience that you want to be able to deal with such a diversity of patient presentations in the community so that definitely will be a barrier …’

## Workforce engagement

Participants believed effective workforce engagement was an enabler of intervention implementation. Factors identified to support this included a previous culture of change and innovation within the health service, staff perceptions of patient benefit in the new model of care and opportunities for collaboration. The importance of role clarity, a dedicated project team, clinical staff champions to drive the implementation and healthcare provider investment in the trial were also highlighted.

‘I think the clinician champion … you know you can’t underestimate because you have to convince the medical staff and you really need a clinician to be doing that for you out there walking the walk you know, saying yeah this is a good thing, I’ve been involved, I’m really happy to be the champion of it.’

‘I think it has brought together people in the organisation who might not otherwise have been brought together, to be having these conversations, and senior people that have influence.’

‘I think the fact that everybody identified that there’s a group of patients out there who would benefit is probably a good thing, and it meant that people are more likely to engage with doing this, and they can see that there’s a worthwhile end result …’

However, participants identified several challenges to workforce engagement they believed created barriers to successful intervention implementation. Organisational resistance to change, a rigid and siloed system with competing demands and priorities between departments were discussed as was a lack of collaboration with healthcare providers, which led to uncertainty regarding roles and responsibilities. Engagement with GP services was also considered to be a significant challenge.

‘Other services aren’t geared to think like us yet; they’re still very rigid and still very protocol based and all those sorts of things, so when we come in and try to interface with them to provide a little bit more of a flexible service, we hit a lot of brick walls, and sometimes it can get frustrating to sort of push back against that.’

‘I guess the difficulty with this project is that we’re just one cog in a big wheel and we’re the only ones, it’s hard to describe the benefits of it to services [who are not involved]. So even though we’ve kind of changed our mindset, the rest of the organisation still hasn’t. So I guess that’s a bit of a challenge …’

‘Primary care is going to have to be the key in this with the patient … I think that relationship between the GP and us needs to be a lot stronger. So we historically haven’t had a very strong relationship there, and we need to build that.’

## Patient engagement

Participants highlighted that the HealthLinks intervention models of care allowed health services to take a holistic approach to patient care and focus on behavioural and social needs of patients as well as their medical needs. They believed this was a key enabler to engaging patients in the trial.

‘… the avoidance of a medical model I think was frankly a masterstroke. And what we then learnt ourselves … was a model of resilience and responsiveness to individual patients’ needs.’

‘… there’s a lot of the time they don’t fit into the standard box of what’s available, so looking at how we can really individualise it … I think a lot more needs to be done for those really difficult complex psychosocial situations.’

Nevertheless, participants acknowledged that there are several barriers to successful patient engagement and there would always be a cohort of patients resistant to intervention due to fixed beliefs about how they receive care, scepticism of what is being offered, concern the care will cost them money and difficulty understanding what benefit the model of care will provide compared with the services they already receive. Participants also acknowledged the challenges health service faced engaging patients with diverse needs (for example, patients with drug and alcohol addiction, low health literacy, cognitive impairment and those from culturally and linguistically diverse backgrounds) because there were often insufficient services for referral. The modality of intervention (for example, Monday to Friday, 9.00 am to 5.00 pm via telephone) and providing access to intervention in a timely manner were also discussed as potential barriers to patient engagement.

‘So I think there’s been a lot of patients … who have been coming here for a medical care for 20 years and that is their medical care … I think those fixed beliefs in people who have been very long term patients are very hard.’

‘The linguistic diversity issue is huge here … and like I think we do a reasonable job of it; we’ve got much better interpreting services and so on, but I still think that there’s a service gap there.’

‘… until we get a seven day a week service happening … there’ll always be those people that we miss on those out of hours weekends or evenings.’

‘And sort of from a more specialist perspective, it’s been a real challenge trying to get sort of rapid access to consultant-level medical opinion for these patients.’

## Evaluation, learning and benefit demonstration

Ongoing evaluation to observe implementation impact was perceived as an enabler of implementation success, especially in relation to patient experience and patient success stories. Participants also discussed the benefit of being able to learn from the experience of other health services participating in the trial.

‘… the HealthLinks people came and talked about the changes and what was happening and told a patient story … and then the outcome for the patient, and that’s really engaging for clinicians to hear that sort of thing.’

However, a lack of timely data due to coding lags was believed to affect the ability to track impact during the trial. Participants also acknowledged that benefit demonstration for patients with chronic and complex conditions takes time and may not be captured in the three-year evaluation period. The burden of data collection for the evaluation and its rigid protocol was also discussed as a barrier.

‘It would be really good to be able to see some outcomes though, because we’re kind of flying blind at the moment, just to see whether ... it’s actually having an impact …’

‘But it’s like we’re running a pilot in real time, but we can’t provide the data in real time …’

## Intervention model of care design

Participants believed the flexibility of the funding model allowed health services to tailor an intervention to the needs of their patient cohort and freedom to be innovative. Some participants discussed taking time to carefully and systematically plan the intervention model of care is important to its successful implementation.

‘So having the clinicians that are allowed to think outside the box and implement things outside the box, rather than being confined to how we’ve always done it. Because I guess if we don’t try something different we’ll never know’.

‘… I would be really disappointed if this was a short-term initiative because the time and the effort and the opportunities I think it would be a golden opportunity … we’ve been talking about chronic disease management for the last 10 years, this is the first real innovative change I’ve seen.’

