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HEALTH ECONOMY

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Outcomes Based Commissioning for vulnerable older people

PREPARED FOR

CENTRAL COAST LOCAL HEALTH DISTRICT

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DISCLAIMER

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PREPARED BY

This report was prepared by:

Dr Henry Cutler, Dr Joanne Epp, Dr Liz Schroeder, Dr Yuanyuan Gu, Mona Aghdaee, Dr Mutsa Gumbie

For further information on this report, or about MUCHE, please contact:

Dr Henry Cutler
Director
P: + 61 2 9850 2998
M: +61 409 770 946
E: henry.cutler@mq.edu.au
health-economy.mq.edu.au

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ETHICS

This research was approved by the Northern Sydney Local Health District Human Research Ethics Committee on 5 May 2017 with reference number LNR/17/HAWKE/7.

About MUCHE

Macquarie University is recognised as one of Australia's leading research universities, with an enviable reputation for excellence. While still relatively young, success of the past 50 years has positioned our distinctive approach to deliver ground-breaking research with world-changing impact.

Recently, we have invested heavily in infrastructure, with over $1 billion spent on facilities and buildings. We have also significantly expanded our teaching and research capacity in health, for example, with the development of a new Faculty of Medicine and Health Sciences, and relocation of the Australian Institute of Health Innovation from the University of NSW.

The University's objectives are to accelerate world-leading research; to prepare world-ready higher degree research candidates; to actively engage externally as a world-recognised research collaborator and partner of choice. We believe collaborating with industries, governments, communities, professions and academic colleagues around the world is paramount to our success.

Macquarie University's Centre for the Health Economy (MUCHE) was recently established as a strategic initiative to undertake innovative research on health, ageing and human services. Our vision is to create a world where decision makers are empowered with applied, trusted and influential research into health and human services policy and systems. Our mission is to deliver leading innovative research by operating professionally, collaboratively and sustainably.

To this end, we undertake research funded by competitive academic grants and for government, business, and not-for-profit organisations, which is used to inform public debate, assist decision-making, and help formulate strategy and policy.

We are interested in investigating the Health Economy at the macro level, with particular focus on the interdependencies of these systems with each other, and the broader economy. This includes investigating factors beyond the health and human services sectors that impact the health and wellbeing of populations.

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We therefore work collaboratively with our partners, and across the University, including the Faculty of Business and Economics, Faculty of Human Sciences, and the Faculty of Medicine and Health Sciences. We also work with Macquarie University's world renowned research hubs, such as partners within the Australian Hearing Hub, the Australian Institute of Health Innovation, and Centre for Emotional Health.

We take pride in combining our professional approach to partner engagement, with our academic approach to methodology, to deliver innovative translational research.

Dr Henry Cutler
Director
Centre for the Health Economy
Macquarie University

Contents

Glossary

ACAT	Aged Care Assessment Team
ACI	Agency for Clinical Innovation (NSW)
AIHW	Australian Institute of Health and Welfare
ATE	Average Treatment Effect
CCAP	Chronic Care for Aboriginal People
CCLHD	Central Coast Local Health District
CCPS	Chronic Conditions Patient Selection Tool
CDMP	Chronic Disease Management Program
CEA	Cost Effectiveness Analysis
CEC	Clinical Excellence Commission (NSW)
CHSP	Commonwealth Home Support Program
CNSS	Community Neurological Support Service
COPD	Chronic Obstructive Airways Disease
CUA	Cost Utility Analysis
DiD	Difference in Difference
ED	Emergency Department
EOI	Expression of Interest
EQ-5D-5L	EuroQol5 Dimension-5 Levels
FTE	Full Time Equivalent
GP	General Practitioner
HARP	Hospital Admission Risk Program
HBA1c	Haemoglobin A1c
HCH	Health Care Homes
HIE	Health Information Exchange
HRQoL	Health Related Quality of Life
HNECCPHN	Hunter New England and Central Coast Primary Health Network
ICD-10	International Statistical Classification of Diseases and Related Health Problems 10th Revision
ICER	Incremental Cost Effectiveness Analysis
ICPCC	Integrated Care for People with Chronic Conditions
IT	Information Technology

KPI	Key Performance Indicator
LBVC	Leading Better Value Care
LGA	Local Government Area
LHD	Local Health District
LoS	Length of Stay
MRC	Medical Research Council (UK)
MUCHE	Macquarie University Centre for the Health Economy
NDIS	National Disability Insurance Scheme
NFP	Not-for-profit
NGO	Non-Government Organisation
NSW	New South Wales
NWAU	National Weighted Activity Unit
OBC	Outcomes Based Commissioning
OLS	Ordinary Least Squares
PHN	Primary Healthcare Network
PICP	Age UK's Personalised Integrated Care Programme
PIR	Partners In Recovery
POPP	Evaluation of the Partnerships for Older People Projects
mPPIC	Modified Patient Perception of Integrated Care
PREMs	Patient Reported Experience Measures
PROMs	Patient Reported Outcome Measures
PROMIS 10	Patient-Reported Outcomes Measurement Information System Global-10 Survey
PSM	Propensity Score Matching
QALY	Quality Adjusted Life Year
RACF	Residential Aged Care Facility
RFT	Request for Tender
ROI	Return on Investment
UK	United Kingdom
US	United States

Key messages

- Managing chronic conditions is one of the greatest challenges facing the NSW healthcare system. Around 34,000 patients with chronic diseases in NSW will have more than six hospital admissions and seven Emergency Department (ED) presentations over a two-year period. These patients have poor health outcomes and place a heavy burden on healthcare system resources.
- The Central Coast Local Health District (CCLHD) developed an Outcomes Based Commissioning (OBC) model to commission two not-for-profit (NFP) providers to deliver care coordination services for people with chronic disease. Recipients were people living in north Wyong aged 65 years or over with two or more chronic conditions, who had experienced at least one unplanned public hospitalisation in the year prior.
- OBC began on 17 January 2017 and finished on 16 January 2018. The intervention group consisted of 407 patients. Of these, 211 enrolled with providers to receive care coordination while 196 chose not to enrol. OBC rewarded providers for reducing unplanned public hospital bed days. Providers chose to receive all their payments based on outcomes and were responsible for developing their own care coordination model.
- Patients were positive about OBC. A patient survey suggests providers were engaged with patients, were good at identifying barriers to improving health and planning to address those barriers, helped most patients increase their self-help capacity and successfully coordinated care for most patients.
- Despite this, results suggest OBC increased Emergency Department (ED) visits for the intervention and enrolled groups compared to the control group. There was also an increase in unplanned public hospitalisations for these two groups compared to the control group, while length of stay decreased, although both these results were not statistically significant.
- Increased public hospital use may have resulted from care coordinators identifying unmet healthcare need, allowing patients to better identify detrimental changes in their health status, and care coordinators encouraging patients to seek help when their health deteriorated.
- While the intervention and enrolled groups experienced an increase in health utility values compared to the control group, these were not statistically significant. There was no statistically significant difference in mortality outcomes over the trial period. Improved health outcomes may manifest beyond the trial period given patient learnings from care coordinators.
- Providers were less successful in helping patients prioritise their health improvement activities and helping with medication management. Information sharing between specialists and providers was disconnected and patients were not satisfied with the level of provider contact after their unplanned public hospital stay.
- When measured over the one year trial period, OBC is unlikely to be deemed cost effective compared to a cost effectiveness threshold of $60,000 per quality adjusted life year (QALY).
- OBC has demonstrated provider willingness to deliver care services within a metropolitan region of NSW and be remunerated based on outcomes.
- There is potential to further explore the use of outcomes based commissioning in NSW. The objective should be to increase health outcomes for every dollar spent, rather than focusing on cost containment. An increase in costs within an increase in health outcomes can result in greater

healthcare system efficiency.

- Outcomes based commissioning for healthcare is complex and often implemented in a rapidly changing environment. Success depends on the composition of market participants, the incentive structure, outcomes measured, the risk adjustment process, information on patients, the interaction of commissioned services with patient characteristics and patient access to alternative services.
- Piloting more outcomes based commissioning programs will provide additional insight into how design characteristics can improve success in NSW, including the size and type of incentive required.
- A blended pricing model that includes some outcomes based component along with other funding types, such as capitation or bundled payments, is likely optimal. Bundled payments could help incentivise cooperation between stakeholders such as GPs and providers. Capitation models could help reduce over-servicing and financial risk.
- Providing relevant information to stakeholders is crucial to successful commissioning. Information on a potential patient cohort mix can help providers better understand the model of care required to generate outcomes and their ability to manage financial risk.
- Open communication between hospitals, providers and GPs throughout the delivery of care coordination is essential. This may require investment in information technology to ensure the efficient flow of information between stakeholders.
- Trust between LHDs and providers is necessary to manage delivery and financial risk. A firm contractual approach may erode trust and reduce the capacity for LHDs to manage risk. A more flexible approach to commissioning requires skilled managers that can identify, assess and appropriately manage risk. This may require strong executive support and investment in education and training.
- A minimum level of service volume may be required for viable outcomes based commissioning. The more patients managed by providers the less likely the providers are exposed to patient outliers that negatively impact outcomes. Managing more patients also gives providers greater capacity to invest in innovative technologies and achieve economies of scale.
- It may be difficult for providers to improve outcomes in a short period of time, such as one year. Relationships between providers and patients must be established and mature. Providers require time to learn and patients require time to respond to services. A minimum of three years should be allowed for future pilot programs.
- An upfront data collection and evaluation plan is essential. Outcomes must be measured before, during and after implementation and include health outcomes and patient experience. Using a control group will avoid misleading conclusions from the natural tendency of patients selected on their prior healthcare use to reduce their healthcare use over time, regardless of receiving the intervention. Combining process evaluation and economic evaluation can help generate a better understanding of the mechanisms of impact and the role of healthcare system context in delivering outcomes.

Executive summary

NSW Health announced the NSW Integrated Care Strategy (2014–2017) in 2014 to develop new service commissioning and delivery approaches in the NSW healthcare system. The objectives were to keep people healthy and at home, provide world-class clinical services with timely access and effective infrastructure, and to better protect the most vulnerable members of the NSW community.

To promote better integration of local community and healthcare services around patient needs, particularly for people suffering long term health conditions, Local Health Districts (LHDs) were given responsibility to develop partnerships with local health and community care organisations to tailor an integrated care system to local needs.

NSW Health selected the Central Coast Local Health District (CCLHD) as one of three demonstrator sites to develop the commissioning and delivery approaches in the NSW Integrated Care Strategy.

The Central Coast is located approximately one hour north of Sydney. It has a mix of socioeconomic groups, but some geographic regions have a large proportion of older people with significant socioeconomic disadvantage and high rates of chronic disease.

The Central Coast healthcare system has faced several challenges. Limited public transport links meant access to general practitioners and allied health service providers has been difficult for some people. Community health services has sometimes struggled to meet patient demand. Primary, acute healthcare services and social care services have not always been well coordinated. These issues have put strain on the two major public hospitals at Gosford and Wyong.

The Central Coast Integrated Care Strategy was developed by the CCLHD and Central Coast NSW Medicare Local (CCNSWML) in 2014. It identified the northern part of the Wyong Local Government Area (LGA) as an area of future integrated healthcare need, based on the high prevalence of chronic conditions, population growth and the projected growth in public hospital use.

The CCLHD, CCNSWML and Family and Community Services (the Partners) developed the Central Coast Outcomes Based Commissioning Framework (OBCF) in 2015. The OBCF outlined an approach to specify, co-design, secure and monitor outcomes regardless of whether they were pursued by Partners or other government or non-government organisations. The OBCF supported Partners when identifying a need for a market-based care solution, to co-design a market with potential government and non-government organisations, and to manage market participants and monitor outcomes.

Outcomes Based Commissioning for care coordination

CCLHD investigated predictive models for unplanned hospitalisation, which identified age, hospitalisation in the past year and having a chronic condition as key factors for predicting unplanned hospital admissions. CCLHD deemed people living in north Wyong had an elevated risk of an unplanned hospitalisation if they were aged 65 years or over, had one or more unplanned hospitalisations in the year prior, and suffered from two or more chronic conditions.

CCLHD consulted widely with the community and clinical stakeholders to determine and prioritise the most effective care design approach with three workshops, two GP panels and 60 community stakeholders. CCLHD concluded care coordination was the most appropriate approach to effectively reduce unplanned hospitalisation risk.

CCLHD developed an Outcomes Based Commissioning (OBC) model to deliver care coordination in north Wyong. The objectives were to develop a flexible network of non-government providers that could respond to individual patient healthcare and social needs. This aligned with the original intent of the NSW Integrated Care Strategy and the Central Coast Integrated Care Strategy.

CCLHD paid two providers to reduce unplanned public hospital bed days. Predicted unplanned public hospital bed days were compared to actual unplanned public hospital bed days to derive payment. CCLHD predicted that 40 per cent of patients meeting the selection criteria would have an unplanned hospitalisation in the following year and would use 40 per cent of the bed days experienced in the prior year.

Providers could choose a combination of an upfront payment and outcomes based payment, although there were some restrictions. The outcomes based payment for each bed day saved was reduced for every dollar the provider sought through an upfront payment. There was also a cap placed on the upfront payment equal to 20 per cent of the expected maximum outcomes based payment. Both providers chose to receive payment based on outcomes only.

While providers were required to deliver care coordination, they were responsible for developing their own care coordination model. CCLHD guided their approach by requesting providers work closely with general practitioners (GPs) identified by CCLHD.

CCLHD committed to active provider management through regular meetings and quarterly updates on service delivery metrics. Providers were also required to collect information on patient health and wellbeing. CCLHD ensured a trusting relationship was developed with providers before and throughout the intervention.

Selecting providers for OBC

CCLHD held industry briefings and assessed market interest among local organisations thought capable of delivering coordinated care. Collaboration between CCLHD, HealthShare and the NSW Contracts and Leasing team led to an expression of interest (EOI) request. This included mandatory compliance criteria and weighted criteria seeking information on the capability of a provider to deliver coordinated care. CCLHD received 20 EOIs from a mix of non-government organisations, although no applications were received from GPs despite their initial interest in industry briefings.

Nine providers were selected to progress to the request for tender stage. Providers were requested to nominate their preferred patient load and willingness to work with up to four GP practices in north Wyong that were selected by CCLHD. Providers received information on the patient selection criteria and the predicted number of unplanned public hospital bed days.

Providers were not given hospital administration data due to privacy restrictions. Providers did not have information on patient willingness to participate in are coordination, or other health and social care resource use characteristics of patients. Providers collected this information after the trial began.

Seven providers submitted tenders. Two not-for-profit providers were selected by CCLHD using price and non-price criteria. Final contracts were signed in December 2016.

Trialling OBC for care coordination

OBC began on 17 January 2017 and finished on 16 January 2018. The intervention group consisted of all patients allocated to providers for care coordination. This totalled 407 patients, after 37 patients were removed before recruitment began due to death, moving into a residential aged care facility (RACF), moving out of the area or changing GP.

Providers enrolled patients into their care coordination model. As enrolment was voluntary, only some patients in the intervention group enrolled with providers. Providers were incentivised to enrol patients given their outcomes based payment was calculated on saved unplanned public hospital bed days for all patients, regardless of enrolment. The enrolled group had 211 patients, or 52 per cent of the intervention group. A total of 196 patients did not enrol.

Providers had different care coordination models, although there were common elements. Both providers assessed the health status and care needs of their enrolled patients. They developed tailored care plans that directed provider care coordination activities. They provided ongoing monitoring of health status and care needs, primarily by telephone, although patients in greatest need also received home visits.

Providers coordinated healthcare services delivered by CCLHD and community services delivered by not-for-profit organisations. Providers also helped patients access home care services funded through Commonwealth Home Support Program (CHSP) and Home Care packages. These services were primarily delivered by the providers themselves, in addition to providing care coordination funded through OBC.

Evaluation methodology

An evaluation was undertaken to determine if OBC reduced unplanned public hospital use, improved health outcomes and improved patient experience in a cost effective and financially sustainable manner.

OBC was evaluated as one complex healthcare intervention to capture changes from individual components and synergies between components. While care coordination was the primary mechanism of impact, other OBC characteristics were likely to have impacted outcomes, such as the commissioning approach and outcomes payment. External factors outside the control of CCLHD and providers were also likely to have impacted outcomes, such as GP involvement and access to social care services.

Data was collected from the NSW Admitted Patient Data Collection and Emergency Department data collection, enrolled patient surveys, semi-structured interviews with providers and CCLHD and program administration data including patient monitoring reports and patient journeys.

The evaluation used a mixed-methods approach. Impacts on hospital use were estimated by separately comparing the intervention group and enrolled group to a control group of 332 people living in south Wyong. Econometric analysis was used to account for potential selection bias.

Health outcomes were measured using mortality and quality adjusted life years (QALYs). Cost effectiveness was estimated using a cost utility analysis and healthcare system perspective. Costs included program costs and changes to hospital costs resulting from OBC. A change in costs incurred outside hospitals could not be included due to data limitations.

An incremental cost effectiveness ratio (ICER) was estimated and compared to an implicit cost effectiveness threshold derived from listings of medications on the Pharmaceutical Benefits Scheme. This is equal to approximately $60,000 per QALY.

The UK Medical Research Council process evaluation framework was used to scrutinise causal mechanisms, focus on how patients interact with complex interventions, and to assess how evaluation findings may be transferred to different healthcare settings. Explicit consideration was given to identifying factors external to OBC that potentially impacted outcomes and the transferability of results.

The NSW Government Commissioning and Contestability Practice Guide was used to develop a framework to assess CCLHD's commissioning approach. An interview with the NSW Ministry of Health helped tailor the evaluation framework to a healthcare setting and develop a set of assessment questions.

Baseline patient characteristics

The average age of the intervention group before OBC began was 80.6 years. The most prevalent chronic conditions were diabetes (33.9 per cent), renal disease (23.9 per cent) and heart disease (21.1 per cent).[1]

The intervention group averaged 1.9 unplanned public hospital admissions in the year prior to OBC and stayed for an average of 4.8 days. They also averaged 2.5 Emergency Department (ED) visits. There were some differences in patient characteristics between the intervention, enrolled and control groups. The potential for bias was taken into consideration when estimating the impact of OBC on hospital use.

Impacts from OBC

Hospital use

The intervention, enrolled and control groups all experienced a reduction in emergency department (ED) visits, unplanned public hospitalisations and unplanned public hospital length of stay (LoS) over the trial period, compared to the previous year. However, reductions were not equal across groups, suggesting OBC may have impacted hospital use.

Intervention group

ED visits for the intervention group reduced less over the trial period compared to the control group. There were an estimated additional 28.5 ED visits for every 100 people in the intervention group compared to the control group. This result was statistically significant at the 90 per cent confidence level.

Unplanned public hospitalisations also reduced less for the intervention group compared to the control group. There were an estimated additional 21 unplanned public hospitalisations for every 100 people in

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[1] Heart disease includes 'congestive heart failure' (6.0 per cent), 'coronary heart disease' (5.8 per cent) and 'other heart disease' (9.3 per cent).

the intervention group compared to the control group. This result was not statistically significant at the 90 per cent confidence level.

OBC is unlikely to have changed unplanned LoS per person in the intervention group. While results suggest there was a reduction of 18.3 days per 100 people, this result was highly insignificant.

Enrolled group

Results for the enrolled group were similar to the intervention group. There were an estimated additional 29.6 ED visits for every 100 people in the enrolled group compared to the control group. This result was statistically significant at the 90 per cent confidence level.

Compared to the control group, the enrolled group experienced an estimated additional 23.3 unplanned hospitalisations for every 100 people, although this was not statistically significant at the 90 per cent confidence level. OBC is unlikely to have changed unplanned LoS for the enrolled group. While results suggest there was a reduction of 4.2 days per 100 people in the enrolled group, this result was highly insignificant.

Health outcomes

Responses from PROMIS 10 were mapped to EQ-5D-5L using an algorithm developed within this study. The mean utility value for the enrolled group increased from 0.65 to 0.69, while the mean utility value for the control group decreased from 0.71 to 0.70. The enrolled group increased their utility values by 0.05 compared to the control group, suggesting OBC may have improved health outcomes, although this result was not statistically significant at the 90 per cent confidence level.

OBC did not significantly impact mortality, with 9.2 per cent deaths in the intervention group and 10.0 per cent in the enrolled group, compared to 9.6 per cent in the control group. However, deaths in the control group were potentially underreported if they occurred outside hospital.

Patient experience

A modified Patient Perception of Integrated Care (mPPIC) survey was administered to 49 enrolled patients in the first six months and at the end of OBC, to evaluate patient experiences with care coordination.

Provider engagement

Providers broadly engaged with patients. Providers sought information on patient health and medical history and those factors at work or home life that affected their health. The quality of communication was acceptable to most respondents, although more than one third said their provider never asked whether they had ideas about how to improve their own health and around 41 per cent of respondents said their provider did not talk with them about setting health goals.

Care received from the provider

Providers were good at identifying barriers to improving health and planning with the patient to address those barriers. Providers were less successful in helping patients prioritise their health improvement activities. More than half of respondents said they benefited from provider help organising care at home, although 37 per cent said this never happened. Providers were successful in helping most respondents increase their self-help capacity. They were less successful in helping with medications, with 43 per cent of respondents noting the provider never talked to them about how they were supposed to take their medication.

Care received from specialists

Information sharing between specialists and the provider was disconnected. Providers were not fully informed about the specialist care being received for more than half of the respondents. It also seemed respondents were not instructed by their specialist to share information with their provider.

Care after hospitalisation

Respondents hospitalised noted a low level of care received from their provider after their hospital stay, with only 8 per cent of hospitalised patients contacted by their provider after their hospital stay. Similarly, only 22 per cent of respondents hospitalised said their provider knew important information about their hospital stay.

Overall experience

Providers were successful in making sure patients were aware of their medical conditions and healthcare options and helped patients manage their own healthcare. Providers were less successful in understanding the needs and preferences of patients. While 45 per cent of respondents said they thought their provider knew all about their medical needs, 28 per cent thought this occurred only sometimes, and another 28 per cent thought their provider did not know about their medical needs.

Cost effectiveness

An economic evaluation was undertaken that included program costs and costs associated with an increase in ED visits.[2] This resulted in the OBC costing $839,798 for the enrolled group and $891,439 for the intervention group without any significant impacts on health outcomes. There was a negative return on investment.

A cost utility analysis was undertaken that included program costs and costs associated with an increase in ED visits and unplanned public hospitalisations, along with an increase in health utilities. Under this scenario, the enrolled group experienced an ICER of $101,967 per QALY, while the intervention group experienced an ICER of $123,223 per QALY.

It is unlikely OBC would be deemed cost effective compared to a $60,000 per QALY threshold. A sensitivity analysis using Monte Carlo simulation suggests there is a 7.0 per cent chance of OBC being cost effective for the enrolled group and a 4.8 per cent chance of OBC being cost effective for the intervention group. Other potential benefits such as improved patient experience and improved ability to self-care were not included in the ICER.

Factors impacting outcomes

Several factors potentially impacted the success of OBC, including the implementation of OBC, the mechanisms of impact and the context for OBC.

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[2] This economic evaluation excluded costs associated with an increase in unplanned public hospitalisations and excluded an increase in health utilities, given both were statistically insignificant.

Implementation

Enrolment

Due to staff changes in CCLHD there was a three-month gap between CCLHD sending out letters to potential patients, and providers undertaking the enrolment process. This created confusion for some patients as they were unsure why they were selected. Other patients and their carers became suspicious of the provider's intentions and were reluctant to enrol.

Patient reach

The number of patients available for enrolment at the start of OBC was less compared to when providers signed their contract. The lower than expected enrolment potentially reduced the ability of providers to improve outcomes. Providers could not enrol patients later if the patient had originally declined enrolment but changed their preference. This also limited provider ability to improve health outcomes.

Patient composition

The risk stratification process resulted in a cohort of patients older and more complex than originally anticipated. Providers noted they were limited in their capacity to improve health outcomes for their patients with more complex conditions, such as dementia or those receiving palliative care.

The amount of patient health information shared by CCLHD with providers before the contract was signed was limited due to privacy concerns. This reduced provider capacity to assess patient cohort risk, tailor their care model to patient needs and estimate their resource requirements before starting OBC. The lack of prior patient information also limited providers in assessing their financial risk as they could not assess the likelihood of patients in the 'not enrolled' group having an unplanned hospitalisation.

Timeframe

The inability of providers to reduce unplanned public hospital bed days was compounded by the relatively short duration of OBC. It took between three to six months to enrol patients, which meant some patients received nearly a full year of coordinated care, while other patients received only six months. Some patients also experienced delays in accessing care recommended by providers, particularly through Home Care packages.

Direct mechanisms of impact

Patient monitoring

The extent to which patients were monitored differed across the two providers, but generally, low care needs patients received a phone call every quarter, while high care needs patients received multiple phone calls and in-home visits. Both providers documented a high level of contact in the first half of OBC, but this dropped off in the third and fourth quarters.

Patient behaviour

Providers' efforts to improve health outcomes were hampered by a lack of patient engagement. Many patients experienced mental ill health such as anxiety and depression, which was exacerbated by social isolation. Some patients were reliant on family carers, while other patients were themselves carers to their spouse.

Access to services

Both providers coordinated a range of community care and home care services to patients including transport to healthcare providers, Meals on Wheels and social and recreational support. Providers were somewhat constrained in offering services funded through Home Care packages, noting delayed access to Home Care packages for some new patients and some patients trying to access higher levels of Home Care packages which limited their care coordination activities.

Indirect mechanisms of impact

Outcome measurement

Providers were paid on their ability to reduce unplanned public hospital bed days compared to a predicted number of unplanned hospital bed days associated with their patients. Predictions were estimated from hospital admission data for the year prior to OBC starting. This exposed providers to financial risk associated with temporal macro health factors such as influenza season severity.

Patients used more allocated unplanned hospital bed days than anticipated, particularly in the first six months of OBC, because some patients required much more healthcare than average, exacerbated by the relatively small patient population allocated to each provider. This reduced program sustainability, leading to a renegotiated contract more than half way through OBC, with payment no longer based on outcomes.

Financial incentives

Both providers chose to accept all funding based on outcomes, which increased their revenue potential but also their financial risk. However, providers experienced their expected annual number of unplanned hospital bed days in the first six months of OBC, which removed the financial incentive for providers to continue offering coordinated care.

CCLHD renegotiated contracts with both providers to ensure care continuity, with funding based on performing specific activities negotiated by CCLHD. Consequently, only the first half of OBC was truly based on outcomes, yet there was potentially less opportunity to improve outcomes given the first three months were characterised by enrolment and patient assessment.

Context

Communication

Providers and CCLHD formed a strong working relationship facilitated by the partnership approach CCLHD had developed in their commissioning approach, including quarterly updates from providers and data sharing where appropriate. However, there were some broader barriers to communication. Providers were not made aware by hospitals or CCLHD when their patients visited the ED or were admitted to hospital, either planned or unplanned. This limited providers' ability to respond immediately to patient needs after either an ED visit or hospital discharge.

GP involvement

Providers also encountered challenges engaging with GPs. GPs were not available for after-hours care meetings, which resulted in little GP involvement in developing and monitoring care coordination plans and services. This was contrary to the original intent of OBC, which recognised an important role for GPs in working with providers to determine appropriate care coordination activities.

Flu season

The 2017 influenza season experienced the highest levels of activity since the 2009 pandemic. Influenza notifications increased in the CCLHD region from 1,080 in 2016 to 4,121 in 2017. While the increase in influenza cases had the potential to significantly increase ED visits and unplanned public hospitalisations, this did not occur in either the intervention or control groups.

Discussion

OBC aimed to keep vulnerable older people healthy and at home by commissioning care coordination of health and community care services. A reduction in ED visits and unplanned public hospitalisations for the intervention, enrolled and control groups suggests this was due to patient selection rather than to care coordination. This 'regression toward the mean' is a common statistical phenomenon and has been found in Australian and international studies on care coordination programs that have selected patients on prior healthcare use.

The purpose of risk stratifying patients is to identify patients most at risk of unplanned hospitalisation who also have the potential to benefit from the proposed intervention. While OBC included patient characteristics most valuable in predicting unplanned hospital admission, there is potential to extend the OBC risk stratification process for better prediction, by including information on GP visits and more information on patient health status by collecting information from GP datasets or asking patients about their health before they were selected.

Results in this study align with other studies that have investigated care coordination, commissioning and the use of outcomes based financial incentives to change behaviour in the healthcare system.

The NSW Chronic Disease Management Program led to an increase in ED visits, unplanned public hospital admissions and potentially preventable admissions for enrolled patients. Increased healthcare use for patients selected into care coordination programs has also been found in the UK, including the Partnerships for Older People Projects and the Age UK's Personalised Integrated Care Programme. Research in the US suggests coordinated care can reduce hospital service utilisation and improve quality of care, although this is the exception.

Research on commissioning in healthcare has mainly focused on the UK. Results have been mixed with disappointing outcomes from commissioning driven by implementation issues and low incentives. Research on 'pay for performance' models has also found mixed results. Many studies have failed to find financial incentives have led to improved outcomes and, of those that have, some have only experienced benefits temporarily.

This study has important evidence based implications for the use of outcomes based payment models to incentivise outcomes through funding and the development of care coordination programs in NSW. It has identified 14 recommendations to help refine OBC, which are outlined in Table ES.1.

Table ES.1: Recommendations to refine OBC

	Topic	Recommendation
1.	Implementation: Enrolment process	Ensure CCLHD notifies patients about the program less than two weeks before the provider contacts patients.
2.	Implementation: Enrolment process	Use GPs to enrol patients given the high level of trust between GPs and patients. Ensure CCLHD and the Primary Health Network facilitate the development of the relationship between providers and GPs.
3.	Implementation: Patient reach	Ensure providers can enrol patients on an ongoing basis using a dynamic patient identification process. Explore the potential to offer the program as an opt-out process.
4	Implementation: Patient reach	Ensure providers are given access to larger cohorts of the intervention group. Ensure providers are given up-to-date patient lists to minimise drop out from changed patient circumstances.
5.	Implementation: Patient composition	Survey patients to better understand their care coordination needs and preferences before commissioning providers. Share this de-identified information with prospective providers along with administration data on hospital use and health conditions to the greatest extent allowable under ethical and privacy requirements. Work upstream with GPs to identify those patients willing to participate.
6	Implementation: Timeframe	Pilot the program for 3–5 years.
7.	Implementation: Measuring outcomes	Re-evaluate selection criteria based on the capacity to improve from coordinated care, rather than focusing on patients with high hospital use before OBC, including consultation with GPs and use of patient data from GPs to improve the risk stratification.
8	Implementation: Measuring outcomes	Rather than using a before and after approach to assess whether providers have impacted outcomes, establish a control group and compare outcomes between the intervention and control groups over the same time period.
9.	Mechanism of impact: Financial incentives	Ensure there is an established plan to allow providers to fail (i.e., models of care transition) while reducing any potential impacts on patients and their care.
10.	Mechanism of impact: Financial incentives	Ensure most of each provider's funding stream is received through a block payment unrelated to outcomes. Offer the block payment either at the end of the program or at specific agreed time points throughout the program.
11.	Mechanism of impact: Financial incentives	Enrol more people into the intervention group to smooth out fluctuations in bed days associated with outliers and reduce the overall impact of outliers on total hospital bed days. Cap unplanned hospital bed day outliers by excluding all bed days outside some boundary (e.g., one standard deviation from the expected mean). Use unplanned hospital admissions rather than bed days as the primary outcome metric to fund providers.
12	Mechanism of impact: GP involvement	Create incentives for providers to undertake other desired behaviours (in addition to reducing unplanned hospital bed days) through payment linked to key performance objectives. Include secondary analysis of process measures alongside primary outcome measures.
13	Mechanism of impact: GP involvement	Ensure providers sign up GPs into their coordinated care programs and use a measure of GP interaction as an outcome. Ensure CCLHD and the Primary Health Network actively facilitate the relationship between providers and GPs.

14. Context: Communication	Ensure providers are made aware when a patient enters hospital. Ensure providers receive hospital discharge summaries. Ensure hospitals involve providers when discussing discharge planning processes for complex patients and give clinical handovers to providers.

Source: MUCHE.

There is an opportunity for outcomes based commissioning to be further explored in NSW to generate better health outcomes and patient experience for every dollar spent. This would align with the NSW Government's exploration of public service provision using strategic commissioning.

Incentivising behaviours using financial incentives is complex. Outcomes based commissioning should fit the local healthcare objective, local healthcare environment, workplace culture and local marketplace, which all interact uniquely. Lessons from OBC can be used to further refine the design of other outcomes based commissioning programs in NSW.

Any future use of outcomes based commissioning should also be supported by LHD executives and management to promote success. This includes giving information to providers to allow them to assess their risk, developing good communication channels with potential investment in information technology to ensure the flow of information between providers and stakeholders with minimal effort, establishing trust between providers and the LHD, and developing an evaluation approach that includes economic and process evaluations to help understand impact and identify lessons.

1. Introduction

Chronic disease among the Australian population is endemic, particularly among older Australians with lower socioeconomic background. This has created poor health outcomes and increased healthcare system expenditure due to greater reliance on unplanned hospital stays. This chapter provides an overview of the NSW Government's response to chronic disease and describes services available to people with chronic conditions in the Central Coast Local Health District (CCLHD).

Integrated care context

Around half of the Australian population have one chronic disease and a fifth of the population suffer from at least two, with prevalence and comorbidities increasing with age.(1) Chronic disease is defined as an illness prolonged in duration that is rarely cured completely and has persistent effects. Most patients manage their conditions well in the primary care setting and have little interaction with acute care services.

In NSW, around 34,000 patients with chronic diseases have more than six hospital admissions and seven Emergency Department (ED) presentations over a two-year period.(2) This group has poor health outcomes and places a heavy burden on healthcare system resources, with associated high costs.

A previous hospital admission is a major risk factor for future ED presentations and unplanned hospital admissions.[3](3) Frequent users of hospital services are typically older people, with multiple morbidities living in areas of socioeconomic disadvantage.(4)

Relying on hospital services to treat people with chronic conditions increases hospital expenditure, both through the delivery of care and the need to expand hospital infrastructure. In response, Australian governments are exploring ways to better integrate healthcare to better meet a person's physical and mental health needs.[4](5) NSW has implemented and tested several approaches under the NSW Strategic Framework for Integrated Care.(6)

Over the last decade, the NSW healthcare system has implemented a number of programs in response to key reports recommending greater integration across care types including:

- NSW Chronic Care Program (2000)
- NSW Chronic Disease Prevention Strategy (2003–2007)
- Rehabilitation for Chronic Disease Guidelines (2006)
- Chronic Care for Aboriginal People Program

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[3] The NSW Health Data Dictionary defines an unplanned (urgent) hospital admission as an admission through the emergency department (the patient may arrive with their own transport or in an ambulance). A planned hospital admission is an admission to a public or private hospital depending on the type of treatment required and its urgency.

[4] Integrated care is defined as 'the provision of seamless, effective and efficient care that responds to all of a person's health needs, across physical and mental health, in partnership with the individual, their carers and family'.(6)

- Integrated Primary and Community Health Policy (2007–2012)
- NSW Integrated Care Strategy (2013–2018).

As part of the *National Health Reform Agreement 2011* between the Commonwealth, territory and state governments, a Primary Health Care Strategic Framework was developed to build a '*consumer focused integrated primary health care system*'. This has provided further impetus for the development of integrated care across Australia.

The NSW Chronic Disease Management Program (CDMP) was developed by the NSW Government in response to the *National Health Reform Agreement 2011*, to meet the growing demand for integrated care across the primary, community and acute care settings for patients with at least one chronic condition requiring complex care.(7)

CDMP targeted patients at risk of preventable and unplanned hospital stays and/or emergency department visits due to chronic disease. It aimed to deliver patient-centred care to patients with chronic disease to improve access to appropriate services, and better manage their care needs, multiple morbidities, disease signs and symptoms, and medications. Activities included targeted enrolment, comprehensive assessment, shared care planning, care coordination, self-management support, and monitoring and review.(7)

While CDMP was implemented throughout NSW, each Local Health District (LHD) retained some flexibility to tailor their program to their own population needs, while fitting within their current service delivery frameworks and infrastructure.

An evaluation of CDMP suggested it did not meet its objectives, highlighting the complexity in selecting participants, and delivering integrated care across a diverse healthcare environment.(7) The CDMP was associated with an increase in unplanned hospital admissions and emergency department presentations and decreased planned acute service use. The enrolment process had inadvertently selected patients into CDMP at the peak of their unplanned hospital use, with subsequent reductions due to a natural tendency of enrollees to revert to their average health service use.(7)

Ongoing changes to integrated care in NSW

The NSW Integrated Care Strategy was finalised in 2014, establishing 17 'Innovator Initiatives' across LHDs and three Integrated Care Demonstration sites. This included the CCLHD Integrated Care Strategy, which comprised Outcomes Based Commissioning (OBC) for north Wyong to keep vulnerable older people healthy and at home, through cost effective coordination of health and community care services, along with programs to integrate care for young people and to provide better coordinated care for people with complex and chronic conditions.

The NSW Ministry of Health also renovated CDMP, changing the name to Integrated Care for People with Chronic Conditions (ICPCC) to reflect the alignment of chronic disease management in the NSW Integrated Care Program, and the related reforms occurring at the federal level.(8)

The ICPCC program defines three types of integrated care interventions: self-management with health coaching, care navigation with non-clinical coordination, and care management with clinical coordination.(8)

Patients with risk scores below 8 were expected to be discharged from CDMP and receive usual care instead, primarily consisting of management through their GP. However, some districts selected patients scoring as low as 6, as well as Aboriginal and Torres Strait Islander patients, to transition to ICPCC.

The NSW Ministry of Health has invested in new information technology systems to enable shared care planning and better information exchange across Primary Healthcare Networks (PHNs) and LHDs. The NSW Agency for Clinical Innovation also collects Patient Reported Measures through PROMIS 10 to support quality improvement.(9)

Integrated care has also changed at the federal level, with the introduction of the Health Care Homes program in 2017. The Australian Government initially selected 165 practices, with 15 operating in the Hunter New England and Central Coast Primary Health Network.(10)

Health Care Homes coordinate care for people with chronic and complex conditions and are integrated across primary and acute care. Eligible patients voluntarily enrol, with their preferred clinician (most likely a GP) tasked with coordinating, managing and supporting patient care through a tailored care plan. Funding is provided for each patient registered, with three levels of funding allocated based on patient need. Stage one of Health Care Homes (2017–2019) will be comprehensively evaluated to inform future support for Health Care Homes.(10)

Caring for people with chronic conditions on the Central Coast

The Central Coast region is located approximately one hour north of Sydney. While there is a mix of socioeconomic groups, some areas have a high proportion of older people, with significant socioeconomic disadvantage and high rates of chronic disease risk factors. This includes some people with:

- limited awareness of available community services and limited public transport links impacting ability to access services
- limited coordination of primary and acute health care services and social care services
- several unplanned hospitalisations each year due to chronic conditions.

People living on the Central Coast with chronic disease requiring acute hospitalisation attend either Gosford or Wyong hospitals. Some may attend either Woy Woy or Long Jetty sub-acute facilities, following acute admission to Gosford or Wyong.

People are supported through a range of chronic disease management programs delivered by the CCLHD as out-patient and community services (see Table 1.1).[5] There are also several community service programs operating on the Central Coast that promote health for people aged 50 years and over.

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[5] Based on information available on various websites as of March 2018.

Table 1.1: Community services accessible to people living on the Central Coast with chronic disease

Service type	Description
Community services managed by CCLHD	
Acute Post-Acute Care Service	A team of nurses, physiotherapists, occupational therapists, community care aides and social workers delivering care at home and in clinics attached to Gosford and Wyong hospitals.
Diabetes services	A team of diabetes nurse educators, a dietician and social worker to help children and adults manage their diabetes.
Community nursing	A team of nurses providing healthcare services at home, including comprehensive health assessment, wound management, palliative care, continence care and stomal therapy.
Better Health Self-Management	A free practical skills workshop to help anyone with chronic health conditions better manage their health.
Cardiology (heart) services	A range of services for people with cardiac conditions, including angiography interventional services, outpatient services for those requiring follow-up after an admission, along with rehabilitation and diagnostic services.
Chest clinic	A range of services offered at Gosford Hospital for people with chest conditions (e.g., tuberculosis) including screening, management and education.
Renal services	Provides dialysis in four locations across the Central Coast and a home haemodialysis and peritoneal dialysis training service for those wanting to dialyse at home.
Stroke rehabilitation services	Provides intensive, slow-stream and geriatric outpatient services such as the Community Neurological Support Service that provides an intensive and non-intensive service.
Community health centres	Provides community nursing, mental health services and drug and alcohol services through eight locations.
Other community services	
Aunty Jean’s Chronic Disease Outreach Program	A weekly meeting of Aboriginal and Torres Strait Islander people run by the Central Coast PHN to check blood pressure, blood sugar level and weight. Participants are also encouraged to set goals, exercise through walking programs, and receive culturally appropriate information.
Get Healthy Information and Coaching	A free service operated by NSW Health that provides telephone coaching to people with chronic disease or obesity to help people reach their goals for healthy eating, increasing physical activity, reducing alcohol use, and reaching and achieving a healthy weight.
iCanQuit	A free online public health program operated by NSW Health to help people stop smoking.
Stepping On	A free program operated by the NSW Office of Preventative Health that provides seven weekly sessions to improve strength and balance activities, and educational material, to prevent falls for those aged 65 years and over.

Source: MUCHE.

In addition to traditional healthcare and public health programs, people aged 65 years and over can access home support services using Australian Government funding, regardless of whether they have a chronic disease. Entry level support is assessed by a Regional Assessment Service and provides access to services under the Commonwealth Home Support Services Program to the following services:

- help at home
- personal care like help getting dressed
- transport
- home modifications like hand rails or ramps
- nursing, physiotherapy and other care
- meals
- household jobs like cleaning or gardening
- equipment like walking frames
- social activities
- respite care
- hospital transition care.

For people with more complex and multiple care needs, assessments are provided by an Aged Care Assessment Team for a referral to the appropriate services under a Home Care package. These help older Australians with complex care needs to live independently in their own homes. The Australian Government provides a subsidy to an approved provider of home care to coordinate a package of care, services and case management to meet the individual's needs.

Each level of Home Care package provides a different subsidy amount, ranging from $8,000 per year for a Level 1 package to $49,500 for high-level care needs.(11) This amount is paid to selected approved home care providers chosen by the recipient to deliver a range of eligible services (see Table 1.2). The subsidy contributes to the total cost of services and care delivery, although care recipients may be required to contribute to their care costs, depending on their financial circumstances.

Table 1.2: Eligible services funded under a Home Care package

Service type	Eligible services (included but not limited to)
Personal services	Assistance with personal activities such as bathing, showering, toileting, dressing and undressing, mobility and communication.
Nutrition, hydration, meal preparation and diet	Assistance with preparing meals, including special diets for health, religious, cultural or other reasons; assistance with using eating utensils and assistance with feeding.
Continence management	Assistance in using continence aids and appliances such as disposable pads and absorbent aids, commode chairs, bedpans and urinals, catheter and urinary drainage appliances, and enemas.
Mobility and dexterity	Providing crutches, quadruped walkers, walking frames, walking sticks, mechanical devices for lifting, bed rails, slide sheets, sheepskins, tri-pillows, pressure-relieving mattresses and assistance with the use of these aids.
Nursing, allied health and other clinical services	Speech therapy, podiatry, occupational or physiotherapy services, hearing and vision services.

Transport and personal assistance	Assistance with shopping, visiting health practitioners and attending social activities.
Management of skin integrity	Assistance with bandages, dressings and skin emollients.
Telehealth	Assistance for video conferencing and digital technology (including remote monitoring) to increase access to timely and appropriate care.
Assistive technology	Providing aids, equipment and devices that assist mobility, communication and personal safety.
Aids and equipment	Assistance for the purchase of some aids and equipment that are directly associated with care needs.

Source: Australian Government (11)

The Australian Government has funded an additional 40,000 Home Care packages over the last two years, to keep people at home. Yet demand currently exceeds supply, and at the end of December 2018, there were 74,000 people waiting for a home care package to which they had been assessed, although 40 per cent had been offered a lower level package.(12) There is no data on the number of people waiting for packages on the Central Coast although anecdotally there are not enough packages to meet population need.

Challenges with usual care

Older people with multiple chronic conditions typically require contact with several types of healthcare providers. One survey found that 21 per cent of Australians above 65 years reported problems with coordinated care, potentially resulting in hospital admissions that could have otherwise been avoided.(13)

A NSW survey of patient experience of their most recent hospitalisation through the emergency department identified significantly lower performance for the CCLHD in categories for care coordination and continuity of hospital and community care at discharge, relative to the NSW average.(14)

Many healthcare services are in different areas on the Central Coast given the relatively low population density compared to a large city. This can result in patients not knowing what services are available or finding it difficult to access appropriate care. In some cases, services are also fragmented, or at capacity and struggle to accommodate the demand for care, with lengthy waiting times.

The lower socioeconomic status of some people also reduces access to private specialists and allied health because of co-payment concerns. Some vulnerable elderly patients have trouble accessing public transport due to poor links and rely on carers transporting them to healthcare services. These factors ultimately put the health of vulnerable elderly patients at risk.(15)

2. Outcomes Based Commissioning

The CCLHD commissioned providers to deliver coordinated care to vulnerable older people with chronic disease to keep them healthy and at home. This chapter provides an overview of OBC model objectives and the process used by CCLHD to develop OBC. It describes the needs assessment, program governance, identification of the patient group, the commissioning framework and funding model, and the provider contract terms and agreements, including monitoring and evaluation activities.

Objectives of OBC

The CCLHD developed OBC for north Wyong to keep vulnerable older people healthy and at home, through cost effective coordination of health and community care services. Other objectives included:

- developing an outcomes based funding structure to pay providers
- improving health outcomes through greater access, increased safety, better compliance and the delivery of evidence based care
- improving patient and carer satisfaction with the healthcare system, along with increased provider satisfaction.

Development of OBC

NSW Health announced the NSW Integrated Care Strategy (2014–2017) in 2014 to develop new service commissioning and delivery approaches in the NSW healthcare system. NSW Health selected CCLHD as one of three demonstrator sites to lead the development of commissioning and delivery approaches in the NSW Integrated Care Strategy.

The CCLHD and Central Coast NSW Medicare Local (CCNSWML) developed the Central Coast Integrated Care Strategy. In March 2015, CCLHD established an Integrated Care Program team to develop the commissioning framework and funding model for OBC.

CCLHD conducted a population based needs assessment in July 2015 and identified north Wyong as an area of high healthcare need, characterised by a population with low socioeconomic status, multiple chronic conditions and lower access to services due to limited public transport links. Hospital data also showed a disproportionate number of unplanned hospital admissions from north Wyong, relative to other areas in the CCLHD.

A Governance Committee was established with members from the CCLHD Integrated Care program and the newly formed Hunter New England and Central Coast Primary Health Network (HNECCPHN)[6], Family and Community Services, and a local GP.

An additional management committee was established to manage OBC, comprising staff from CCLHD, HNECCPHN, and Hunter Medical Research Institute with responsibilities to report program progress back to the Governance Committee, and provide technical advice and support to the program.

The design phase of OBC was influenced by inputs from many external organisations including the University of Newcastle, the Centre for Rural and Remote Mental Health, PWC, and the International Federation of Integrated Care.(16)

Care design consultations

CCLHD undertook a series of consultations with community and clinical stakeholders to determine and prioritise the most effective care design approach to meet the needs of vulnerable older people. This included workshops involving GP panels and 60 community stakeholders. While several care approaches were proposed, such as shared care plans, case conferencing and health promotion programs, CCLHD chose to fund a care coordination approach as this was considered the best option by stakeholders to keep older people healthy and at home.