On the other hand, participants discussed that the complex funding model was a challenging concept to comprehend and this could impact engagement with the trial. Competition from other change initiatives and not having adequate resources to match the model of care were also discussed as barriers to intervention implementation.

‘So it’s just a really difficult concept to explain and particularly when it doesn’t actually impact them, they’re still getting funding the way they’re getting it, and so for them they’re like well …’

‘And as I said it’s a very complex program, so just getting your head around it, it takes a bit of time as well.’

## IT systems

Involvement of IT and decision support teams in assisting to integrate the patient identification algorithm into local systems was discussed as vital to HealthLinks implementation.

‘IT access so that we can get the right patients … so having good support from the data team as well about trying to understand what are the characteristics of the cohort that we can, and then trying to identify what we can.’

However, poor IT infrastructure and non-centralised systems were perceived to have a negative impact on information sharing, within health services and with external partners and primary care services.

‘I do think our technology interface could be better. We’ve talked about that in our project as well … our systems don’t talk well to each other, community system doesn’t talk well to inpatients, and there’s patient duplication of information in multiple areas and those sort of things.’

## Patient identification processes

Most participants believed the patient identification algorithm enabled the identification of patients appropriate for enrolment in the HealthLinks intervention and generated an increase in referrals to services compared with traditional referral pathways.

‘… I do think it does a reasonable job, yeah. Nothing’s perfect, never will be.’

In contrast, others identified barriers to algorithm integration including its complexity, making alterations and a time lag in data required for accurate patient identification. Some participants also questioned whether the algorithm identified the right cohort of patients for intervention and others acknowledged the lack of inclusion of social determinant of health in the intervention model of care.

‘I think the biggest barrier for us and probably most of the other health services was getting the algorithm working internally … that was a big problem especially initially …’

‘I think the other thing that’s going to always be a challenge is how long it takes medical records to get coded so that the data is there in the background for the algorithm to run.’

‘I think it was okay because I think for us when we identify complex patients it’s definitely around their health issues, but it’s often a lot of other social issues as well.’

# Appendix 4: Abbreviations and definitions

|  |  |
| --- | --- |
| AR-DRG | Australian refined diagnosis-related group |
| Census table | The Census table follows HealthLinks patients through time and updates their status on a monthly basis. It keeps a record of patient status (Eligible, Enrolled, Excluded, Died), the amount of time a patient has had a status of Eligible, Enrolled or Excluded. It also tracks the amount of WIES used and notes dates of status changes. |
| CEO | chief executive officer |
| COPD | chronic obstructive pulmonary disease |
| CSIRO | Commonwealth Scientific and Industrial Research Organisation |
| department | Department of Health |
| DID | difference-in-difference |
| DRG | diagnosis-related group |
| ED | emergency department |
| GP | general practitioner |
| HARP | Hospital Admission Risk Program |
| HealthLinks eligible | Patients who score equal to, or above, a threshold value (9+), based on the previous six months of admitted and emergency presentation data. |
| HealthLinks enrolled | A patient becomes enrolled upon an eligible unplanned medical episode if the patient has not had an episode in the past 365 days that meets the exclusion criteria and the current eligible unplanned medical episode achieves a total score of 11 or more under the HealthLinks algorithm.  Patient is funded under the capitation model if enrolled at a health service participating in the HealthLinks funding model. |
| HealthLinks | HealthLinks Chronic Care |
| IRSAD | Index of Relative Socio-economic Advantage and Disadvantage |
| RE-AIM | Reach, Effectiveness, Adoption, Implementation and Maintenance framework |
| SAS | Statistical Analysis System |
| SEIFA | Socio-Economic Indexes for Areas |
| SQL | Structured Query Language used for access and manipulate databases. |
| Staging table | The Staging table is a version of VAED with HealthLinks specific content that has been derived to inform the HealthLinks algorithm. |
| VAED | Victorian Admitted Episode Dataset |
| VEMD | Victorian Emergency Minimum Dataset |
| VINAH | Victorian Integrated Non-Admitted Health |
| WIES | weighted inlier equivalent separation |

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27. Patients with renal disease, diabetes or resident in an aged care facility were not excluded from HealthLinks enrolment. See Appendices 1 and 2 for further detail. [↑](#footnote-ref-3)
28. Patients with renal disease, diabetes or resident in an aged care facility were not excluded from HealthLinks enrolment. See Appendices 1 and 2 for further detail. [↑](#footnote-ref-4)
29. An unplanned medical admission that does not meet any of the exclusion criteria or is part of an episode that includes a subacute care type. [↑](#footnote-ref-5)
30. One or more contiguous separations within a health service are grouped into episodes. Contiguous separations are when the:

    admission date of the second separation is less than or equal to 12 hours of the discharge date of the first separation, or

    admission date of the second separation is greater than 12 hours and less than or equal to 24 hours of the discharge date of the first separation, and the separation mode of the first separation or the admission source of the second separation contain either transfer or statistical separation codes. [↑](#footnote-ref-6)
31. See Appendix 2. [↑](#footnote-ref-7)
32. Based on the SQL algorithm the current unplanned medical episode is included in the scoring algorithm. Hence, the total score of 11+. This differs from the original SAS-based algorithm, which did not score the current episode. [↑](#footnote-ref-8)