Patient and GP selection

CCLHD undertook a study to develop predictive models for emergency hospitalisation that identified age, hospitalisation in the past year and having a chronic condition as key factors for predicting unplanned hospital admissions.(17) CCLHD's analysis of 2014 and 2015 hospital administration data supported the study conclusions. As a result, CCLHD used the following criteria to risk stratify the OBC patient cohort:

- aged over 65 years
- one or more unplanned hospital admission in the previous 12 months to either Gosford or Wyong public hospitals
- two or more chronic conditions
- does not reside in a residential aged care facility.

Criteria were applied to hospital administration data, resulting in many patients being eligible for OBC. An estimated 20 per cent of the population in the CCLHD catchment, approximately 65,000 people, were aged 65 years and over. Of this cohort, 16 per cent, or about 10,000 people, had at least one unplanned hospital admission in the year prior, regardless of disease status.

CCLHD used ICD-10 codes to identify patients with at least two chronic conditions. Chronic conditions for the purpose of OBC were defined from the following list.

- Diabetes
- Coronary Heart Disease

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[6] CCNSWML merged with Hunter and New England Medicare Locals to establish the New England and Central Coast Primary Health Network (HNECCPHN) in April 2015. Archived information is available from: https://www.centralcoastaustralia.com.au/news/an-exciting-future-ahead-for-primary-health-care-in-our-region/

- Stroke
- Peripheral Vascular Disease
- Congestive Heart Failure
- Other heart diseases
- Chronic respiratory conditions
- Renal
- Liver Disease
- Morbid Obesity
- Chronic Neurological Conditions
- Dementia
- Arthritis
- Gout.

As CCLHD aimed to strengthen GP involvement in coordinated care through OBC, potential GP practices were identified to participate in the program. CCLHD identified the four north Wyong practices with the most risk stratified patients:

- Toukley Family Practice
- The Lake Munmorah Doctors Surgery
- Hammond Road Medical Centre
- Waratah Medical Services (Kanwal branch).

CCLHD initially focused on a 'feasibility cohort' of 600 patients (the intervention group), however GP practice size varied. This resulted in a more limited set of patients selected for OBC.

The same stratification approach was used to identify the control group. However, patients in the control group were linked to seven GP practices in south Wyong, which has similar socioeconomic characteristics to north Wyong.

Commissioning approach

CCLHD sought a coordinated approach to regional service planning, delivery and resourcing across health and social services, involving both public and private sectors.(15) Its aim was to develop a flexible network of providers that could respond to the individual health and social needs of the north Wyong population, with a particular focus on the most vulnerable people.(15)

CCLHD used several criteria to develop its commissioning approach. This included a funding model that was measurable; patient related; provider related; system related; and cost related.(18) While initial discussion on the development of OBC in CCLHD centred around funding coordinated care activities, CCLHD decided to pursue an outcomes based funding approach using reduced unplanned hospital bed days as the outcome measure.(18)

The commissioning approach and funding model involved trialling a new approach in the NSW health system. The trial required permission from the NSW Ministry of Health and NSW Treasury in recognition of the level of innovation involved and the degree of working outside the scope of usual healthcare delivery, which met the Ministry's aim of achieving cashable savings or transferable funding.(18) The approvals required to work outside normal NSW Health practice contributed to a lengthy development process and delays going live.

In addition, high level changes to the overall governance (senior executive changes) and the risk environment throughout the program cycle (from program design, to program implementation, and through to program evaluation) affected the timeframes and direction.

Outcomes Based Commissioning approach

The 2015 *Central Coast Outcomes Based Commissioning Framework* (the *Framework)* was developed as part of the Central Coast Integrated Care Program to promote integrated care and change how services are currently organised and funded. The aim of the *Framework* was to define outcomes based commissioning, outline key principles, explain the OBC cycle, and provide information on key roles and responsibilities for successful commissioning.(19)

The *Framework* defined outcomes based commissioning as more than procurement, involving a process of specifying, co-designing, securing and monitoring the achievements of outcomes as defined by the population. This process is demonstrated in the commissioning cycle outlined in Figure 2.1, which was applied to OBC by CCLHD.

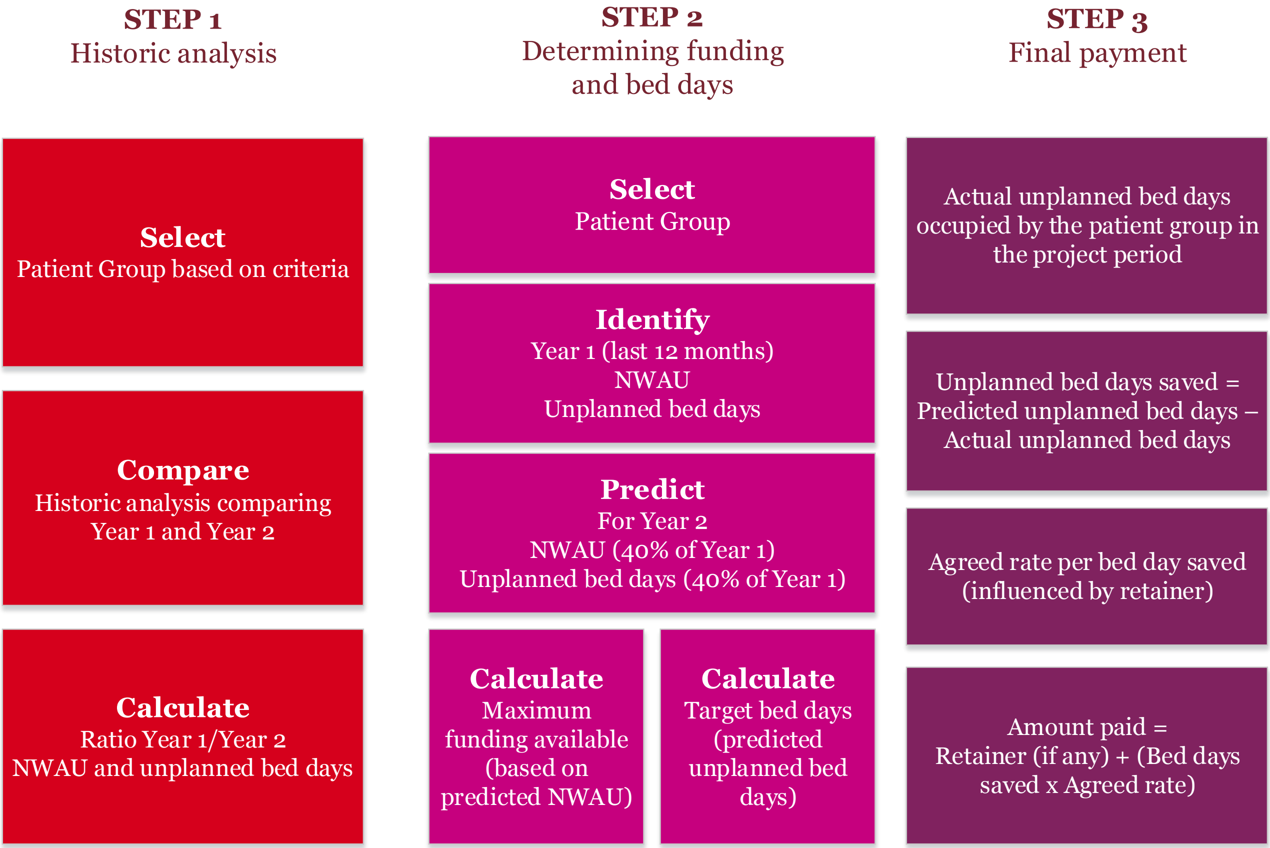
Figure 2.1: Outcomes based commissioning cycle

Source: CCLHD.

Funding model design

The OBC funding model was developed around paying private providers to reduce unplanned public hospital bed days associated with their allocated patient cohort, relative to their predicted unplanned public hospital bed days (see Figure 2.2.) This was regardless of whether those patients enrolled with the provider or not,[7] to ensure providers were incentivised to enrol as many patients in their allocated cohort as possible.

Figure 2.2: Overview of funding model design



STEP 1
Historic analysis

Select
Patient Group based on criteria

Compare
Historic analysis comparing Year 1 and Year 2

Calculate
Ratio Year 1/Year 2 NWAU and unplanned bed days

STEP 2
Determining funding and bed days

Select
Patient Group

Identify
Year 1 (last 12 months)
NWAU
Unplanned bed days

Predict
For Year 2
NWAU (40% of Year 1)
Unplanned bed days (40% of Year 1)

Calculate
Maximum funding available (based on predicted NWAU)

Calculate
Target bed days (predicted unplanned bed days)

STEP 3
Final payment

Actual unplanned bed days occupied by the patient group in the project period

Unplanned bed days saved = Predicted unplanned bed days – Actual unplanned bed days

Agreed rate per bed day saved (influenced by retainer)

Amount paid = Retainer (if any) + (Bed days saved x Agreed rate)

Note: NWAU= National Weighted Activity Unit.

Source: CCLHD.

Hospital administration data on prior unplanned public hospital bed days were used to predict the expected level of unplanned hospital bed days and National Weighted Activity Units (NWAU) for each cohort of patients allocated to each provider.

CCLHD estimated that 40 per cent of patients meeting the selection criteria were expected to have an unplanned hospitalisation in the following year, and would use 40 per cent of the bed days experienced in the year prior.(16)

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[7] Only unplanned bed days associated with Gosford or Wyong hospitals were included. Potential reductions in unplanned admissions to private hospitals were excluded.

Given OBC was due to start in September 2016, the patient group used to estimate the expected number of unplanned hospitalisations and bed days was drawn from the previous year's hospital admission dataset ending in June 2016. It differed from the cohort of patients allocated to providers in OBC given the start of OBC was delayed until January 2017.

Hospital administrative data delays made it difficult to access a 'live' or current cohort. Data are not regarded as finalised until at least three months after a set date, and only then contain all the information used to identify a study cohort.

CCLHD derived estimates on the potential effectiveness of coordinated care programs from a literature review.(20, 21) CCLHD estimated that for 600 patients and a study power of 80 per cent, OBC would reduce the probability of unplanned public hospitalisations from 40 per cent to 32 per cent, equivalent to a 20 per cent reduction.(16) CCLHD assumed there would be an equivalent reduction in unplanned public hospital bed days.

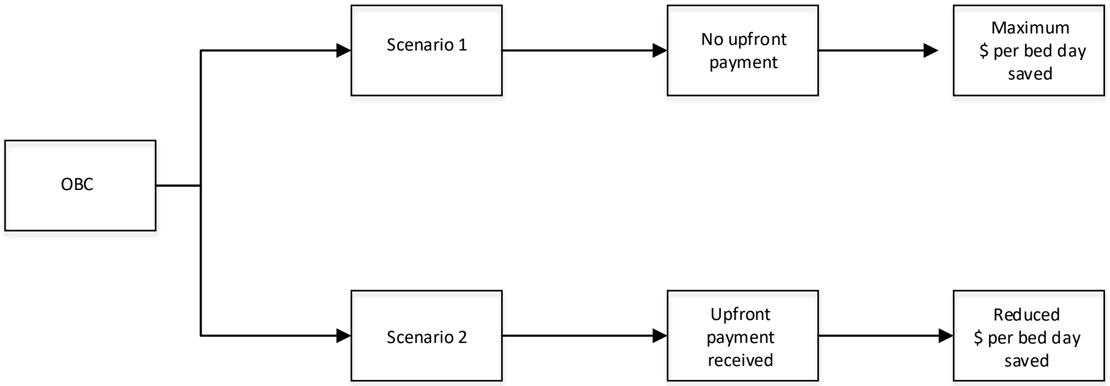
A predicted reduction in unplanned public hospital bed days was applied to each provider's allocated patient cohort, based on the cohort's prior NWAU and unplanned public hospital bed days. This was allocated to each provider as the maximum number of unplanned public hospital bed days saved that CCLHD was willing to fund.

Providers could choose to take an upfront payment to a maximum of 20 per cent of the expected maximum outcomes based payment, however any upfront payment would reduce the price per unplanned public hospital bed day saved the provider could receive (see Figure 2.3). For example, a provider could choose to not receive an upfront payment and would receive a higher price compared to a provider that did choose to receive some upfront payment.

Allowing providers to negotiate the upfront payment relative to the price of each unplanned public hospital bed day saved meant several payment scenarios could result (see Figure 2.4). One scenario could include 'no payment' if a provider chose no upfront payment and did not reduce any unplanned public hospital bed days for their allocated patient cohort. A provider could maximise their payment if it chose no upfront payment and reduced the expected number of unplanned public hospital bed days allocated by CCLHD.

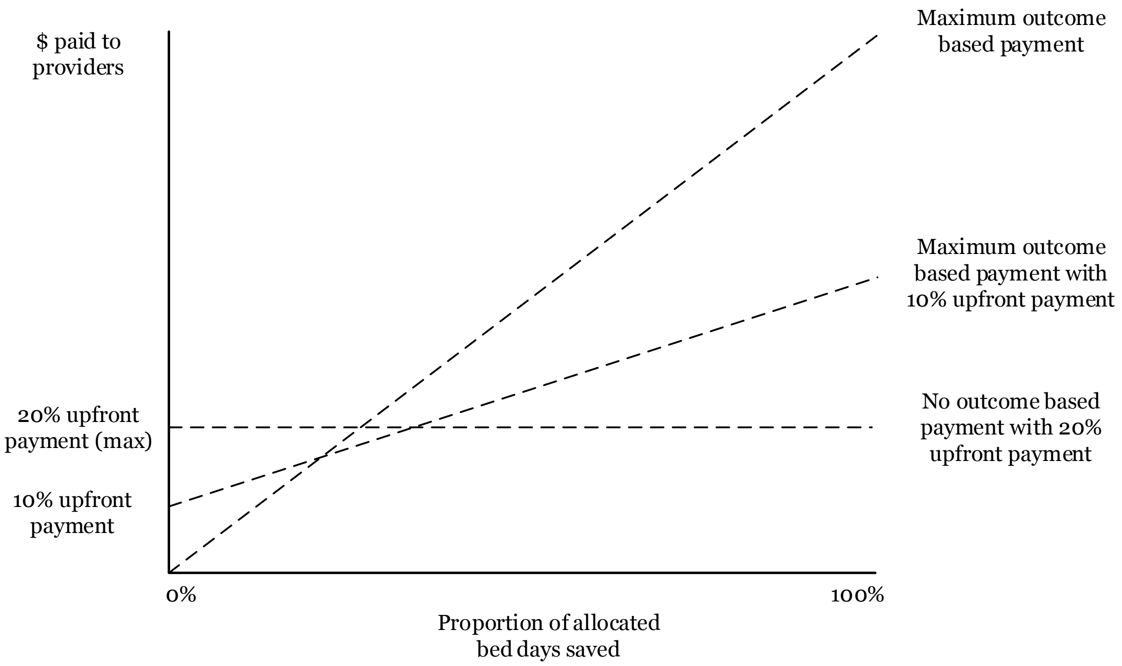
A provider could mitigate some payment risk by choosing a combination of upfront payment and payment for saving unplanned public hospital bed days, although the price for each bed day saved would be reduced (as represented by the reduced slope in Figure 2.4). A provider would mitigate all funding risk if they chose the maximum 20 per cent upfront payment, but would not receive payment for any unplanned public hospital bed days saved.

Figure 2.3: Outcomes based payment options framework



Source: CCLHD. (18)

Figure 2.4: Potential provider funding based on chosen upfront payment



Source: CCLHD and NSW Ministry of Health.

Market assessment and creation

CCLHD held industry briefings to provide information about OBC, and assess market interest among local organisations thought capable of delivering coordinated care. Encouraged by feedback, an Expression of Interest (EOI) was subsequently released, which included mandatory compliance and other weighted criteria.(18)

Mandatory Compliance (unweighted)

- Evidence of relevant insurances.

- Clinical and corporate governance structure.
- Willingness to work within and be reimbursed through an outcomes based framework.

Weighted Criteria

- Experience in working in a coordinated care approach.
- Experience in delivering face to face services in socioeconomically disadvantaged communities such as north Wyong.
- Plans for location of frontline staff.
- Experience in working with older vulnerable people still living at home or in residential care.
- Experience in working with general practitioners.
- Ability to work collaboratively with other stakeholders or providers.

CCLHD received twenty EOIs from a mix of local and non-local organisations, not-for-profits and for-profit organisations. No applications were received from general practitioners. Nine providers were selected to progress to the Request for Tender stage.

Tender process

OBC involved collaboration and co-learning with HealthShare and the CCLHD's Contracts and Leasing Team to develop the tendering and contracting process in the new 'outcomes' focused space, which was new for all parties. A multi-agency committee was engaged for the tender review phase, and an external probity officer was hired to ensure probity throughout the tender process.

The tender process followed the NSW Health procurement policy.(22) CCLHD aimed for a minimum of one and a maximum of four providers. CCLHD and providers negotiated the value of the contract and payment scenario during the selection process. Providers were expected to have a good understanding of their preferred upfront payment proportion, and the price for each unplanned public hospital bed day saved.

Providers were requested to nominate their preferred patient load and willingness to work with up to four specified general practices in north Wyong. Providers could opt to take on any number of GP practices and were required to nominate which practice they would engage with. While all efforts were made to match providers with their patient group preferences, providers were invited to discuss an alternative patient group allocation where any patient group was over or under selected.

Providers received a profile of their patient group from CCLHD prior to contract negotiation, which included their predicted number of public unplanned hospital bed days for the duration of OBC.

CCLHD used price and non-price criteria to evaluate the tenders including:

- model of care
- working with general practices
- implementation plan
- experience in working to outcomes

- support for frontline staff
- data collection specifications
- connections with social service and private providers
- working with a population in north Wyong
- case study response
- total cost.

Seven providers submitted tenders. Applicants were initially assessed against the mandatory, non-price based criteria and providers not meeting these criteria were excluded. Remaining applicants were assessed against price criteria (and any other additional non-price based criteria) and ranked accordingly. Two preferred tenderers were selected although finalising the contracts was delayed for three months due to staff changes in CCLHD. Contracts with the two private providers were signed in December 2016.

Contract terms and agreements

Contract terms and negotiated funding payments for the two providers were established with CCLHD during 2016. Specific financial details are not described here due to commercial in confidence arrangements.

Estimated volume of unplanned hospital bed day for each provider

CCLHD provided the target total number of unplanned public hospital bed days saved, based on the number of patients each provider was willing to accept (see Table 2.1). One provider agreed to a total of 166 patients from two GP practices. The other provider agreed to 278 patients from a separate two GP practices.

Table 2.1: Initial bed day targets

	Provider 1	Provider 2
Patients	166	278
Total bed days target	711	1,274
Bed days per patient	4.2	4.8

Note: Initial bed day targets were adjusted after 28 days as 32 patients were excluded from Provider 1 and five patients were excluded from Provider 2.

Source: CCLHD.

Delivery of care

CCLHD required providers to develop their own care coordination model so that providers would own the risk for their chosen model of care. CCLHD requested providers to work closely with the general practice associated with each enrolled patient. CCLHD committed to active oversight of providers, including meetings and quarterly data updates for each patient enrolled in the program. These reports included the following items.

- Whether the patient was actively involved in the program.

- If the patient was not actively involved, the reason for non-involvement.
- If the patient had a carer.
- Number and type (face to face, phone) of interventions provided.
- If the patient had been admitted to Gosford or Wyong hospitals.
- If the provider undertook direct liaison with hospital services (for admitted patients) to manage return to home and type of liaison undertaken.
- A classification as to whether the patient's level of function and independence had:
  - improved
  - stabilised
  - declined
  - data unavailable.
- If regular communication was occurring with the patient's GP, and the types of communication undertaken.
- If the patient was receiving an aged care package (with description of package type).
- Number of general practice attendances.
- If healthcare had been accessed outside Central Coast, and if so what type of care.
- If the patient had been admitted to a private hospital and number of times.
- If the patient had received any allied health care (excluding that provided by CCLHD), what type and number of times.
- If the patient had accessed other programs that would benefit their health and wellbeing, with a short description of the program.
- Any additional relevant information, such as:
  - adverse events or incidents over the quarterly period and the action taken by the provider
  - modifications of the model of care proposed as part of the tender.

Providers were required to present and provide two patient journeys at the quarterly management meetings. Content for the patient journey included:

- name of client
- dates of service delivery
- type and mode of service delivery provided
- type and mode of service delivery provided by other service providers
- period of hospital admission.

Monitoring and evaluation

Providers were required to provide CCLHD with information about their coordinated care model and report on service delivery metrics (see Table 2.2). They were also required to conduct surveys to collect information on the health and wellbeing of their patient cohort.

Surveys administered included the Patient-Reported Outcomes Measurement Information System Global-10 (PROMIS 10) survey when a patient started and concluded OBC, along with the Chronic Conditions Patient Selection Tool. Providers could use their own survey instruments to assess patient health and wellbeing and to triage patients according to unplanned hospitalisation risk.

Table 2.2: Key performance indicators for providers

Category		Key performance indicator
Reporting	1	Patient report for each patient (quarterly)
	2	Adverse events or incidents and action taken (quarterly)
Governance	3	Sign off on all quarterly reports by Governance group/person
Operational	4	Patient Reported Outcomes Measure (PROMs) at baseline, 6 and 12 months
	5	Present 2 patient journeys at each quarterly relationship meeting
	6	For all patients admitted to hospital, liaison was undertaken to transition people home. Evidence to be available where requested.
	7	For all enrolled patients regular communication with GP to be established. Evidence to be made available where requested.

Source: CCLHD.

3. Intervention

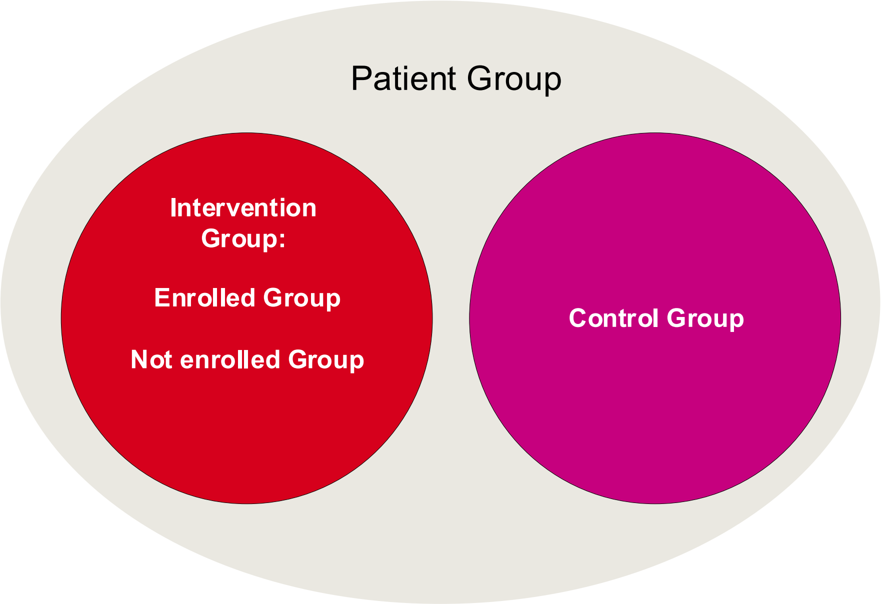
OBC started on 17 January 2017 and finished on 16 January 2018. This chapter outlines the different patient cohorts, patient selection process and each provider's care coordination model.

Patient cohort

There were three patient groups associated with OBC, and one control group used for the evaluation (see Figure 3.1). The 'intervention group' included the total patient cohort allocated to each provider by CCLHD, once each provider had excluded patients for not meeting selection criteria in the first 28 days of OBC starting due to death or patients moving into a residential aged care facility, moving out of the area or changing GPs.[8]

The 'enrolled' group was the subset of patients in the intervention group that provided consent to receive coordinated care from each provider. The 'not enrolled' group was the subset of patients in the intervention group that did not provided consent to receive coordinated care from the provider, either because they chose not to receive care, or could not be contacted by the provider.

Figure 3.1: Patient group, intervention group and control group



Source: CCLHD and MUCHE.

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[8] There was three months' difference between CCLHD developing the list of patient cohorts for each provider and the start of OBC. Hence, some patients were taken off the patient cohort list within the first 28 days of OBC starting given they no longer met the selection criteria.

Intervention group

CCLHD applied the selection criteria to hospital administration data from October 2015 to October 2016 to identify 587 patients in the intervention group (see Figure 3.2). This was reduced to 444 patients due to patients having died, or opting out of sharing their contact information with providers, moving to a residential aged care facility or not being contactable.

Provider 1 was allocated 166 patients and Provider 2 was allocated 278 patients. Each patient cohort had a mix of people with complex and less complex health conditions. All were identified as being at risk of unplanned hospitalisation in 2017.

Provider 1 excluded 32 patients at 28 days due to a combination of deaths, patients moving into a residential aged care facility, patients moving out of the area or changing GPs. This reduced their total allocated cohort to 134 patients. Provider 2 excluded five patients at 28 days, reducing their total allocated cohort of patients to 273 patients. There were no revisions to bed day targets for either provider. The intervention group had 407 patients at the start of OBC on 17 January 2017.

Enrolled and not enrolled groups

Providers were required to enrol patients from their patient cohort once OBC had begun. CCLHD provided the name, address, date of birth and Medicare number for each patient who had consented to be contacted by a provider.

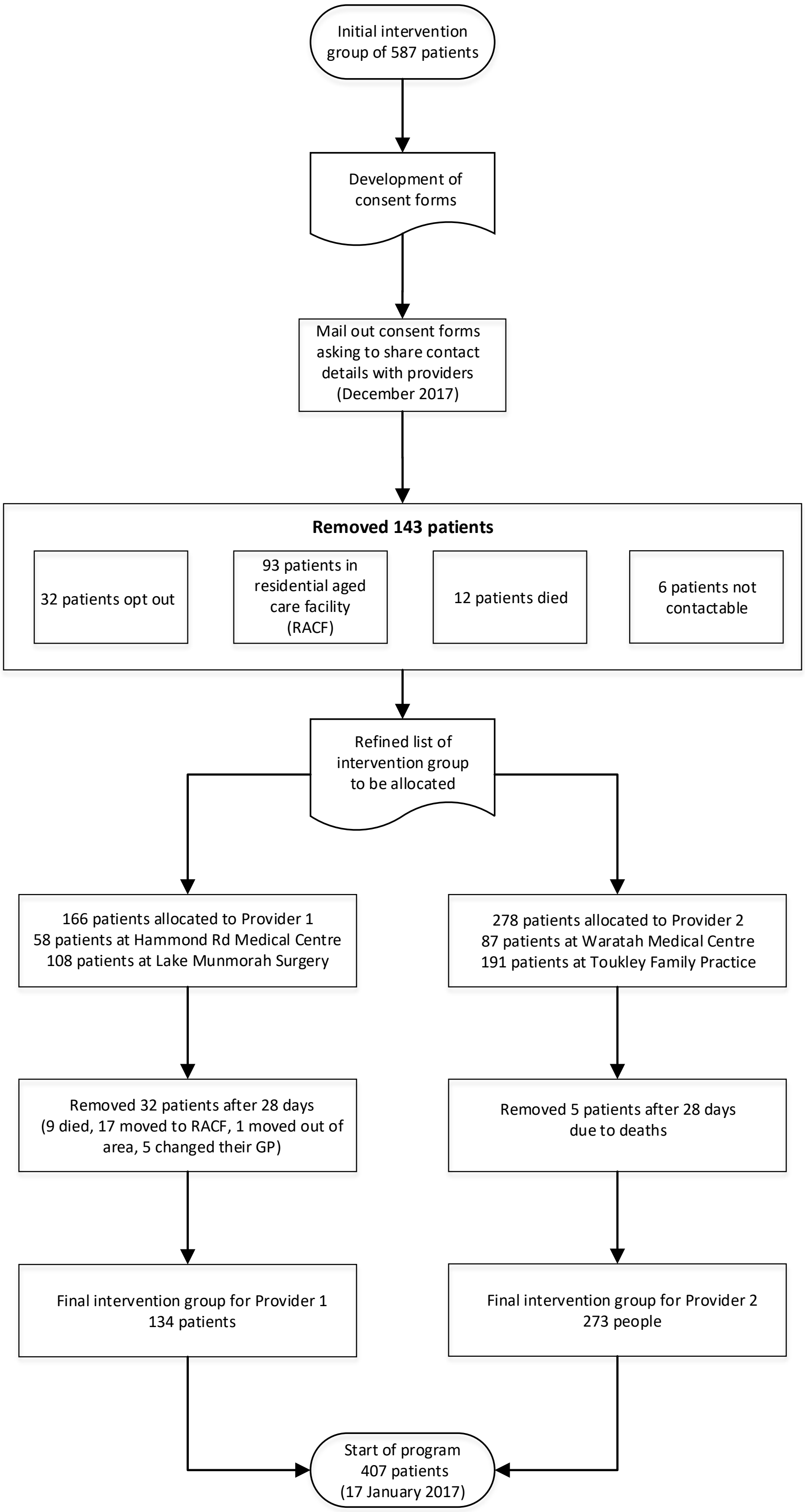
Providers primarily undertook enrolment in the first three months from the start of OBC. Provider 1 enrolled 74 patients while Provider 2 enrolled 137 patients, representing around 52 per cent of the intervention group.

The not enrolled group consisted of those patients in the intervention group who had not provided consent to receive coordinated care from the provider. It had 196 patients, representing around 48 per cent of the intervention group.

Control group

CCLHD selected 332 patients for the control group using similar criteria and the same hospital administration dataset used to select the intervention group. Differences in criteria were that patients selected for the control group lived in south Wyong (which has a similar socioeconomic profile) and were linked to seven GP practices.

Figure 3.2: Process to establish the intervention group



Source: MUCHE based on data provided by CCLHD.

Provider care models

Providers were required to implement their own care coordination model to meet the healthcare needs and preferences of their allocated patient cohort. While this resulted in two different intended care coordination models, both shared similar characteristics.

Providers first contacted their allocated patient cohort to enrol each patient. Once consent was given, a care coordinator from a multidisciplinary team visited the patient at home to undertake an initial assessment, agree on goals and develop a shared care plan.

Patients were coordinated with a range of services where required including services offered by CCLHD, NSW Health public health programs and through not-for-profits. Patients were helped to apply for the Commonwealth Home Support Services or Home Care packages. Patients with access to these aged care support packages were offered home care services delivered by the provider if deemed necessary.

A central part of care coordination for both providers was ongoing monitoring, either by telephone or additional home visits. Enrolled patients continued to be enrolled until OBC finished, unless they requested not to receive any additional care coordination from the provider.

Provider 1 care coordination approach

Provider 1 established their care coordination model with two registered nurses working the equivalent of one full time equivalent (FTE) hours, one case manager working 0.8 FTE hours and one administrative support person working 0.5 FTE hours.

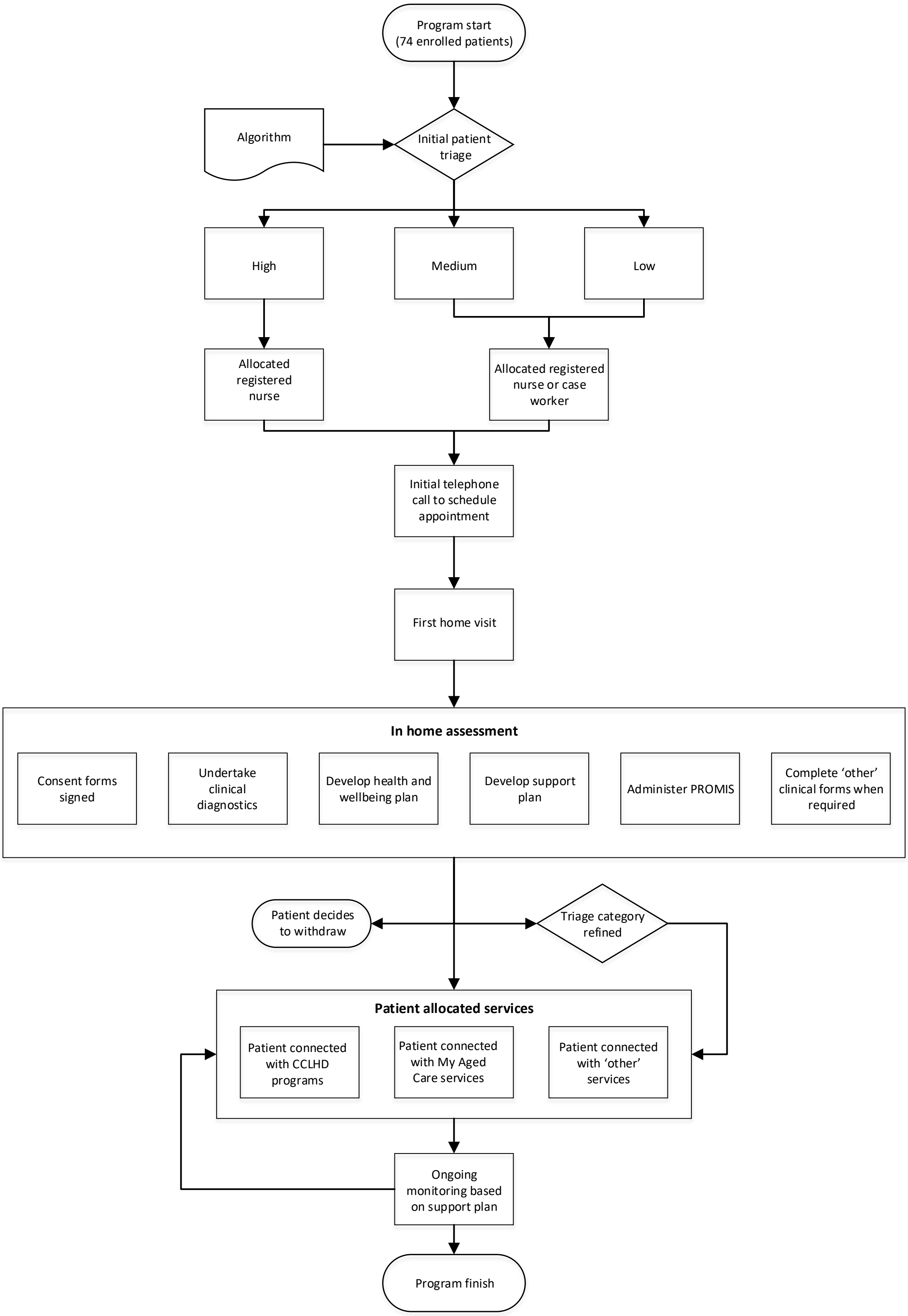
This provider first categorised enrolled patients according to their risk of experiencing an unplanned public hospital admission into low, medium or high using an algorithm developed in-house (see Figure 3.3) to determine whether to allocate a registered nurse or case manager as the care coordinator.

All enrolled patients received a phone call to schedule an initial appointment for an in-home assessment to assess patient care needs. These included the PROMIS 10 and the Chronic Conditions Patient Selection (CCPS) surveys, along with a mini-mental health examination and a geriatric depression scale measuring cognitive impairment.

Provider 1 helped enrolled patients develop a health and wellbeing plan, which outlined goals patients wanted to achieve through care coordination. This provider also developed a formal care plan with some patients, while others were educated to use the clinical action plans provided by their GP to improve health literacy. Provider 1 further refined the initial risk categorisation of each patient after the initial in-home visit.

Patients were connected to services operated by CCLHD, federally funded aged care services, and services offered through other means. For those not receiving aged care services, Provider 1 provided a link to the My Aged Care website to register for a basic assessment through a Regional Assessment Service or a more complex assessment through an Aged Care Assessment Team.

Figure 3.3: Provider 1 care coordination approach



Source: MUCHE.

Enrolled patients were given educational material on flu vaccinations and a seven-week falls prevention program operated by the NSW Ministry of Health called Stepping On. Provider 1 referred some patients to Meals on Wheels, community transport, cardiac rehabilitation, cooking and nutrition classes, Better Health Self-Management course, Tea and Technology IT education courses, dietician workshops, exercise programs, seniors' education classes at local neighbourhood centres and referrals for social outings to improve socialisation.

Provider 1 monitored enrolled patients' care needs through telephone calls or home visits, depending on patient risk and patient preferences. High risk patients received a minimum of one phone call every month and one home visit every three months. Some patients received monthly home visits. Case managers telephoned their assigned medium to low risk patients at least once every three months. Patient medications and the use of medical devices such as continuous positive airway pressure machines, nebulisers and asthma inhalers were also monitored.

Communication with healthcare providers

Provider 1 sought to communicate with patient GPs through telephone, mail or case conferences.[9] Case conferences were the preferred option given there is a Medicare billing code for multidisciplinary case conferences with GPs.

Patient clinical information was collected and shared using ISBAR (Identify, Situation, Background, Assessment and Recommendation).(23) This relies on a combination of patient recall of hospitalisations, visits to specialists, and participation in chronic or complex primary health programs along with GP practices' report.

Provider 1 did not establish a communication channel with either Gosford or Wyong hospitals. Instead, each patient was given an identification card to show hospital staff when either attending an emergency department or being admitted. The provider hoped hospital staff would inform it accordingly.

Provider 2 care coordination approach

Provider 2 established their care coordination approach with a registered nurse and an enrolled nurse, and two occupational therapists.

All enrolled patients first received a phone call to schedule an initial appointment for an in-home assessment (see Figure 3.4) to assess patient care needs, set goals and develop a set of recommended services for the patient.

Provider 2 developed patient care plans based on goals they formulated during initial home assessments. These were revised according to changing patients' needs. This provider also assessed the risk of unplanned public hospitalisation for each patient, based on information collected at the appointment, any clinical information received from the patient's GP, and staff judgements.

Provider 2 helped patients connect with healthcare services, such as their GP, specialists and allied health services such as occupational therapists, physiotherapists and podiatrists. Patients were also connected with the Stepping On program.

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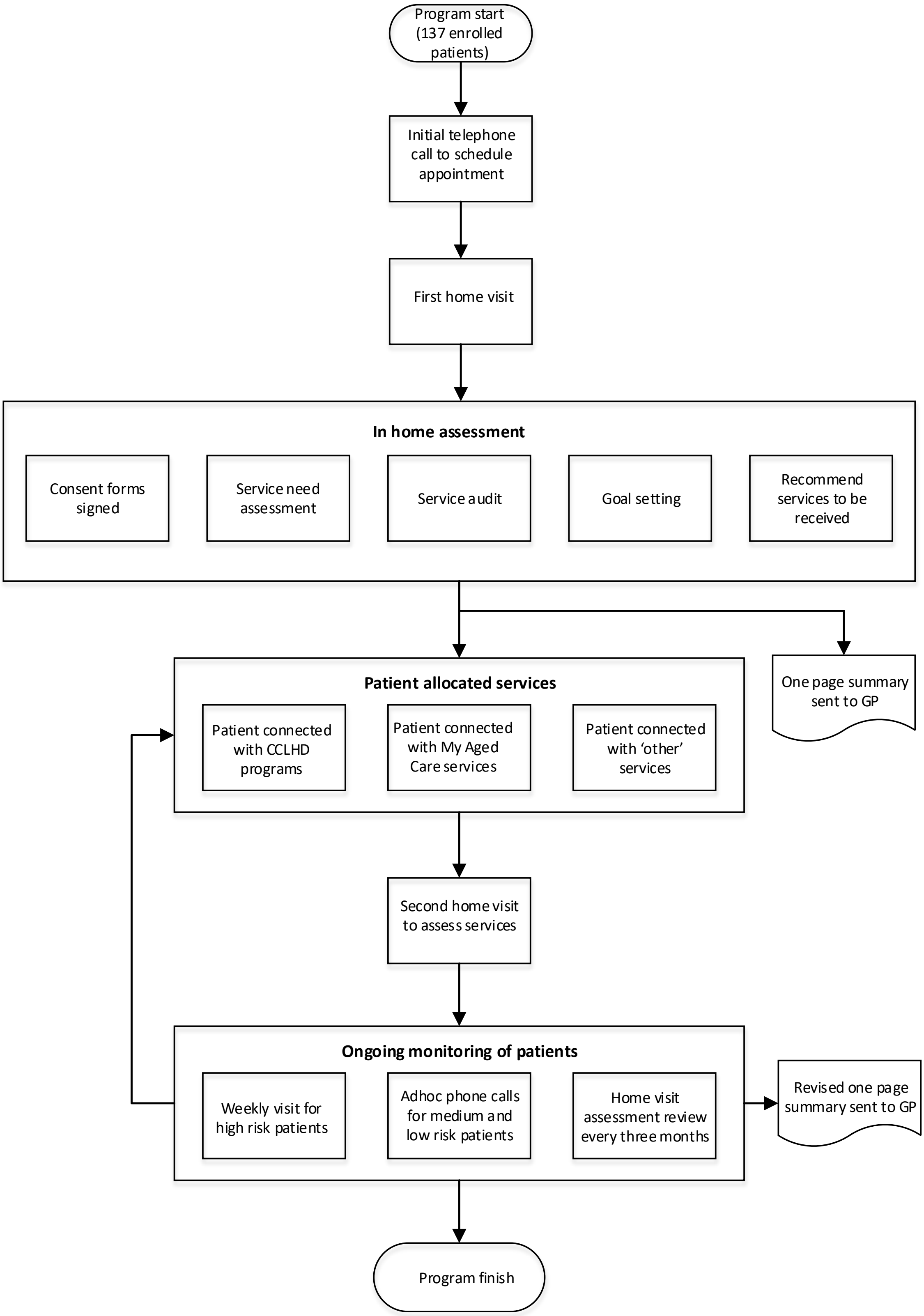
[9] A case conference can occur face-to-face, by phone or by video conference, or through a combination of these. The case conferencing team must include a GP and at least two other health or community care providers, one of whom can be another medical practitioner. Each team member should provide a different kind of care or service to the patient.

Figure 3.4: Provider 2 care coordination approach



Source: MUCHE.

Provider 2 connected some patients with aged care services, through the My Aged Care website and with Meals on Wheels, community transport, hearing services, mobility aid services, and continence aid services. This provider also connected some enrolled patients to broader social services, such as social workers at Centrelink and Housing NSW, NSW Ombudsman, legal aid, financial counsel, the San Remo and Toukley neighbourhood centres, and recreational centres.

Patients were monitored through home visits and telephone calls. The type and frequency of communication with each patient depended on each patient's healthcare needs and preferences. Enrolled patients deemed at high risk of an unplanned public hospitalisation were allocated weekly home visits. Patients deemed low risk received ad hoc telephone calls or quarterly home visits.

Provider 2 provided patients and carers with reminders to attend GP appointments and guided some patients on questions to ask their GP. This provider provided iPads to reduce social isolation for some patients through greater connections to family and current affairs.

Communication with healthcare providers

Provider 2 sent letters to all enrolled patients' GPs outlining the services patients had been referred to. It also sought to communicate with GPs through case conferences, telephone or by letter. Provider 2 did not establish a formal communication channel with Gosford or Wyong hospitals.

4. Evaluation methodology

This chapter outlines the evaluation methodology, including methods to remove potential selection bias when estimating the impact on hospital use, methods to estimate cost effectiveness and return on investment, and methods to assess factors that impacted outcomes and costs, including the implementation and commissioning processes.

Evaluation objective

The evaluation objective was to determine if OBC was superior to usual care in terms of health outcomes, cost effectiveness and patient experience. The evaluation research question was:

> Did OBC reduce unplanned hospital admissions and improve health outcomes and patient experience for a risk stratified cohort of patients living in the north Wyong region, in a cost effective and financially sustainable manner?

The evaluation was undertaken using a mixed-methods approach. Hospital use and patient characteristic data spanning five years were extracted from the NSW Admitted Patient Data Collection and Emergency Department data collection. Impacts were estimated by separately comparing the intervention and enrolled groups to a control group, using Difference in Difference (DiD) analysis with entropy balancing to account for potential selection bias.

Cost effectiveness was estimated using a cost utility analysis and healthcare system perspective. Benefits were represented through quality adjusted life years (QALYs) while costs were related to a change in hospital utilisation and program costs. An incremental cost effectiveness ratio (ICER) was estimated and compared to an implicit cost effectiveness threshold derived from listings of medications on the Pharmaceutical Benefits Scheme.

Factors impacting outcomes and costs were estimated using process evaluation to explore mechanisms of impact, along with contextual factors that shape the process of how each mechanism generates outcomes. Evaluation criteria were developed after undertaking a systematic literature review of relevant process evaluation frameworks.

A commissioning assessment framework was developed by reviewing best practice commissioning approaches for healthcare, and the NSW Government's commissioning policies and guidelines. The assessment framework was used to compare CCLHD's commissioning approach to best practice.

Impacts on outcomes

Hospital use

Analysis was undertaken to estimate the impact of OBC on emergency department (ED) visits, unplanned public hospital admission, and length of stay (LoS). Differences in hospital use for the intervention group and enrolled group were compared to a control group. The purpose of evaluating the intervention group was to estimate the average impact across those enrolled and not enrolled, given funding to providers was on this basis. The enrolled group was evaluated to determine the impact of care coordination delivered by providers on hospital use.

Patients in each group are likely to differ systematically across unobserved characteristics affecting outcomes such as unobserved health behaviours despite CCLHD using the same selection criteria. Further selection bias between the enrolled and not enrolled groups may also occur given patients self-selected. Estimating the impact of OBC without adjustment was therefore subject to potential selection bias.

Two alternative DiD approaches were used. The first approach was a DiD regression including individual fixed effects to control for time-invariant unobserved heterogeneity. The second approach combined entropy balancing with the DiD regression to better control for observed and unobserved factors.(24)

The model used in the first approach was:

$$y_{i,t} = \mu + \beta T_i D_t + \delta Z_{it} + a_i + \lambda_t + \varepsilon_{it} \qquad (1)$$

where:

y_{it} is the outcome variable; μ is the intercept; T_i is a dummy equal to one if patient i is in the treatment group or zero otherwise; D_t is a dummy equal to one for the post-treatment year or zero otherwise; Z_{it} is a dummy equal to one if the patient is dead or zero otherwise; a_i are patient fixed effects, λ_t are year dummies to account for time trends (e.g. technical progress); and ε_{it} is the error term.

The model used in the second approach was:

$$y_{i,t} = \mu + \beta T_i D_t + \gamma T_i + \theta X_i + \delta Z_{it} + \lambda_t + \varepsilon_{it} \qquad (2)$$

where:

X_i is a vector of time-invariant control variables (including age, gender and chronic condition dummies). The fixed effects a_i are excluded in this model because pre-treatment outcomes (proxy for unobserved time-invariant and time-varying unobserved factors) are considered in entropy balancing.

Two types of time-varying control variables were included in the model, including death status dummy variable and a set of year dummy variables. Other time-varying control variables such as health status were not included given unavailable data.

The coefficient of interest was the DiD estimator (β), which captured the average treatment effect on the treated (ATT). If $\beta<0$ then OBC has reduced hospital use.

The DiD estimator is unbiased under the common trend assumption. This required that trends in the outcome for the intervention and enrolled groups would have followed the same trend found in the control group's outcomes in the absence of OBC (i.e., the mean difference in outcomes between each group and the control group is constant over time). While this assumption cannot be tested, a proxy test was undertaken to determine whether pre-treatment trends were parallel between the two groups before the implementation of OBC.

Combining DiD and entropy balancing

DiD was combined with entropy balancing to minimise potential bias from unobservable and observable patient characteristics. Entropy balancing was used to first pre-process the data to create a balanced sample of covariates across the intervention, enrolled and control groups. This involved assigning a scalar weight to each sample unit to ensure a set of balance constraints on the sample moments of the covariate distributions were satisfied. This resulted in reweighted groups that match on the sample moments.(24)

Individual covariates and pre-treatment outcomes were used to balance the samples.(25) Covariates included age, gender, presence of chronic conditions[10] and a dummy variable indicating whether the patient had died prior to the start date of OBC.

Pre-treatment outcomes were matched to improve the balance between groups for the unobserved time-invariant and time-varying unobserved factors such as health status since these outcomes can proxy for the confounders.(25)

Weights were generated to balance matching variables between groups.[11] (26) Samples were balanced on the first moment for dummy variables and the highest possible moment for continuous variables. This reduced dependence on the model to adequately account for potential differences in covariates when estimating the treatment effect.

Robust standard errors (i.e., clustering on individuals) were considered. Given the number of clusters is relatively large, this adjustment helped mitigate the potential over-rejection problem for DiD estimates.(27)

There are several advantages of using entropy balancing compared to other matching techniques, such as matching and propensity score methods. Entropy balancing can obtain a high degree of balance by imposing a potentially large set of balance constraints that involve the first, second and possibly higher moments of the covariate distributions. It will always (at least weakly) improve on the balance from conventional matching methods with regard to the specified balance constraints.(24)

Entropy balancing also retains valuable information in the sample by allowing the unit weights to vary smoothly across units, which means no sample units are discarded from the analysis. This retains efficiency for the regression analysis and is more suitable for smaller sample sizes.

Health outcomes

Health outcomes were assessed using quality adjusted life years (QALYs) (see Chapter 5). The differences in health outcomes for the intervention and enrolled groups were compared to the difference in health outcome for the control group. No adjustments were made to account for other patient characteristics confounding health outcomes, given limited data collected on patient characteristics.

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[10] Chronic conditions included diabetes, coronary heart disease, stroke, peripheral vascular disease, congestive heart failure, other heart disease, chronic respiratory conditions, renal failure, liver disease, morbid obesity, chronic neurological conditions, dementia, arthritis and gout.

[11] This was undertaken using the *ebalance* command in STATA.

Patient experience

Patient experiences were assessed from data collected using a survey based on the Harvard School of Public Health Patient Perceptions of Integrated Care (PPIC) questionnaire. This was administered to patients in the enrolled group who had consented to being surveyed (see Chapter 5).

A mixed-methods approach was used to assess the survey data. Sample statistics were generated across each survey question (mean, median and variance) and across time to determine the heterogeneity across patient experience. Differences in means across time were assessed for their statistical significance. A thematic analysis was also undertaken by grouping questions according to themes and assessing responses against those themes.

Cost effectiveness analysis

The economic evaluation sought to determine whether OBC was cost effective compared to 'usual' care. To meet the needs of different stakeholders, two types of economic evaluations were conducted: a cost utility analysis (CUA) and return on investment (ROI) analysis.

The CUA was undertaken on the enrolled group and intervention group to compare differences in health outcomes and costs before and after OBC. Health outcomes were compared to the control group.

Health outcomes were represented by quality adjusted life years (QALYs). QALY weights were derived from the PROMIS 10 survey administered by providers at the beginning and end of OBC. PROMIS 10 responses were mapped to ED-5D-5L using an algorithm developed for this study (see Appendix D), as QALY weights could not be directly obtained. Costs included those associated with implementing OBC (provider payments and program administration), and a change in hospital use derived from hospital administration data.

An incremental cost effectiveness ratio (ICER) was calculated by dividing differences in costs by differences in QALYs for the enrolled group and control group. The ICER was compared to a cost effectiveness threshold of $60,000 per QALY gained, which represents an implicit cost effectiveness threshold derived from listings of medications on the Pharmaceutical Benefits Scheme.(28)

Factors impacting outcomes and costs

Process evaluation

A process evaluation was undertaken to provide further insight into what outcomes were delivered through OBC and how these were delivered. This included determining the extent to which outcomes were affected by provider care coordination versus the implementation process, and the potential effectiveness of delivering OBC in a different healthcare context.

Many process evaluation frameworks have been used to evaluate healthcare programs.(5, 29) A literature review was conducted to identify the most appropriate process evaluation framework to evaluate OBC.

The literature review suggested earlier process evaluation frameworks were theory driven based on context, mechanism and outcome.(30) These evolved to become more guiding in their approach. For example, the RE-AIM framework framed a process evaluation in terms of reach, efficacy, adoption, implementation and maintenance.(31)

More recent frameworks built on the RE-AIM framework by adding components,(32) focusing on the feasibility of data collection,(33) and incorporating normalisation process theory.(34) Most recently, frameworks have shifted from capturing what is delivered,(32, 33) to understanding how implementation is achieved through explicitly evaluating the mechanisms of impact.(35)

The process evaluation framework developed by the UK Medical Research Council was adopted to evaluate OBC.(35) It was chosen for its scrutiny of causal mechanisms, focus on how participants interact with complex interventions, and its capacity to seek understanding on how findings may be transferred to different settings and populations.

These components were considered important given the context of this evaluation. Evaluating causal mechanisms of outcomes and costs is necessary to better understand results from the economic evaluation of OBC, and to identify potentially modifiable factors that could improve cost effectiveness.

Understanding the role patients played in engaging with providers and services was also important. Positive behavioural change is a key component in successful care coordination,(32) and a significant amount of effort has gone into understanding how to motivate patients to manage their own health and healthcare better.(36)

The Medical Research Council process evaluation framework also provided an opportunity to seek lessons for coordinated care programs in other local health districts. This is particularly important given the NSW Ministry of Health is investing in care models to keep people out of hospital, along with pursuing value based care through its Leading Better Value Care program.(37)

Figure 4.1 shows the application of the Medical Research Council process evaluation framework to OBC. The implementation phase explored how implementation of OBC impacted outcomes. This included evaluating the fidelity and dose of provider care coordination, along with the healthcare services, process and system structures used to facilitate this delivery.

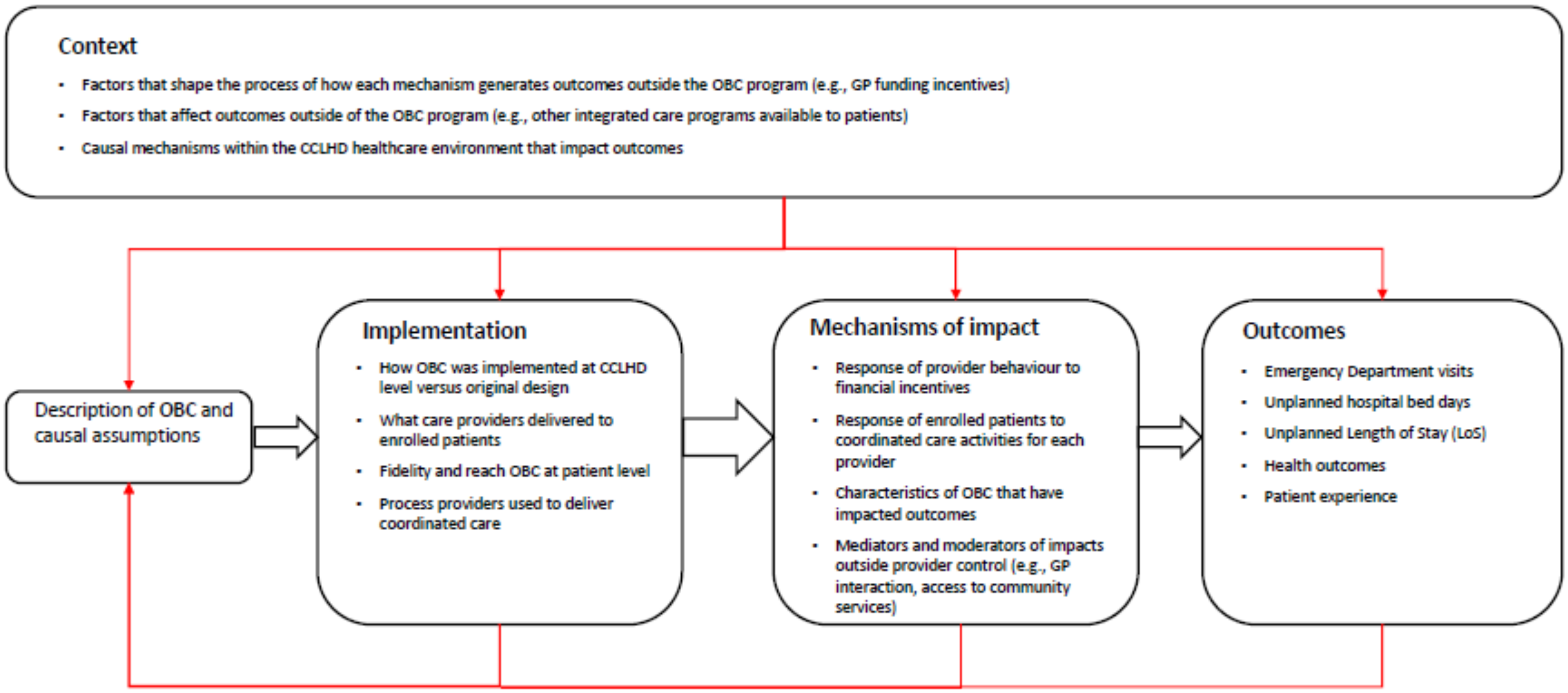
Evaluating mechanisms of impact focused on identifying how the design of OBC and provider care coordination models impacted outcomes. This included evaluating the role of patient behaviours and the mediators and moderators that impacted the relationship between providers and patients.

Context of delivery focused on identifying and measuring those factors external to OBC that impacted outcomes, factors that shape the process of how each mechanism generates outcomes outside the program, and causal mechanisms in the CCLHD healthcare environment that impact outcomes. It assessed the extent to which providers relied on other healthcare system stakeholders such as GPs to deliver outcomes, and identifying content characteristics necessary for the success of OBC in other local health districts.

The process evaluation started with a detailed description of OBC and the development of a program logic to inform the evaluation (see Table 4.1). Published information was collected from CCLHD on the development and structure of OBC, and its underlying theory. Understanding was refined through workshops and meetings held with the project steering committee and the project director and manager.

Information sought related to the program design process, patient and GP selection, funding model design, market assessment and creation, tender process, contract terms and agreement, and mechanisms employed by CCLHD to monitor and evaluate providers.

Figure 4.1: Process evaluation framework used to assess OBC



Source: MUCHE adapted from Moore et al. (2015) (35)

Table 4.1: OBC program logic

Component	Description
Problem	• There is a lack of care that keeps people healthy and at home for the vulnerable elderly population with a high risk of unplanned hospitalisation.
Approach/Evidence	• Patient centred coordinated care services for vulnerable elderly people can support improved access to medical and social care services that will reduce unplanned hospitalisations. • Commissioning private providers with an outcome based payment contract will incentivise them to develop care coordination models specifically designed to keep people out of hospital. • Care can be strengthened through improved communication between providers (GPs, hospitals and community care providers).
Inputs/Intervention	• The vulnerable elderly population (or patient cohort) is provided with patient centred coordinated care services including: ○ Improved access to appropriate community services (social, transport, GP, allied health, Meals on Wheels etc.) ○ Improved access to wellness coaching, exercise and falls prevention programs ○ Improved access to home nursing through aged care packages ○ Improved integrated care through better communication between CCLHD, GPs and community providers.
Activities by provider staff	• Provider staff undertake several ongoing activities to monitor and adjust care coordination requirements, including: ○ Conduct in-person needs assessment of all patients and prepare care plans ○ Monitor patients for changes to health status and healthcare needs ○ Arrange community services and enrolment in programs as needed (e.g., transport to medical appointments, Meals on Wheels, exercise programs etc.) ○ Arrange ACAT assessments where appropriate ○ Prepare patient status reports for communication with GPs ○ Ensure patients are cared for after returning from hospitalisation. • Patients are engaged with providers and follow instructions to seek health and social care services recommended by the provider. Carers also take an active role in motivating the patient to access services.
Outputs	• Providers deliver home-based care coordination services with a focus on integrated medical (tertiary and primary sector) and social and other community services support. • Providers are incentivised to provide appropriate patient centred care coordination services resulting in improved health outcomes and fewer unplanned hospitalisations for the patient cohort.
Outcomes	• Reduced unplanned hospital use. • Improved health outcomes. • Improved patient experience.
Impact	• Providers receive agreed payment for meeting targeted number of bed days. • Patients have improved health outcomes and fewer unplanned hospitalisations. • CCLHD, GPs and community providers have established more effective integrated care workflow for vulnerable elderly population.

Source: CCLHD and MUCHE.

Workshops were held with providers to gather information on components in their care coordination model and their causal assumptions. Additional information was sought on resources allocated by providers, types of services patients were referred to, patient monitoring processes, and communication channels established with health providers, including GPs and hospitals. The care coordination approach was mapped and shared with each provider for confirmation.

A systematic literature review was undertaken to gather lessons from process evaluations applied to health interventions like OBC (see Appendix A). Lessons were sought on questions explored, components measured, data collection process, and methods for data analysis. Differences in context between the intervention examined and OBC were considered when determining whether components to evaluate and methods could be replicated.

Core aims for the process evaluation were constructed to meet four primary needs:

- to better understand how providers impacted outcomes and costs and the influence of context
- to identify areas where OBC could be improved to maximise cost effectiveness
- to inform the development of recommendations on whether CCLHD should continue with OBC
- to assess whether OBC could be delivered in other local health districts.

Questions were developed to help inform core aims. These were presented in workshops held with each provider and CCLHD towards the end of OBC. Workshops were recorded and transcribed. Routine monitoring data collected by CCLHD throughout the trial was requested, along with 31 patient case studies developed by providers at the end of OBC. Patient experience data were collected through a self-reported questionnaire (see Chapter 5).

Information collected through the workshops, along with patient case studies, was assessed by generating broad themes and comparing responses across providers and CCLHD perspectives to identify potential connections and disconnections between responses. Analytic accounts of the workshops were written up and compared to the transcribed data and broad themes.

Workshop information was considered the primary source of information given this is where specific research questions were answered. Information from routine monitoring data and response to the patient self-reported questionnaire were used to validate the information collected from providers, and to identify sub-themes not otherwise noted by either providers or CCLHD.

Commissioning and contestability assessment

The process used by CCLHD to undertake commissioning and contestability of providers to deliver care coordination was assessed to identify barriers to establishing a functioning market, and characteristics of the commissioning and contestability approach that may have impacted outcomes.

A literature review was undertaken to identify potential frameworks to assess the commissioning and contestability approach used by CCLHD, and their applicability for evaluating OBC, but few studies were found.

An Australian study focusing on the primary care setting provided lessons for new commissioners of primary healthcare services.(38) It found detailed knowledge of the service and sector, sharing information and networking contributed to successful commissioning.

Barriers to successful commissioning included lack of resources (time and personnel), difficulties maintaining relationships with partners, difficulty obtaining external (clinical) support, and limited use of decision support tools, including priority setting tools for resource allocation.

The commissioning and contestability framework developed by NSW Treasury was adopted to evaluate OBC.(39) Known as the Practice Guide, it contains a set of principles to promote a customer centric approach to service delivery to improve quality, productivity and access to services. It also includes guidance on undertaking six stages of the commissioning and contestability process.

The Practice Guide is a whole of government approach to commissioning and contestability. The NSW Ministry of Health was consulted to determine specific considerations related to healthcare. These were used to develop a set of assessment questions to evaluate the six stages of commissioning and contestability outlined by the Practice Guide (see Table 4.2).

These questions were presented in workshops held separately with each provider and CCLHD towards the end of OBC. Workshops were recorded and transcribed and analysed using other information collected from CCLHD (e.g., provider contracts) and routine monitoring data.

Table 4.2: Framework to assess the commissioning approach

NSW Commissioning and Contestability Practice Guide	NSW Ministry of Health considerations	Assessment questions
Needs assessment and objectives to define population needs and desired outcomes from commissioning	• Focus on patient-centred outcomes • Inclusion of patient reported measures	• Was there a clear demand for the service? • Were the desired service outcomes identified?
System value and chain analysis to understand the services currently delivered, required changes to improve service delivery	• Rationale given for services not to be delivered by NSW Health • Consideration of industrial relations implications	• Was there detailed knowledge of the service and the sector? • To what extent should NSW Health/the market have been involved in the project?
System design to develop the commissioning approach, including demand and supply considerations	• Consideration of whether operating models can result in the desired outcome • Explicit rationale demonstrated through a business case	• Was it clear that the considered operating models would result in the desired outcomes? • Did the commissioning design include an assessment of price offered, compliance with delivery needs, and independent cost assessments?
Strategy and planning to determine required services, time, governance and measurement of provider performance outcomes	• Ensuring all spectrums of delivery are considered in the business case • Exploring whether the proposed procurement approach is suitable	• Was there adequate information sharing? • Were there adequate skills in quantifying costing and structuring demand? • Was the procurement approach suitable?
Implementation and management to establish and administer the commissioning system, contestability strategy and procurement approaches	• Inclusion of a program logic (and contract) linked to appropriate outcomes	• Were there adequate skills in contracting and management? • Were there adequate skills in engagement of the population and stakeholders, and ensuring services were effective and high quality? • Was there adequate collaboration and partnership, information management, innovation governance, compliance, accountability, project management and leadership? • Was there a plan/program logic (and related contract) to achieve the preferred model?
Monitoring, learning and evaluation to determine provider performance and respond to changes within the commissioning design	• A consumer focus throughout the process	• Was the implementation plan (and related contract) reviewed and updated as required? • Was there a consumer focus throughout the process?

Source: MUCHE.

5. Data collection

This chapter describes the data collection methods to support the evaluation, including collecting hospital administration data, surveying enrolled patients, and interviews with providers and CCLHD. It provides the data collection timeline and the response rate for each survey.

Outcomes

Hospital use

Hospital use and patient characteristic data were collected from the Admitted Patient Data Collection and the Emergency Department data collection, accessed by CCLHD through the NSW Health Information Exchange. Data in these datasets are routinely collected by clinicians and support staff through the operational activities of public hospitals. Data were de-identified and cleaned by the CCLHD, provided at the patient episode of care level, and spanned 1 January 2013 to 16 January 2018.

Hospital use data included ED visits, unplanned hospitalisations and planned hospitalisations. Sub-acute care data were not available. Key ED data included hospital identifier, arrival mode, date of arrival and departure, triage category, SNOMED code, and ICD-10 diagnosis. Key hospitalisation data included hospital identifier, admission type, date of arrival and departure, source of referral, and ICD-10 diagnosis.

Data on patient characteristics included age, gender, marital status, indigenous status, whether the patient held private health insurance, and whether the person died in hospital.

Health outcomes

Health outcomes were collected through enrolled patient surveys. Providers were contractually responsible for administering the PROMIS 10 survey,(40) and the NSW Chronic Conditions Patient Selection (CCPS) tool,(41) to all enrolled patients, upon enrolment and once OBC had finished.[12,13] CCLHD administered these surveys to consenting persons in the control group.

Consenting enrolled and control group patients were also asked to complete the EQ-5D-5L, which was administered by CCLHD. The objective was to provide this survey at the beginning and end of OBC, although there were delays due to limited access to resources by CCLHD. An additional study to map PROMIS 10 results to ED-5D-5L in order to derive QALYs was undertaken to ensure health outcomes could be measured at the beginning and end of OBC (see Appendix D).

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[12] PROMIS Global Health 10 consists of 10 questions about physical function, pain, fatigue, emotional distress, social health and general perceptions of health.

[13] Chronic Conditions Patient Selection (CCPS) tool was developed by NSW Health to standardise the approaches for patient selection for integrated care interventions and includes patients' clinical assessment, self-reported health and factors affecting their self-management care.

Data on deaths occurring in hospital were collected from the Admitted Patient Data Collection and the Emergency Department data collection. Data on deaths occurring outside hospital were collected from patient records kept by providers and deaths recorded in other hospital administrative databases.

Patient experience

Patient experience was collected through a modified Harvard School of Public Health Patient Perceptions of Integrated Care (PPIC) survey, which has 80 questions about patients' experience and satisfaction with receiving coordinated care delivered through primary care doctors. (42)

Some questions were removed on patient characteristics and healthcare use as they duplicated questions in other administered surveys, while others were removed because they were deemed irrelevant, leaving 60 questions for participants to answer. Other questions were reworded to better reflect the structure and characteristics of care coordination delivered under OBC. The survey was administered between August and October 2017, and again between January and February 2018 once OBC had finished.

Costs

Data on ED visits and hospitalisation costs were collected from CCLHD. Costs were constructed using the costing process embedded in all local health districts by the NSW Ministry of Health. They include all direct and indirect costs related to each patient episode of care.

Direct costs were directly related to a patient episode of care and include the salary costs of clinicians and allied health staff, medicine costs, diagnostic imaging and pathology costs and the cost of prostheses. Indirect costs were not directly attributed to an episode of care (e.g., hospital cleaning) and include overhead costs.

Direct and indirect costs were allocated to a standardised set of cost centres (e.g., a ward). These were then allocated to patient episodes of care based on actual costs, and relative value units that reflect utilisation of the cost centre resource in the patient episode of care.

Data on program costs were sourced from CCLHD. These included costs incurred by CCLHD related to managing and supporting the implementation and delivery of OBC, along with costs associated with provider payments.

Factors impacting outcomes and costs

Data to assess factors impacting outcomes and costs were sourced from the patient, provider and CCLHD perspectives (see Table 5.1).

The patient perspective was sourced from the modified PPIC survey, along with 31 patient journeys compiled by providers at the end of OBC, and 118 provider handover notes given to CCLHD in December 2017. These were completed in a template developed by CCLHD.

The information requested covered the level of need for each enrolled patient and why the level of need was selected by the provider. It included a list of services being accessed by each enrolled patient, and the process for handing the enrolled patient over to the CCLHD and their GP, including recommendations for ongoing care coordination.

Table 5.1: Data collection methods to assess factors impacting outcomes and costs

Domain	Data source	Tool	Collection responsibility
Patient perspective	Patient	Modified PPIC survey	CCLHD
	Patient	Patient monitoring reports	Provider
	Patient	Patient journeys	Provider
	Patient	Patient handover notes	Provider
Provider perspective	Provider	Semi-structured interviews	MUCHE
	Provider	Quarterly monitoring reports	CCLHD
CCLHD perspective	CCLHD	Semi-structured interviews	MUCHE
	CCLHD	Steering Committee minutes	CCLHD
	CCLHD	Program administrative data	CCLHD

Source: MUCHE.

The provider perspective was sourced through semi-structured interviews and quarterly patient monitoring reports developed by providers and given to CCLHD as part of their quarterly monitoring regime (see Table 5.2).

The CCLHD perspective was sourced through semi-structured interviews. Minutes from Steering Committee meetings and program manager meetings were also used, along with program administrative data sourced from CCLHD.

Table 5.2: Data collection domains in patient monitoring reports

Domain	Description
Patient involvement	Details on the number of enrolled patients.
Carer relationship	Details on whether enrolled patients had carer arrangements or none.
Interventions	Details on provider contact with enrolled patients, and whether contact was through in-home visits or telephone calls.
Hospital liaison	Details on patient follow-up activities undertaken by providers for those enrolled patients discharged from hospital.
Function and independence	Details on whether the enrolled patients’ wellbeing had deteriorated, improved or stabilised since enrolment.
GP communication	Details on the amount and type of provider contact with GPs.
Patient GP attendance	Details on the number of GP visits for enrolled patients.
Allied health intervention	Details on the frequency and type of allied health services used by enrolled patients.
Support Care Packages	Details on status of assessment and service arrangements related to aged care for enrolled patients.
Other interventions	Details on frequency and type of other services (e.g., transport, Meals on Wheels) arranged for enrolled patients.

Source: MUCHE.

Survey timing

All surveys were administered twice although the scheduling of each survey varied. The objective was to administer each survey when the patient enrolled into OBC, and again when it had finished. Surveys were not administrated as planned and the timing of data collection varied for each survey and the enrolled and control group (see Table 5.3 and Appendix B).

Table 5.3: Timeline of survey data collection

Data source	Data time label	Enrolled group	Control group	Collection responsibility
PROMIS 10	First collection	Jan–Aug 2017	Aug–Oct 2017	Providers collected data for the enrolled group while CCLHD collected data for the control group
	Second collection	Aug 2017 Oct–Nov 2017 Jan–Feb 2018	Feb 2018	
NSW Chronic Conditions Patient Selection	First collection	Jan–Aug 2017	N/A	Providers collected data for the enrolled group. No data collected for the control group
	Second collection	Aug 2017 Oct–Nov 2017 Jan–Feb 2018	N/A	
EQ-5D-5L	First collection	Aug–Oct 2017	Aug–Oct 2017	CCLHD collected data for the enrolled and control groups
	Second collection	Jan–Feb 2018	Feb 2018	
Modified PPIC survey	First collection	Aug–Oct 2017	N/A	CCLHD collected data for the enrolled group. No data collected for the control group
	Second collection	Jan–Feb 2018	N/A	

Note: PPIC = Patient Perceptions of Integrated Care

Source: MUCHE.

Survey response rate

Response to each survey varied depending on the type of survey and administration (see Table 5.4). Response was greatest for PROMIS 10 administered by providers to enrolled patients, ranging from 79 per cent for the first collection to 66 per cent for the second collection.

Patients were less likely to respond to surveys administered by the CCLHD, particularly for patients in the control group. For example, the response rate for PROMIS 10 administered to the control group was 17 per cent for the first collection and 16 per cent for the second collection.

Table 5.4: Number of patients completing each survey

Domain	PROMIS 10	EQ-5D-5L	Modified PPIC
Enrolled group			
First collection	167	63	58
Second collection	139	56	55
Both	138	53	49
Control group			
First collection	57	62	N/A
Second collection	53	55	N/A
Both	43	50	N/A

Note: There were 211 participants in the enrolled group and 332 in the control group.

Source: MUCHE based on data provided by CCLHD.

6. Patient characteristics

Data were collected from hospital administration datasets on the intervention and control groups, and from surveys administered to enrolled patients. This chapter describes the baseline characteristics of patients prior to starting OBC, including demographics, health status and hospital use.

Baseline characteristics

Demographics

Patient demographics were sourced from the Emergency Department Data Collection and Admitted Patient Data Collection provided by CCLHD. The intervention group was similar to the control group prior to OBC starting (see Table 6.1), with average age of 80.6 years at the start of OBC, while the average age for the control group was 82 years and with a greater proportion of patients aged above 85 years. The control group was also represented by slightly more males. There were minor differences in between the enrolled and not enrolled groups, with those choosing to enrol being one year younger on average, and more likely to be male.

Table 6.1: Patient group demographics at the start of OBC

	Intervention group			Control group
	Enrolled	Not enrolled	Total	
Number of patients	209	198	407	332
Age				
Mean - years	80.1	81.1	80.6	82.0
Median - years	80.0	81.0	80.5	83.0
Standard deviation	7.0	8.2	7.6	7.8
Min	66.0	65.0	65.5	65.0
Max	96.0	103.0	99.4	98.0
Age group (as a proportion)				
65-69	6.7%	9.6%	8.1%	7.5%
70-74	14.8%	14.1%	14.5%	11.5%
75-79	25.4%	19.2%	22.4%	21.4%
80-84	22.5%	21.2%	21.9%	16.9%
85-89	20.1%	17.2%	18.7%	25.0%
90+	10.5%	18.7%	14.5%	17.8%
Gender				
Male	52.6%	50.5%	51.6%	52.4%

Female	47.4%	49.5%	48.4%	47.6%
Marital Status				
Never married	1.9%	4.6%	3.2%	3.3%
Widowed	29.7%	40.9%	35.1%	36.8%
Divorced	13.4%	9.1%	11.3%	11.5%
Separated	4.3%	4.0%	4.2%	2.1%
Married (registered and de facto)	50.7%	41.4%	46.2%	46.1%
Not stated/inadequately described	0.0%	0.0%	0.0%	0.30%
Indigenous status				
Aboriginal but not Torres Strait Islander origin	1.9%	1.0%	1.5%	1.5%
Torres Strait Islander but not Aboriginal origin	0.5%	0.0%	0.3%	0.0%
Both Aboriginal and Torres Strait Islander origin	0.0%	0.0%	0.0%	0.0%
Neither Aboriginal nor Torres Strait Islander origin	97.1%	99.0%	98.0%	98.5%
Not stated	0.5%	0.0%	0.3%	0.0%

Note: Data at 17 January 2017.
Source: MUCHE based on data provided by CCLHD.

Health status

The prevalence of chronic conditions was sourced from the Admitted Patient Data Collection provided by CCLHD (see Table 6.2). This was recorded when a patient was admitted to a public hospital. Overall, patients from the intervention and control groups had a similar health status on average, although some differences existed that were likely to impact healthcare use and health outcomes.

The most prevalent conditions across all groups were diabetes, renal disease and heart disease. Diabetes was most prevalent in the enrolled group. Heart disease was more prevalent in the not enrolled group, while stroke and renal disease were most prevalent in the control group. The dementia rate was low among all groups compared to the population prevalence rates for Australians aged 65 years and over.(1)

Table 6.2: Prevalence of chronic conditions before OBC

	Intervention			Control
	Enrolled	Not enrolled	Total	
Number of chronic conditions recorded	2,732	2,155	4,887	4,034
Arthritis	2.0%	2.1%	2.0%	1.8%
Chronic Neurological Conditions	1.5%	2.8%	2.1%	2.6%

Chronic Respiratory Conditions	5.5%	6.9%	6.2%	4.9%
Congestive Heart Failure	4.3%	7.7%	6.0%	4.2%
Coronary Heart Disease	5.3%	6.3%	5.8%	5.3%
Dementia	0.3%	3.7%	2.0%	2.9%
Diabetes	37.9%	29.6%	33.9%	23.1%
Diabetes/Peripheral Vascular Disease	3.3%	3.2%	3.3%	2.1%
Gout	0.7%	0.9%	0.8%	0.7%
Liver Disease	1.3%	0.2%	0.8%	1.4%
Morbid Obesity	0.4%	0.5%	0.4%	0.3%
Other Heart Disease	8.7%	10.0%	9.3%	9.1%
Peripheral Vascular Disease	2.0%	0.6%	1.3%	1.0%
Renal	24.5%	23.2%	23.9%	37.2%
Stroke	2.2%	2.6%	2.4%	3.5%

Notes: Data for 20 October 2015 to 19 October 2016 for those alive at the start of OBC. This reflects the period chosen by CCLHD when allocating patients drawn from the hospital administration dataset into OBC.

Source: MUCHE based on data provided by CCLHD.

Hospital use

Hospital use was sourced from the Emergency Department Data Collection and the Admitted Patient Data Collection provided by CCLHD (see Table 6.3). All patients had at least one unplanned hospital admission, with the average being 1.9 for both the intervention and control groups. Many patients also had a planned hospital admission.

The average length of stay for an unplanned public hospital admission was 4.8 days for the intervention group and 5.6 days for the control group. There was variation within the intervention group, with the enrolled group spending 0.8 days less in hospital on average than the not enrolled group.

Table 6.3: Inpatient admissions before OBC

	Intervention			Control
	Enrolled	Not enrolled	Total	
Public hospital admissions				
Episodes of care	664	617	1,281	1,007
Planned	33.1%	26.6%	30.0%	33.8%
Unplanned	59.5%	64.8%	62.1%	61.4%
Not assigned	7.4%	8.6%	8.0%	4.9%
Number of episodes per patient				
Planned	1.1	0.8	0.9	1.0
Unplanned	1.9	2.0	1.9	1.9
Average length of stay (days) - Planned				

Episodes	220	164	384	340
Mean	1.3	1.4	1.3	1.2
Standard deviation	1.2	1.8	1.5	1.5
Median	1	1	1	1
Min	1	1	1	1
Max	12	18	18	17
Average length of stay (days) - Unplanned				
Episodes	395	400	795	618
Mean	4.4	5.2	4.8	5.6
Standard deviation	6.7	6.2	6.5	7.0
Median	2	3	3	3
Min	1	1	1	1
Max	94	39	94	91

Note: Data for 20 October 2015 to 19 October 2016 for those alive at the start of OBC. This reflects the period chosen by CCLHD when allocating patients drawn from the hospital administration dataset into OBC.

Source: MUCHE based on data provided by CCLHD.

The intervention group averaged 2.5 ED visits before OBC, while the control group averaged 2.1 visits (see Table 6.4). Around 10 per cent of control group patients were more likely to arrive at ED from an ambulance compared to the intervention group. Enrolled group patients were less likely to arrive by ambulance. Patients in the control group were more likely to be triaged into an urgent category upon ED arrival compared to the intervention group, and were more likely to be admitted from the ED.

Table 6.4: Emergency department use before OBC

		Intervention		Control
	Enrolled	Not enrolled	Total	
Number of ED presentations	515	482	997	699
Mean presentations per patient	2.5	2.4	2.5	2.1
Arrival				
Ambulance, air ambulance or helicopter rescue service	60.2%	66.0%	63.0%	73.1%
Police/correctional services vehicle	0.0%	0.2%	0.1%	0.1%
Other	39.8%	33.8%	36.9%	26.8%
Triage Category				
Resuscitation: immediate (within seconds)	1.0%	1.9%	1.4%	1.4%
Emergency: within 10 minutes	17.3%	20.5%	18.9%	21.9%
Urgent: within 30 minutes	41.9%	41.9%	41.9%	45.2%
Semi-urgent: within 60 minutes	38.1%	33.6%	35.9%	29.9%
Non-urgent: within 120 minutes	1.8%	2.1%	1.9%	1.6%

ED departure status				
Admitted to this hospital	66.6%	72.8%	69.6%	82.6%
Departed without being admitted or referred to another hospital	26.0%	19.1%	22.7%	13.0%
Referred to another hospital for admission	7.2%	7.3%	7.2%	3.6%
Did not wait to be attended by a health care professional	0.0%	0.2%	0.1%	0.3%
Left at own risk before ED episode was completed	0.2%	0.0%	0.1%	0.1%
Died in emergency department	0.0%	0.0%	0.0%	0.0%
Dead on arrival	0.0%	0.6%	0.3%	0.4%

Note: Data for 20 October 2015 to 19 October 2016 for those alive at the start of OBC. This reflects the period chosen by CCLHD when allocating patients drawn from the hospital administration dataset into OBC.

Source: MUCHE based on data provided by CCLHD.

7. Impacts from OBC

Analysis was undertaken using hospital administration data on the trends in hospital activity before and after OBC, and the change in hospital activity between the intervention and enrolled groups compared to the control group. This chapter presents the econometric results on the impact of OBC on hospital activity, along with differences in health outcomes and costs, and results from a cost utility analysis on the intervention and enrolled groups and a return of investment analysis on OBC.

Hospital use

Rates of hospital activity

There was a significant reduction in hospital activity for all groups within the OBC trial period. While nearly all patients in the year before OBC had at least one ED visit and all had at least one unplanned hospitalisation, many patients had no ED visits or no unplanned hospitalisations during OBC (see Table 7.1).

Table 7.1: Number of patients with zero hospital activity

	Person	Proportion
	number	*per cent*
ED visits		
Intervention group	198	48.6
Enrolled group	86	41.1
Not enrolled group	112	56.6
Control group	170	51.2
Unplanned hospitalisations		
Intervention group	164	40.3
Enrolled group	64	30.6
Not enrolled group	100	50.5
Control group	152	45.8

Note: Period is 17 January 2017 to 16 January 2018.

Source: MUCHE based on data provided by CCLHD.

Mean ED visits per person varied before OBC, with the intervention group experiencing 2.4 visits per person, and the control group experiencing 1.9 visits per person (see Table 7.2). Patients were more similar within the intervention group, with the enrolled group experiencing 2.5 ED visits per person and the not enrolled group experiencing 2.3 ED visits per person.

Mean ED visits per person reduced by just under one third for the intervention and control group over the duration of OBC. The reduction was less pronounced for the enrolled group, and most pronounced for the not enrolled group.

Unplanned hospitalisations reduced at a similar rate for the intervention and control group over the duration of OBC, by just over one third. The reduction was less pronounced for the enrolled group, and most pronounced for the not enrolled group.

Table 7.2: Change in ED visits and unplanned hospitalisations

	Year before OBC[1]	OBC[2]	Absolute change	Proportional change
	per person	*per person*	*per person*	*per cent*
ED visits				
Intervention group	2.4	1.6	-0.8	-32.0
Enrolled group	2.5	1.9	-0.6	-25.6
Not enrolled group	2.3	1.4	-0.9	-39.1
Control group	1.9	1.3	-0.6	-33.1
Unplanned hospitalisations				
Intervention group	1.9	1.2	-0.7	-37.6
Enrolled group	1.9	1.3	-0.6	-30.8
Not enrolled group	2.0	1.1	-0.9	-44.6
Control group	1.6	1.1	-0.6	-35.5

Note: 1. Period is 17 January 2016 to 16 January 2017, 2. Period is 17 January 2017 to 16 January 2018.

Source: MUCHE based on data provided by CCLHD.

The mean unplanned length of stay (LoS) per person was 9.3 days for the intervention and control groups before OBC (see Table 7.3). It decreased more for the control group compared to the intervention group during OBC. This was due to a small reduction in the enrolled group, declining by around 5.2 per cent compared to 44.3 per cent for the not enrolled group.

Table 7.3: Change in mean unplanned length of stay

	Year before OBC[1]	OBC[2]	Absolute change	Proportional change
	per person	*per person*	*per person*	*per cent*
Intervention group	9.3	6.7	-2.6	-27.9
Enrolled group	7.7	7.3	-0.4	-5.2
Not enrolled group	11.0	6.1	-4.9	-44.3
Control group	9.3	6.2	-3.1	-33.7

Note: 1. Period is 17 January 2016 to 16 January 2017, 2. Period is 17 January 2017 to 16 January 2018.

Source: MUCHE based on data provided by CCLHD.

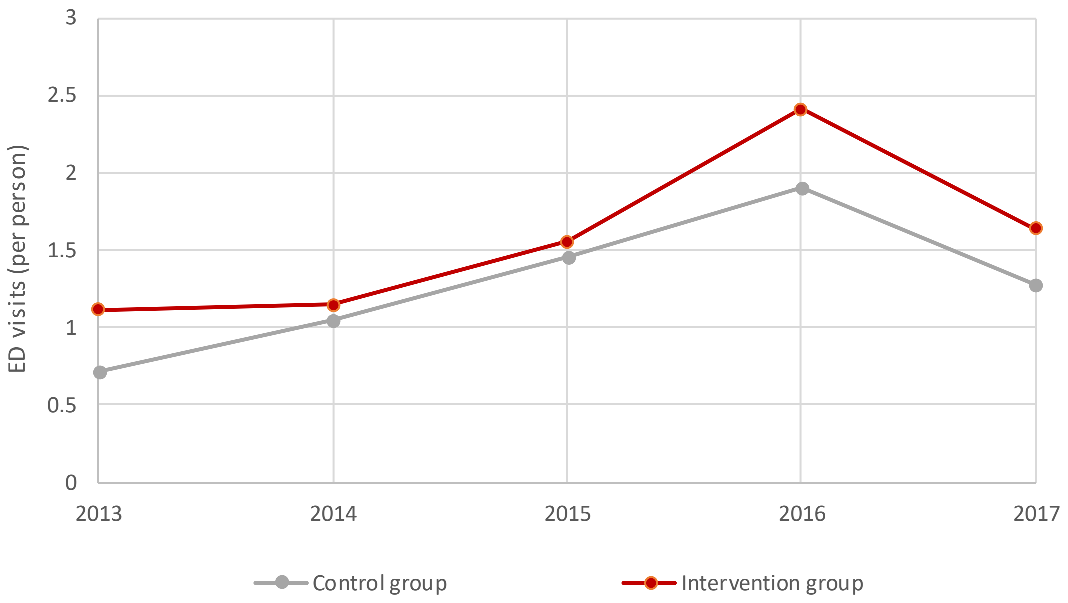
Trends in hospital activity

Hospital activity for the intervention and control groups increased significantly in the four years prior to OBC being implemented and then decreased significantly once OBC was introduced (see Appendix C for enrolled group trends).

ED visits per person increased by 62 and 77 per cent between 2013 and 2016 for the control and intervention group respectively (see Chart 7.1), while unplanned hospitalisations increased by 99 and 141 per cent respectively (see Chart 7.2). Trends for ED visits were similar for the control and intervention groups, while the increasing trend for unplanned hospitalisations was steeper for the intervention group compared to the control group.

Mean unplanned LoS per person increased by 99 and 124 per cent between 2013 and 2016 for the control and intervention groups respectively (see Chart 7.3). Trends were similar across the control and intervention groups.

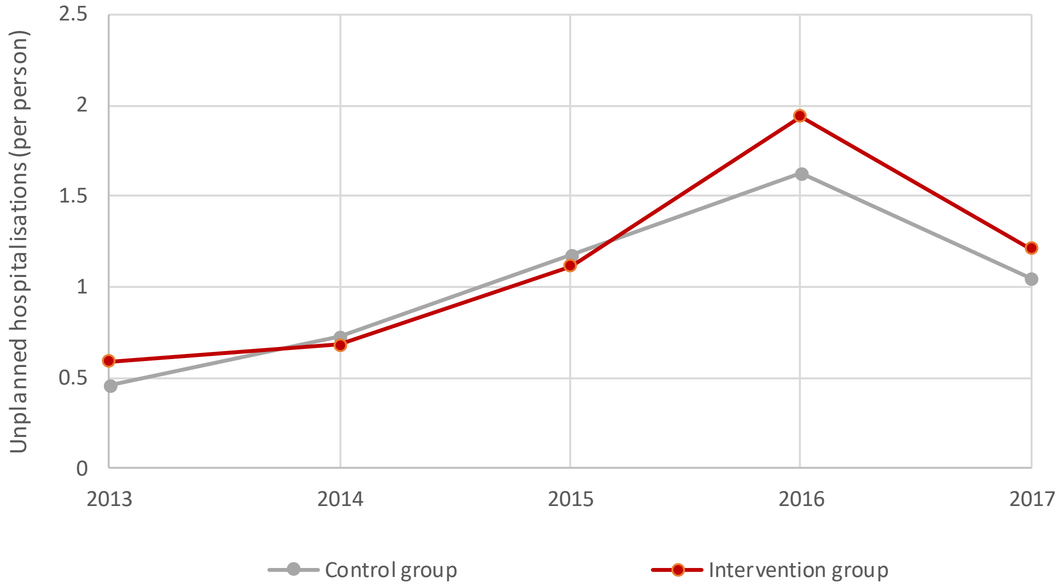
Chart 7.1: Trends in mean number of ED visits



Note: Year 2017 also includes 16 days of additional data considering OBC finished on 16 January 2018.

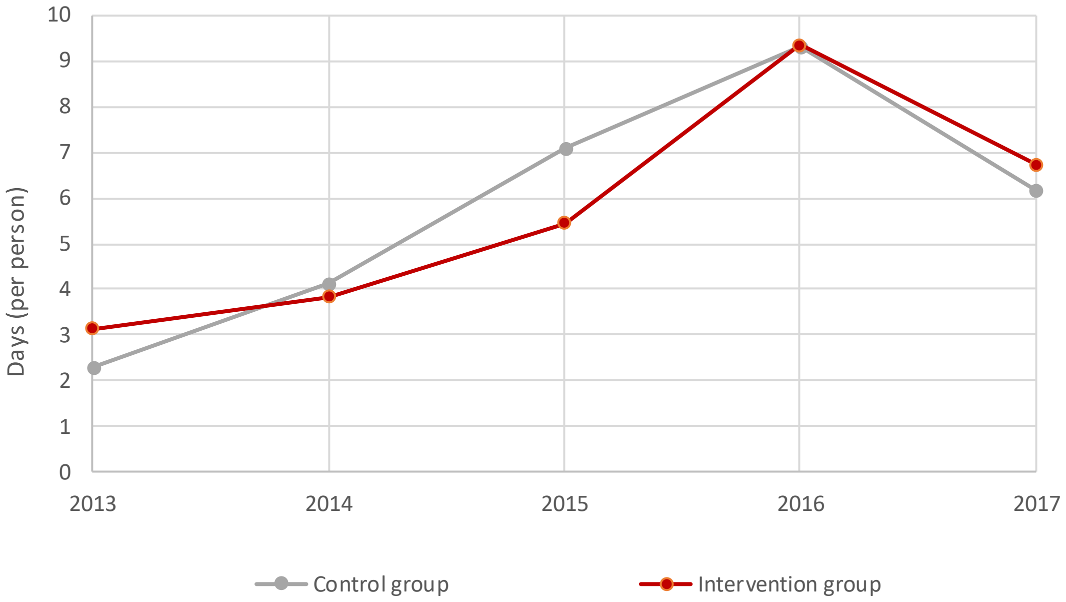
Source: MUCHE based on data provided by CCLHD.

Chart 7.2: Trends in mean number of unplanned hospitalisations



Note: Year 2017 also includes 16 days of additional data considering OBC finished on 16 January 2018.
Source: MUCHE based on data provided by CCLHD.

Chart 7.3: Trends in mean unplanned length of stay per person



Note: Year 2017 also includes 16 days of additional data considering OBC finished on 16 January 2018.
Source: MUCHE based on data provided by CCLHD.

Impact of OBC on hospital use

The intervention and control groups both experienced a reduction in ED visits, unplanned public hospitalisations and LoS over the OBC trial period. However, reductions were not equal across groups suggesting OBC may have impacted hospital use.

Intervention group

Econometric analysis suggests OBC increased ED visits for the intervention group, with an additional 28.5 ED visits for every 100 people in the intervention group compared to the control group. This was statistically significant at the 90 per cent confidence level (see Table 7.4).[14]

OBC may have increased unplanned hospitalisations for the intervention group. It was estimated there were an additional 21 unplanned hospitalisations for every 100 people in the intervention group compared to the control group, although this was not statistically significant at the 90 per cent confidence level. There is some uncertainty with this result given the relatively small sample size.

OBC is unlikely to have changed unplanned LoS per person. While results suggest there was a reduction of 18.3 days per 100 people, this result was highly insignificant. It is likely this result would remain insignificant if the sample size were increased.

Table 7.4: Impact on hospital use for the intervention group

	DiD estimator (β)	Standard error	P> |t|
Emergency Department visits			
DiD analysis	0.089	0.128	0.485
DiD analysis with entropy balancing	**0.285**	**0.157**	**0.071***
Unplanned hospitalisation			
DiD analysis	0.087	0.113	0.440
DiD analysis with entropy balancing	**0.210**	**0.170**	**0.217**
Unplanned LoS per person			
DiD analysis	0.962	0.908	0.290
DiD analysis with entropy balancing	**-0.183**	**1.027**	**0.859**

Note: Intervention group versus control group. Entropy balancing undertaken using individual characteristics and past outcomes. * = significant at 10%.

Source: MUCHE based on data provided by CCLHD.

Enrolled group

Econometric analysis suggests OBC increased ED visits for the enrolled group, with an estimated additional 29.6 ED visits for every 100 people in the enrolled group compared to the control group, which was statistically significant at the 90 per cent confidence level (see Table 7.5).

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[14] The common trend assumption required for DiD analysis was rejected, suggesting DiD analysis with entropy balancing was the most appropriate model.

OBC may have also increased unplanned hospitalisations, with an estimated additional 23.3 unplanned hospitalisations for every 100 people in the enrolled group compared to the control group, although this was not statistically significant at the 90 per cent confidence level. Once again, the small sample size introduces some uncertainty with this result.

OBC is unlikely to have changed unplanned LoS for the enrolled group. While results suggest there was a reduction of 4.2 days per 100 people in the enrolled group, this result was highly insignificant.

Table 7.5: Impact on hospital use for the enrolled group

	DiD estimator (β)	Standard error	P> |t|
Emergency Department visits			
DiD analysis	0.247	0.150	0.101
DiD analysis with entropy balancing	**0.296**	**0.175**	**0.092***
Unplanned hospitalisation			
DiD analysis	0.221	0.133	0.098*
DiD analysis with entropy balancing	**0.233**	**0.168**	**0.167**
Unplanned LoS per person			
DiD analysis	1.973	1.060	0.063*
DiD analysis with entropy balancing	**-0.042**	**1.428**	**0.977**

Note: Enrolled group versus control group. Entropy balancing undertaken using individual characteristics and past outcomes. * = significant at 10%.

Source: MUCHE based on data provided by CCLHD.

Impact on health outcomes

Health related quality of life

Response to the PROMIS 10 survey suggested OBC may not have significantly impacted physical or mental health outcomes (see Table 7.6). While the control group started with slightly better physical and mental health outcomes compared to the enrolled group, the differences in mean scores were not statistically significant at the 90 per cent confidence level.

The physical health score in the PROMIS 10 survey increased for both groups by around 2 per cent but was not statistically significant. The mental health score for the enrolled group also increased but by less than 1 per cent and was not statistically significant. This contrasted with the mental health score of the control group, which decreased by around 4 per cent, although the decline was not statistically significant at the 90 per cent confidence level.

Responses from PROMIS 10 were mapped to EQ-5D-5L using an algorithm developed for this study (see Appendix D) to estimate the change in utility values within the OBC trial period.

The mean utility value for the enrolled group increased from 0.65 to 0.69 between the first and second data collections, equating to a 0.04 increase in utility, although the difference was not statistically significant at the 90 per cent confidence level (see Table 7.7).

Table 7.6: PROMIS 10 survey results

	Enrolled (n=138)			Control (n=43)			Difference in difference
	First collection	Second collection	Difference	First collection	Second collection	Difference	
Physical health score							
Mean	11.25	11.5	0.25	12.05	12.32	0.27	0.02
Standard deviation	2.68	2.52		3.14	3.38		
Highest	19	19	0	18	19	1	
Lowest	7	6	-1	6	6	0	
Mental health score							
Mean	12.09	12.11	0.02	13.12	12.56	-0.56	-0.58
Standard deviation	3.06	3.09		3.87	3.49		
Highest	19	20	1	19	20	1	
Lowest	6	5	-1	4	4	0	

Note: The PROMIS 10 questionnaire consists of ten questions about physical function, pain, fatigue, emotional distress, social health and general perceptions of health. Each question has a severity level from one to five, except for ‘pain’ which has a severity level from one to ten. Two summary scores for physical and mental health were derived, which range from 4 (the worst possible status) and 20 (the best possible status). Response rates for patients completing the survey in both data collection rounds were 66 per cent for the enrolled group and 13 per cent for the control group.

Source: MUCHE based on data provided by CCLHD.

Table 7.7: Change in utility values

	Enrolled (n=138)			Control (n=43)			Difference in differences
	First collection	Second collection	Difference	First collection	Second collection	Difference	
Mean	0.65	0.69	0.04	0.71	0.70	-0.01	-0.05
Standard deviation	0.28	0.24		0.27	0.30		
Highest	0.98	0.98	0	0.97	0.99	0.02	
Lowest	-0.21	-0.21	0	-0.04	-0.37	-0.33	

Note: Utility value estimates were derived by mapping PROMIS 10 results to EQ-5D-5L and calculating utility values. Response rates were 66 per cent for the enrolled group and 13 per cent for the control group.

Source: MUCHE based on data provided by CCLHD.

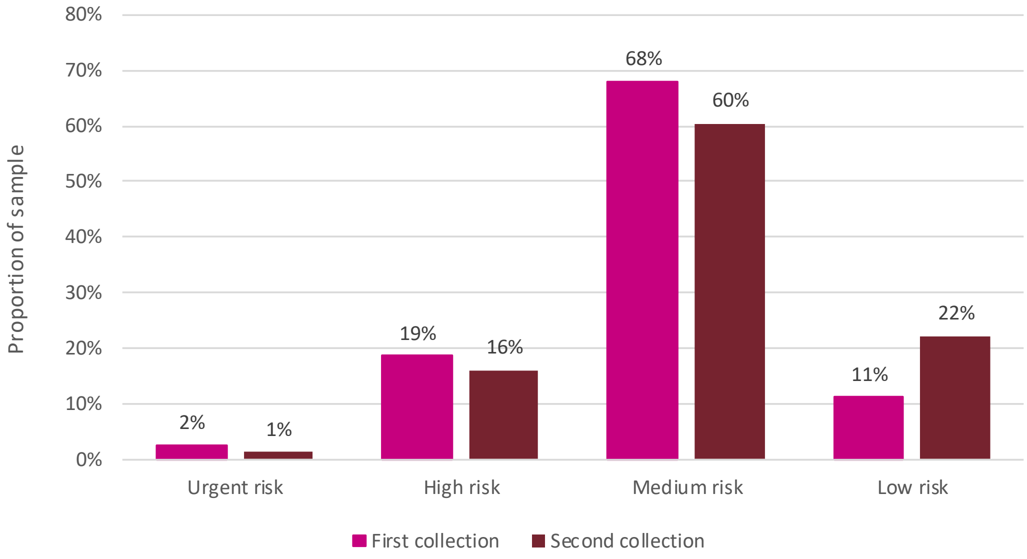
The mean utility for the control group reduced from 0.71 to 0.70, equating to a 0.01 decrease in utility, although the difference was not statistically significant. This suggests the enrolled group enjoyed a 0.05 increase in utility compared to the control group, however this difference was not significant at the 90 per cent confidence level.[15]

Patient health risk

The NSW Chronic Conditions Patient Selection Tool (CCPS) collected information on patients' chronic conditions, health risk factors, psycho-social and demographic factors. Response to the CCPS survey suggests there was a shift in the distribution of risk towards low risk during OBC (see **Error! Not a valid bookmark self-reference.**).

The proportion of enrolled patients in the urgent, high and medium risk categories reduced, while the proportion of enrolled patients in the low risk category increased from 11 per cent to 22 per cent. It is uncertain whether OBC impacted this shift given the control group was not administered the tool.

Chart 7.4: Assessed health risk at the start and finish of OBC for enrolled group



Source: MUCHE based on data provided by CCLHD.

Mortality

Mortality in the intervention group during OBC was similar to the control group, with 9.2 per cent of patients in the intervention group dying compared to 9.6 per cent of patients in the control group (see Chart 7.5).

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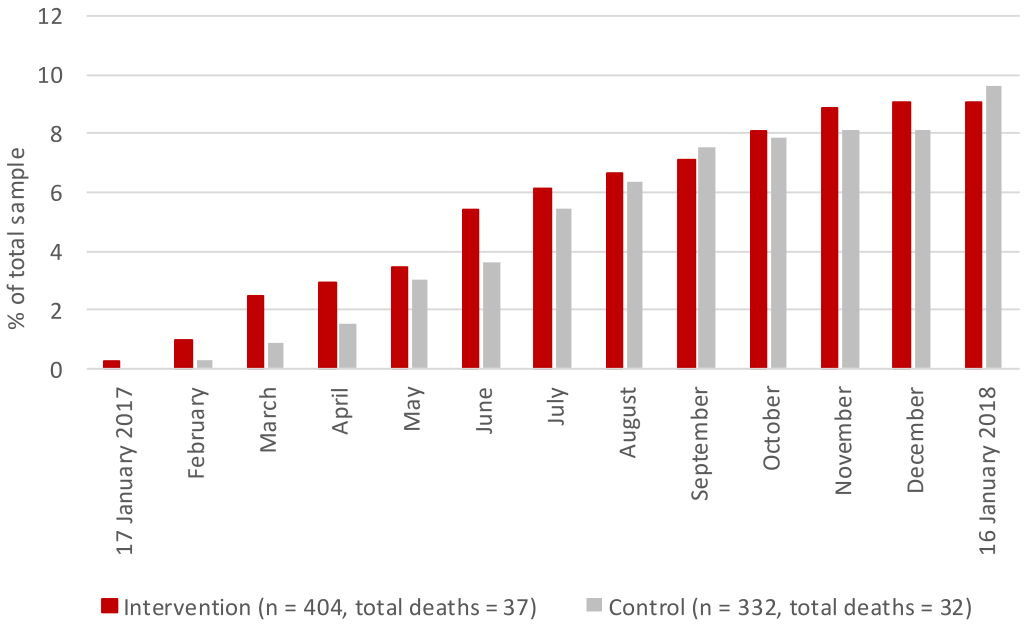
[15] This estimator may be confounded by observable and non observable patient characteristics. Difference in difference (DiD) modelling was not undertaken given the small sample size for the control group.

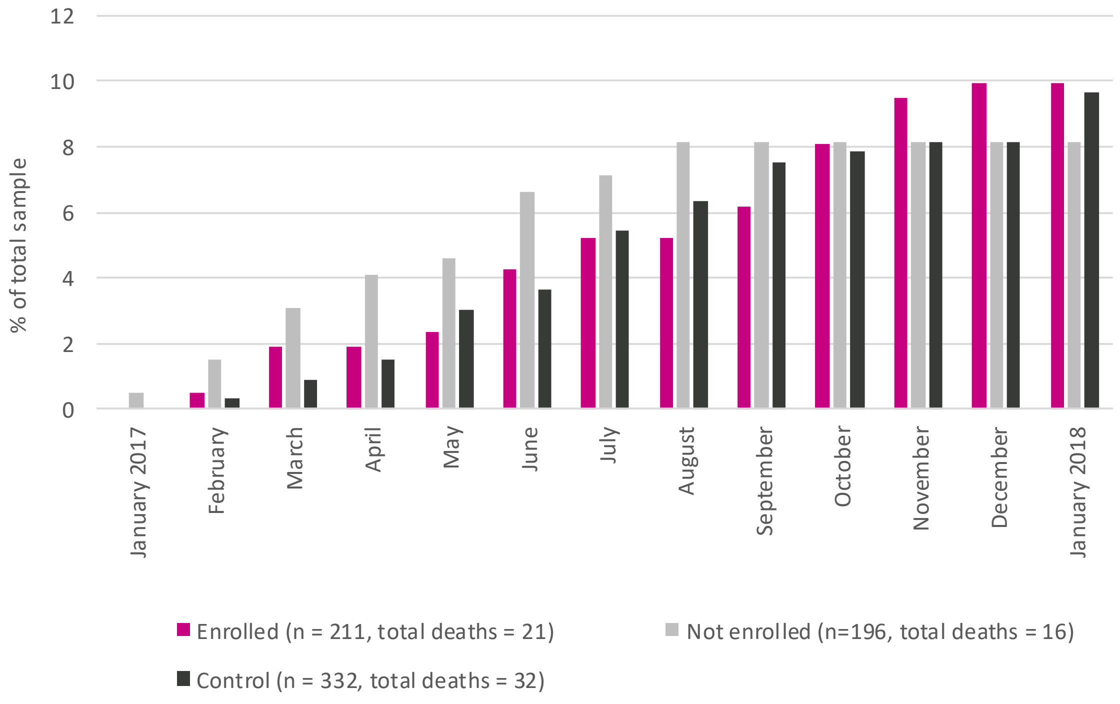
There was some variation in mortality between the enrolled and not enrolled groups, with around 10 per cent of patients in the enrolled group dying compared to 8.2 per cent of patients in the not enrolled group (see Chart 7.6).

Chart 7.5: Accumulated deaths for the intervention and control groups



Source: MUCHE based on data provided by CCLHD.

Chart 7.6: Accumulated deaths for the enrolled, not enrolled and control groups



Note: January 2017 = 17–31 January, January 2018 = 1–16 January.

Source: MUCHE based on data provided by CCLHD.

The difference in deaths is likely due to differences in observed and unobserved characteristics of both groups before the start of OBC (see Chapter 6). Deaths in the control group were potentially underreported if they occurred outside a hospital given these are not always recorded by CCLHD.

Impact on patient experience

A modified Patient Perception of Integrated Care (mPPIC) survey was administered to enrolled patients to evaluate patient experience with the coordinated care models delivered by providers. Patients were surveyed by CCLHD within the OBC trial period and once OBC had finished.

The mPPIC survey consisted of 60 questions, and a thematic analysis was undertaken on the responses. Themes included provider engagement, care received from the provider, care received from specialists, care after hospitalisation, and overall experience. Appendix E provides detailed results from the survey, including response rates.

Provider engagement

Nearly half of patients reported they received a reminder from the provider's office about their appointment, although only 39 per cent received instructions telling them what to expect or how to prepare for the visit. Only around one quarter of patients noted that their provider cancelled or changed the date of an appointment.

Providers seemed to have sought information on patient health and medical history, although not from all patients. While 41 per cent of patients noted that providers always knew the important information about their medical history, 30 per cent noted this was never the case. Similarly, 54 per cent of patients noted providers always asked about things in their work or life at home that affect their health, while 37 per cent suggested this was never the case. Providers seemed to have improved their knowledge of patient health and medical history during OBC.

Most patients seemed to believe the quality of communication from the provider was acceptable. More than half of all patients noted the provider explained things in a way that was easy to understand, listened carefully to them, showed respect for what they had to say, and spent enough time with them. Communication also improved during OBC.

There was less enthusiasm from patients regarding provider efforts to better understand patient preferences. More than one third of patients noted their provider never asked whether they had ideas about how to improve their health, and 41 per cent noted their provider did not talk with them about setting goals for their health. However, 80 per cent of patients thought providers knew the values and beliefs that were important to their healthcare, and 75 per cent of patients believed the care they received from their provider helped them meet their goals.

Care received from the provider

Nearly a quarter of patients noted some things made it hard for them to take care of their health. It seems providers were attuned, with 83 per cent of patients noting that providers asked them about those things, while 69 per cent noted that providers came up with a plan to help address those things.

However, providers were less successful in helping patients decide the most important activities to improve their health, with 43 per cent noting this never happened.

Providers noted their care coordination models helped people gain access to services. This was confirmed by nearly half of patients, who noted they always benefited from providers' help for organising care at home. However, there seemed to have been some gaps in helping people gain access to care, with 37 per cent of patients noting they never received help from providers to organise in-home services.

There was a mixed response on whether providers helped patients increase their self-help capacity. Only 33 per cent of patients reported receiving instructions from their provider on taking care of their health, while 69 per cent of these patients noted the instruction was either always or usually helpful. In contrast, 19 per cent of patients never found the instruction useful.

Most patients (83 per cent) noted they knew how to ask for help if they faced any trouble in taking care of their health at home. However, it seems providers were less successful in helping patients with their medications. While 87 per cent of patients noted they were taking prescription medicine, 43 per cent of them noted that the provider never talked to them about how they were supposed to take their medication. Similarly, 75 per cent of patients noted they never talked about possible adverse reactions to medications with the provider. However, it seems providers had improved their approach to helping patients with their medications between the two data collection points.

Providers noted they regularly met with patients, with the frequency determined by the assessed clinical need and patient preferences. However, 59 per cent of patients noted they were never contacted by the provider between visits, and only 23 per cent noted that providers always contacted them.

Care received from specialists

Survey responses suggest providers were not fully informed about the specialist care being received by their patients. Of the patients, 56 per cent noted the provider never seemed to be informed about the care received and only 26 per cent of patients mentioned that the provider always knew about the received care from a specialist.

Most patients (88 per cent) noted they never had to repeat information to the provider. While this may indicate the provider was fully informed through other channels, information collected from provider interviews suggests this was not the case. Instead, this response may reflect a disconnect with the information the provider would have liked to receive from the patient after a specialist visit, and what the patient believes the provider needs to be informed about to deliver care coordination.

Care after hospitalisation

Patients who were hospitalised noted a low level of care received from the provider after their hospital stay. Only 8 per cent of hospitalised patients were contacted by the provider after their hospital stay, and only 5 per cent were contacted by the provider to check if they were able to follow instructions about any medicines they were prescribed. Similarly, only 22 per cent of patients hospitalised noted that their provider knew the important information about their hospital stay.

Overall experience

Overall, providers were successful in making sure patients were aware of their medical conditions and healthcare options, and helped patients manage their own healthcare. Providers were less successful in understanding the needs and preferences of patients. While 45 per cent of patients noted they thought their provider knew all about their medical needs, 28 per cent of patients thought this occurred only sometimes, and another 28 per cent thought their provider did not know about their medical needs. Similarly, 40 per cent of patients noted the provider did not know about all the medicines they were taking, and 40 per cent also noted nobody from the provider knew them well as a person.

Cost effectiveness

A cost utility analysis was undertaken to estimate the cost effectiveness of OBC for the enrolled group and intervention group compared to the control group.

Incremental cost effectiveness ratios (ICERs) were generated by dividing the change in costs by the change in outcomes. ICERs were compared to an implicit cost effectiveness threshold of $60,000 per QALY, derived from listings of medications on the Pharmaceutical Benefits Scheme

Health outcomes were measured using utilities derived from mapping PROMIS 10 survey responses to EQ-5D-5L utility values. A healthcare system perspective was taken. Costs included those associated with a change in unplanned hospitalisation between the enrolled and intervention groups compared to the control group, along with OBC program costs. Costs associated with patient care outside hospital could not be included as data were not collected.

The time horizon was one year, representing the OBC trial period. There is some uncertainty whether the impacts on ED visits and unplanned hospitalisation would persist once OBC stopped. A one year time horizon may underestimate changes to health outcomes and associated costs if they persist beyond this period.

Hospital costs

Costs associated with ED visits and unplanned hospitalisations were broadly similar for the control and intervention groups, demonstrated through similar means, medians and standard deviations (see Table 7.8). Testing the bootstrapped mean differences suggests they were not significantly different from zero at the 95 per cent confidence level.

Cost distributions for ED visits (see Chart 7.7) and unplanned hospitalisations (see Chart 7.8) are right skewed, which is typical of cost distributions in healthcare because costs cannot be negative (placing a lower bound on costs) and many patients require more healthcare than the average patient.

There are substantial differences between the two cost distributions. ED visit costs are somewhat bounded given some patients briefly visit ED, and nearly all patients will either be admitted or sent home within 24 hours. There is little chance for large cost outliers.

Table 7.8: Costs associated with ED visits and unplanned hospitalisations[1]

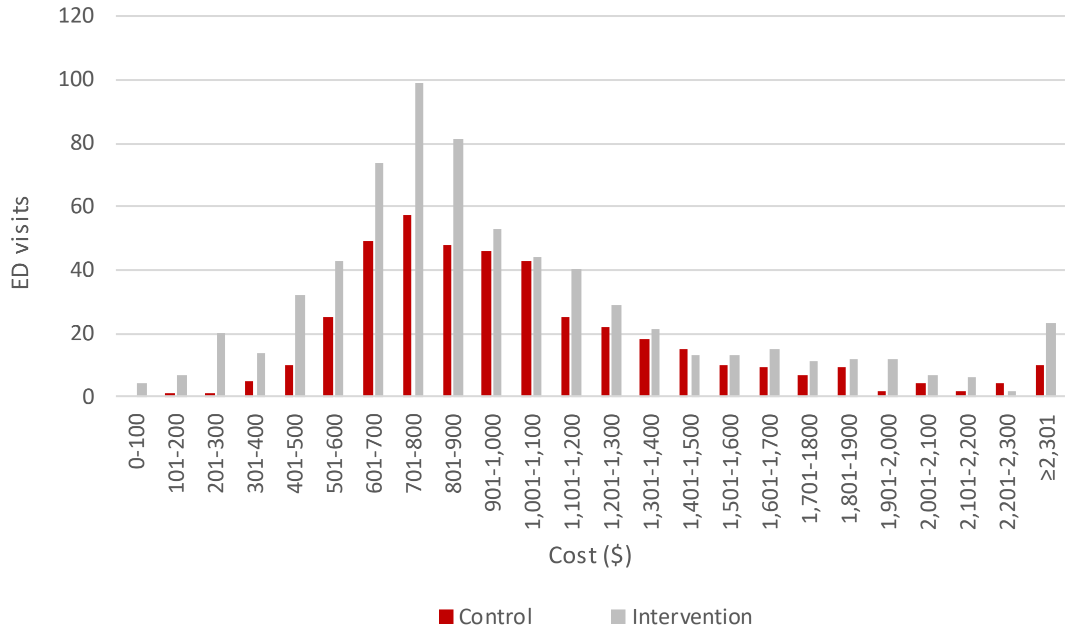
	Control group	Intervention group
	$	$
ED visits[2]		
Min	182	35
Max	4,127	4,204

Sum	441,048	673,590
Mean	1,010	954
Median	903	829
Standard deviation	462	526
Unplanned hospitalisations[3]		
Min	98	60
Max	102,647	150,182
Sum	3,456,291	4,883,260
Mean	4,514	4,636
Median	796	813
Standard deviation	8,943	9,919

Note: 1. Data for the duration of OBC (17 January 2017 to 16 January 2018). 2. Cost data were missing for all ED visits that departed before 1 July 2017, equating to 48 per cent of all cost data for ED visits. Missing cost data were imputed by multiplying the conditional mean cost per minute spent in ED by the number of minutes spent in ED. 3. Cost data were missing for all unplanned hospitalisation episodes that ended before 1 July 2017, equating to 45 per cent of all cost data for unplanned hospitalisation episodes. Missing cost data were imputed by multiplying the conditional mean cost per day by the number of days spent in hospital.

Source: MUCHE based on data provided by CCLHD.

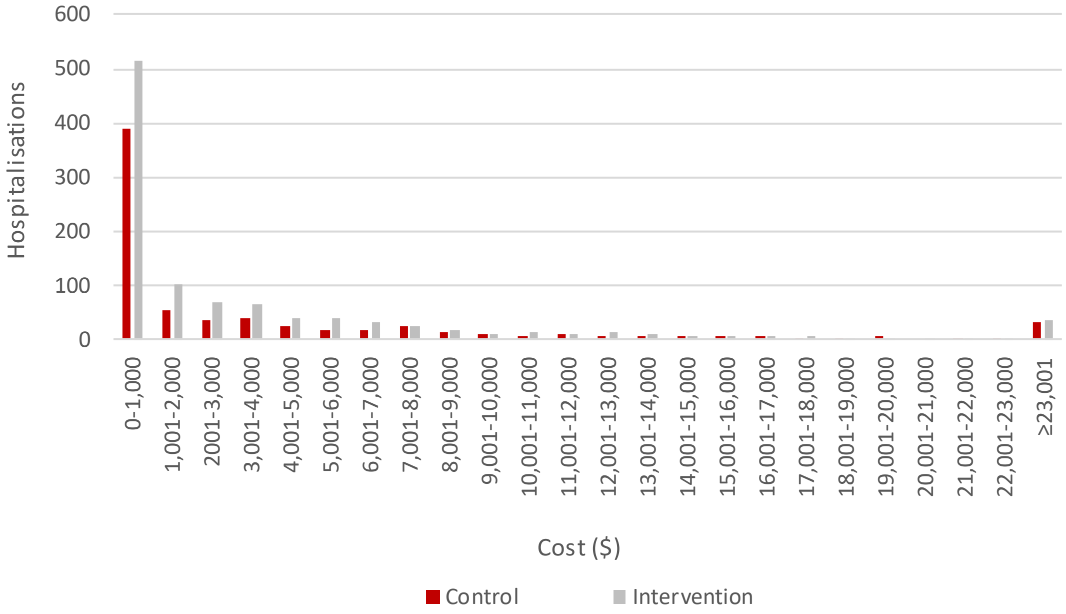
Chart 7.7: Distribution of ED visit costs during OBC



Note: Data for duration of OBC (17 January 2017 to 16 January 2018).

Source: MUCHE based on data provided by CCLHD.

Chart 7.8: Distribution of unplanned hospitalisation costs during OBC



Note: Data for duration of OBC (17 January 2017 to 16 January 2018).

Source: MUCHE based on data provided by CCLHD.

Unplanned hospitalisation costs are characterised by the distribution in length of stay. Most patients stayed for a short period, typically one or two nights and were discharged. Some patients required much more hospital care, resulting in large cost outliers that are several standard deviations above the mean.

Impact on hospital costs

The impact of OBC on hospital costs was estimated by calculating the change in ED visits and unplanned public hospitalisations from coefficients derived from DiD with entropy balancing modelling and multiplying this change by their mean costs.[16]

It was estimated that OBC increased costs for the intervention group by $110,659 due to increased ED visits and potentially increased costs for the intervention group by $396,239 due to increased unplanned hospitalisations (see Table 7.9).[17] It was estimated that OBC increased costs by $59,018 due to increased ED visits and potentially increased costs for the enrolled group by $225,759 due to increased unplanned hospitalisations.

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[16] A change in costs associated with differences in unplanned LoS per person was not estimated given the result was highly insignificant.

[17] Cost estimates for unplanned hospitalisations are uncertain for the intervention and enrolled groups given the impact of OBC on unplanned hospitalisations was not statistically significant at the 90 per cent confidence level.

Table 7.9: Change in hospital costs

	β	Estimated change	Mean cost	Total cost
		number	*$*	*$*
Intervention group				
ED visits	0.285	116	954	110,659
Unplanned hospitalisations	0.21	85	4,636	396,239
Total				506,898
Enrolled group				
ED visits	0.296	62	954	59,018
Unplanned hospitalisations	0.233	49	4,636	225,759
Total				284,778

Note: ED visit costs were estimated by multiplying the mean ED visit cost by the estimated change in ED visits. Unplanned hospitalisation costs were estimated by multiplying the mean cost per unplanned hospitalisation day by the estimated change in unplanned hospitalisations.[18]

Source: MUCHE based on data provided by CCLHD.

Program costs

The total cost of OBC for design, implementation, management, evaluation and payments to providers was $1.1 million. Costs associated with design and evaluation were excluded from the total cost included in the economic evaluation as design costs will not be incurred if OBC continued, while evaluation costs are not part of OBC.

Removing these costs results in total program costs of $780,780, which equates to $1,918 per person in the intervention group or $3,736 per person in the enrolled group. Costs related to project management, project governance and funding to providers are provided in Table 7.10.

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[18] Cost data was not available for ED visits or unplanned hospitalisations experienced outside the duration of OBC. This meant DiD analysis could not be used to estimate the impact of OBC on hospital costs.

Table 7.10: OBC program costs used in the economic evaluation

	Cost
	$
Program Management	30,000
Project Steering Group	5,000
Project Manager	100,000
Contracts with providers	645,780
Total	780,780

Source: CCLHD.

Other costs

Costs incurred outside hospital were not included in the economic analysis as they could not be collected from intervention group patients who decided not to enrol or from control group patients. These costs are associated with changes to primary care, allied health, pharmaceuticals and social care services resulting from care coordination. Out of pocket costs were also excluded due to data limitations.

Economic evaluation results

An economic evaluation was first undertaken using only significant impacts from OBC on hospital costs. This approach included costs associated with an increase in ED visits but excluded costs associated with unplanned hospitalisations and changes to health utilities, given both were found to be statistically insignificant. This resulted in the OBC costing $839,798 for the enrolled group and $891,439 for the intervention group without any significant impacts on health outcomes.

While results for unplanned hospitalisations and changes to health utilities were statistically insignificant, this may have resulted from the small samples. A cost utility analysis was therefore undertaken as a scenario analysis using coefficients for unplanned hospitalisations and differences in health utilities, assuming these results represent the true effects of OBC.

Under this scenario, the enrolled group experienced a 10.45 increase in QALYs at an increase in costs of $1.1 million, comprised of $780,780 in program costs and $284,778 associated with changes to hospital use (see Table 7.11). This equates to an ICER of $101,967 per QALY.

Assuming the not enrolled group experienced the same health utility change as the control group, the intervention group also experienced a 10.45 increase in QALYs at an increase in costs of $1.3 million, comprised of $780,780 in program costs and $506,898 associated with changes to hospital use (see Table 7.10). This equates to an ICER of $123,223 per QALY.

These results should be interpreted with caution. Other benefits likely to have accrued to patients, such as improved patient experience and improved ability to self-care (found in responses to the mPPIC survey) were not included in the ICERs.

Table 7.11: Incremental cost effectiveness ratios

	Program cost[1]	Change in hospital cost[2]	Total cost	QALY	ICER
	$	*$*		*number*	*$ per QALY*
Enrolled group[3]	780,780	284,778	1,065,558	10.45	101,967
Intervention group[4]	780,780	506,898	1,287,678	10.45	123,223

Note: 1. Program costs were assumed to be equally relevant for the enrolled and intervention groups. A change in hospital costs was estimated using the DiD estimators and mean costs for ED visits and unplanned hospitalisations. 3. This assumed that mean utility estimates derived from the 138 enrolled patients who completed the PROMIS 10 survey were representative of the mean utility estimates of the 71 patients where PROMIS 10 data were not available. 4. This assumed change in health outcomes for the not enrolled group were the same as the control group given the not enrolled group did not receive care coordination.

Source: MUCHE based on data provided by CCLHD.

Sensitivity analysis

A sensitivity analysis was undertaken to determine the likelihood of OBC being cost effective. This was to account for uncertainty associated with the estimated impacts of OBC on ED visits and unplanned hospitalisations, uncertainty associated with their unit costs and the uncertainty associated with estimated increases in health utilities.

A Monte Carlo simulation was undertaken using 10,000 iterations. Normal distributions were developed for the coefficients associated with the impact of OBC on ED visits and unplanned hospitalisations, using the standard error derived from the DiD analysis with entropy balancing. A normal distribution was developed for the difference in health utility values, while gamma distributions for the unit costs were developed from the hospital cost data received from CCLHD (see Table 7.12).

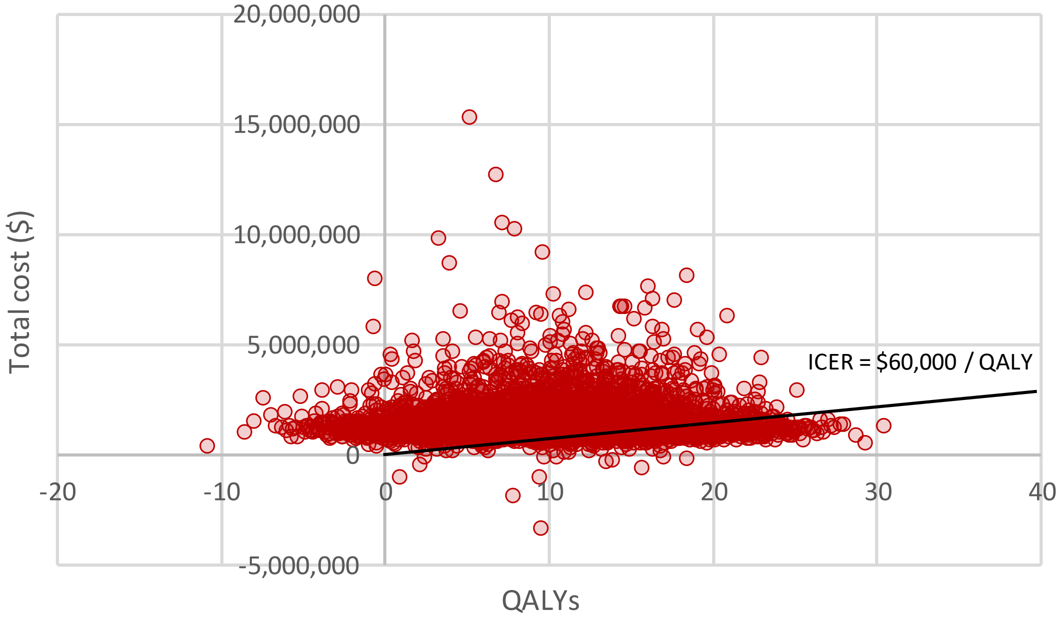
Table 7.12: Sensitivity analysis parameters

	Mean	Standard error	Distribution
ED visits - Intervention	0.285	0.157	Normal
ED visits - Enrolled	0.296	0.175	Normal
Unplanned hospitalisations - Intervention	0.21	0.17	Normal
Unplanned hospitalisations - Enrolled	0.233	0.168	Normal
Mean cost - ED visits	$954	526	Gamma
Mean cost - Unplanned hospitalisations	$4,636	9,920	Gamma
Health outcomes - Utility	10.45	5.225	Normal

Source: MUCHE.

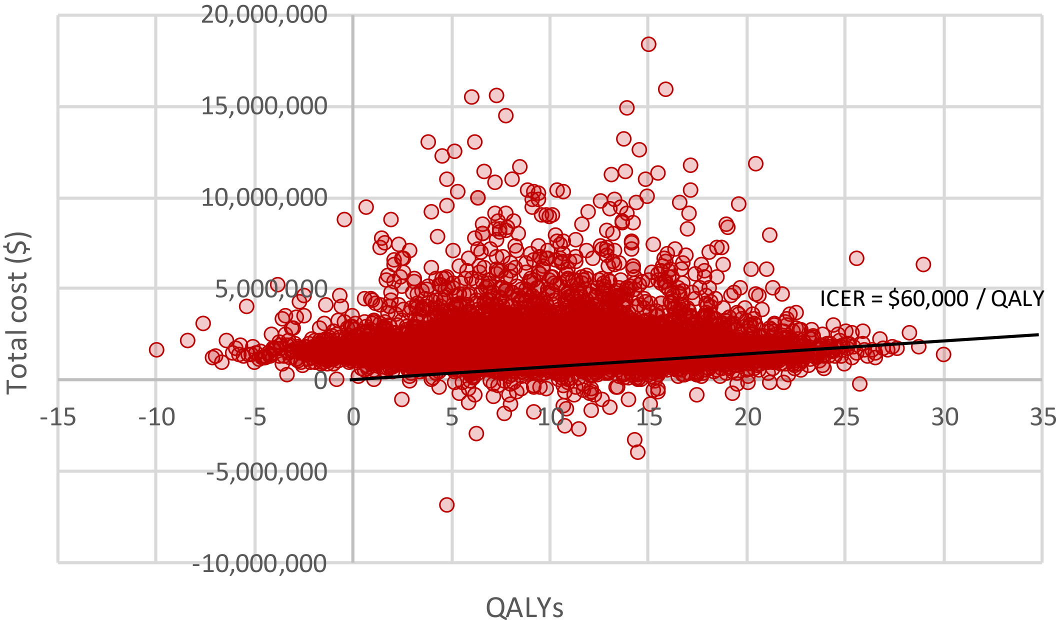
The sensitivity analysis suggests OBC is unlikely to be deemed cost effective when compared to a $60,000 per QALY cost effectiveness threshold. This is demonstrated through the Monte Carlo simulation results (see Chart 7.9 and Chart 7.10), with most simulations lying above the threshold. Cost effectiveness acceptability curves suggest there is a 7.0 per cent chance of OBC being cost effective for the enrolled group (see Chart 7.11) and a 4.8 per cent chance of OBC being cost effective for the intervention group (see Chart 7.12).

Chart 7.9: Monte carlo simulation results – Enrolled group



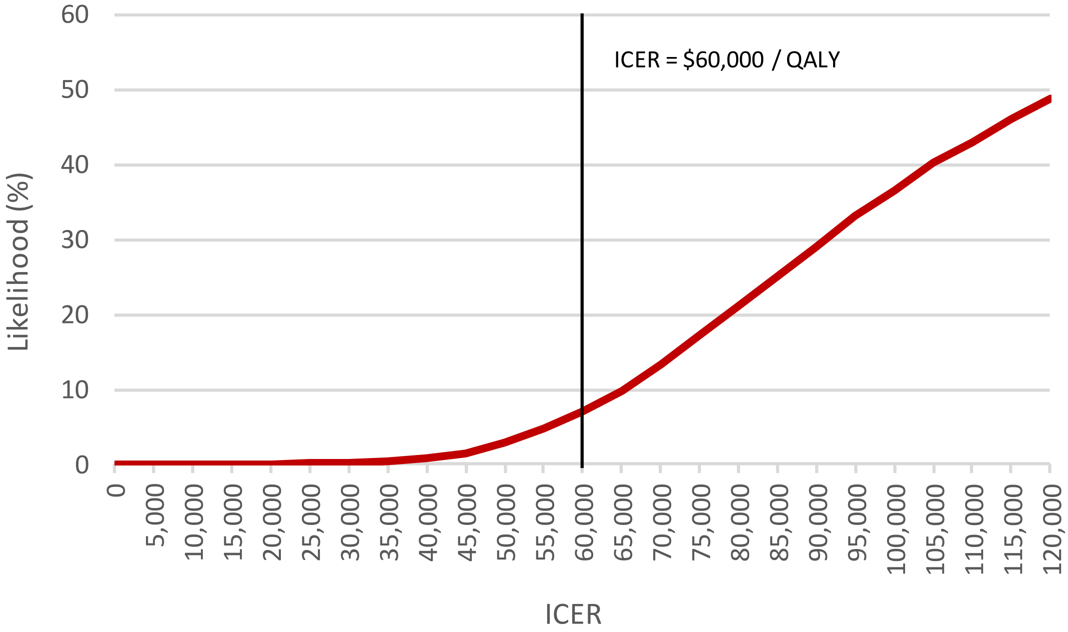
Source: MUCHE.

Chart 7.10: Monte carlo simulation results – Intervention group



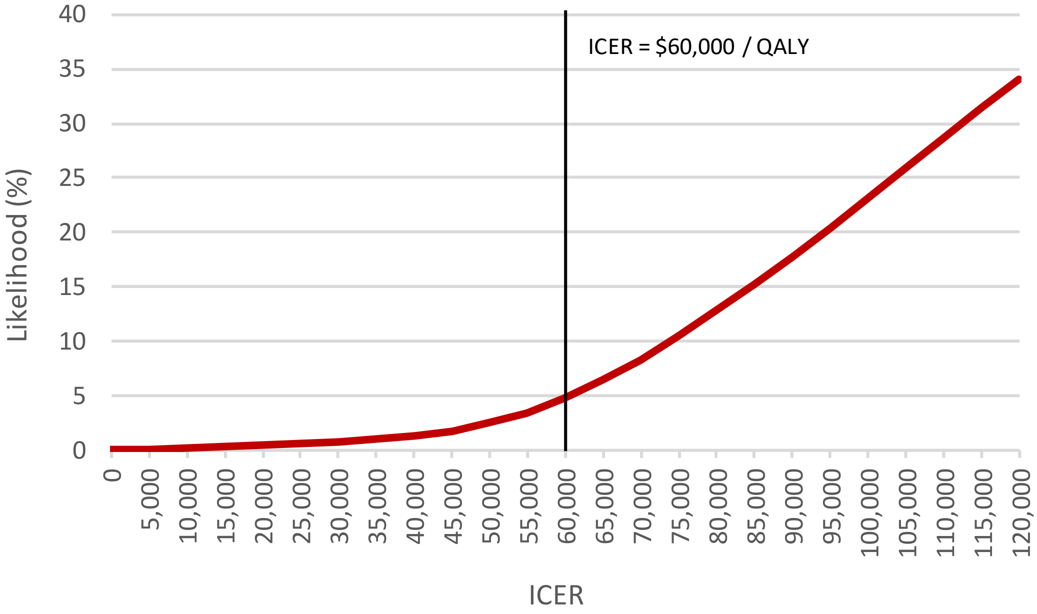
Source: MUCHE.

Chart 7.11: Cost effectiveness acceptability curve – Enrolled group



Source: MUCHE.

Chart 7.12: Cost effectiveness acceptability curve – Intervention group



Source: MUCHE.

Return on investment

Return on investment (ROI) analysis was undertaken by dividing the difference between OBC outputs and program costs by program costs. OBC outputs were represented by an increase in ED visit costs of $110,659 for the intervention group. Program costs included all costs associated with design, implementation, management, evaluation and payments to providers and totalled $1.1 million (see Table 7.13). Results suggest there was a negative ROI of 110 per cent (see Table 7.14).

Table 7.13: Program costs used in the ROI

	Cost
	$
Program Management	30,000
Project Steering Group	5,000
Project Manager	100,000
Project Support	35,000
Consultancy - Evaluation	191,380
Consumables	1,000
Contracts with providers	645,780
Total	1,113,160

Source: CCLHD.

Table 7.14: ROI associated with the intervention group

Program outputs (increased ED visits)	$110,659
Program costs	$1,113,160
Difference in outputs vs costs	$1,223,819
ROI (%)	109.9

Source: MUCHE.

8. Factors impacting outcomes

While the impact of OBC was small and potentially insignificant, patients reported they were broadly satisfied with their care coordination. This chapter reviews the potential factors impacting outcomes in the context of the process evaluation framework and evaluates the commissioning process used against the NSW Commissioning and Contestability Practice Guide.

Implementation

Enrolment process

Providers were required to enrol their allocated cohort of patients into coordinated care. CCLHD provided some support, sending letters to inform potential participants of the program, and giving patient contact information to providers.

However, unforeseen difficulties with the enrolment process delayed enrolment. CCLHD noted there were barriers to accessing patient contact details due to NSW privacy concerns which delayed the enrolment process, although probably did not impact outcomes.

There was also three months between CCLHD sending out letters to potential patients, and providers undertaking enrolment. Some patients noted they had not received a letter from CCLHD and were unaware of the program. Providers noted this created confusion for some patients as they were unsure why they had been selected. Other patients and their carers became suspicious of the provider's intentions and were reluctant to enrol.

Providers also expressed a desire to be involved in the enrolment process prior to care coordination starting. This would have allowed care coordination to begin for everyone at the same time and given providers a full year to deliver care coordination to patients, increasing their chance of generating better health outcomes.

Patient reach

OBC was structured to incentivise providers to enrol as many of their allocated patients as possible. Payment was based on reducing the number of unplanned public hospital bed days, which could not be achieved without keeping some patients out of hospital through care coordination.

The number of patients available for enrolment at the start of OBC was less compared to when providers signed their contract. The initial intervention group consisted of 587 patients, but CCLHD removed 143 patients due to patients opting out, moving into a residential aged care facility, not being contactable or dying. There was a four-month delay in accessing patient information, which meant patient circumstances had changed. A further 37 patients were removed by providers for the same reasons within the first 28 days of OBC starting.

Providers noted they sought to enrol all patients allocated to them by CCLHD, but they managed to enrol only 52 per cent. The lower than expected enrolment directly impacted the ability of providers to improve outcomes given they could not provide care coordination to these patients. Effectively, providers could only manage around half their funding risk.

Provider response to reduced patient reach was also restricted. Providers could not enrol patients later if the patient had originally declined enrolment but their preference changed. This may occur if the patient experienced an unplanned hospitalisation, or lost support from their carer, for example.

This reduced the ability of providers to manage their financial risk. One provider noted they would have liked the opportunity to enrol patients once they were discharged from an unplanned hospitalisation. The provider noted it would have also provided them with an opportunity to develop a coordinated care plan for the patient based on their discharge plan.

The initial reduction in patients and the limited success in enrolling patients reduced providers' ability to achieve economies of scale. One provider noted this reduced the incentive to invest in additional healthcare infrastructure, such as software programs to better manage patients. Both providers noted they would have accepted more patients from CCLHD as it would have allowed them to improve productivity through implementing more flexible staff arrangements.

Patient composition

The primary objective of OBC was to keep vulnerable older people healthy and at home, through cost effective coordination of health and community care services. This led CCLHD to select patients based on minimum criteria, including age (greater than 65 years), at least one unplanned hospital inpatient stay in the last year, and at least two chronic conditions.

Interviews with providers and CCLHD suggest the risk stratification process resulted in a cohort of patients older and more complex than originally anticipated. Providers noted they were limited in their capacity to improve health outcomes for their patients with more complex conditions, such as dementia or those receiving palliative care. They suggested these patients required a more healthcare related approach, with a greater focus on additional nursing support. One provider noted their care coordination model was better suited for patients with earlier stages of chronic disease.

The amount of patient health information shared with providers by CCLHD before the contract was signed was limited due to privacy concerns. It consisted of a predicted number of public unplanned hospital bed days during OBC, but no other health information.

This reduced provider capacity to assess patient cohort risk, tailor their care model to patient needs and estimate their resource requirements before starting OBC. One provider noted they reduced a full time position to a part time position, and increased their nursing capacity, in response to the difference between their expected patient cohort profile and their enrolled group.

The lack of prior patient information also limited providers in assessing their financial risk as they could not assess the likelihood of patients in the not enrolled group having an unplanned hospitalisation. Providers were also limited in their capacity to target patients with complex healthcare needs first in the enrolment process, as each patient had to be assessed by the provider before a complete picture of the enrolled patient cohort could be determined.

Timeframe

OBC operated for one year, which limited the potential for providers to impact health outcomes. While both providers had experience providing care for older people with chronic conditions through their Home Care packages, neither had experience with the explicit objective of keeping people out of hospital. Providers were required to undertake a learning process by adjusting their care model and patient monitoring.

There was also some delay in patients accessing care coordination. It took providers between three to six months to fully establish their enrolled group, which meant some patients received nearly a full year of coordinated care, while other patients received only six months.

Providers were also required to assess patient needs, develop a care plan and seek access to care services, which were limited in some instances (e.g., providers noted delays in access to Home Care packages). This further delayed access to care for patients, limiting the capacity of providers to impact health outcomes.

Measuring outcomes

Payments to providers were based on outcomes measured by the number of unplanned public hospital bed days avoided. This was determined by the number of unplanned hospitalisations and the length of stay once admitted.

Care coordination was expected to reduce the number of hospitalisations. It also had the capacity to reduce the length of stay for an unplanned hospitalisation if care coordination by providers ensured patients were admitted with less severity. This could happen if patients identified a decline in health status earlier because their health literacy improved or they had better access to their GP through improved transport, for example. Results from the modified PPIC survey suggest patients received instructions from their provider on how to take care of their health, while patient journeys and patient monitoring reports confirm transport was provided to patients for GP visits.

Providers had no direct control over the length of stay once patients were admitted. This was particularly the case given providers were mostly unaware when their patient entered hospital, so could not participate in discharge planning to expedite their departure. Using unplanned public hospital bed days as the measure reduced the ability of providers to achieve outcomes.

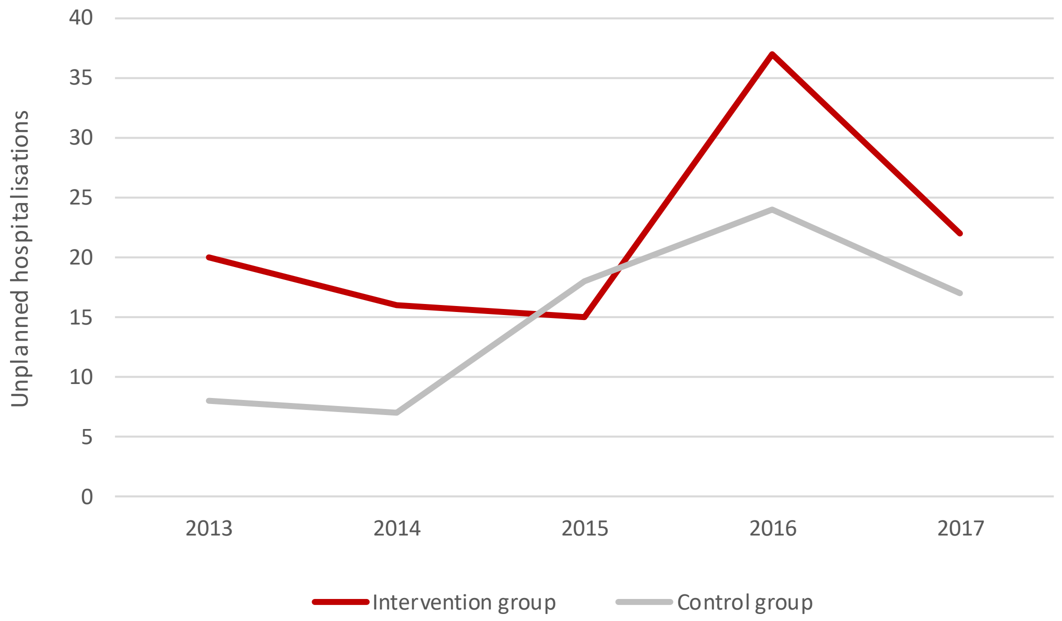
CCLHD estimated that each patient cohort allocated to providers would use 40 per cent of bed days experienced in the year prior. This was the basis for establishing bed day targets with providers. The reduction in bed days was based on experience in a patient group drawn from the previous year's hospital admission dataset ending in June 2016.

This exposed providers to macro health risks to patients that were prevalent throughout OBC but not prevalent in the period of estimation. In particular, the 2017 influenza season experienced the highest levels of activity since the 2009 pandemic year, which increased cases of Influenza A (H3N2) particularly within the elderly and put additional pressure on hospitals.(43) This increased influenza notifications in the CCLHD from 1,080 in 2016(44) to 4,121 in 2017.(45)

Providers believed the severe flu season did not significantly impact their unplanned hospitalisations. Hospital administration data suggest this may have been the case, with a reduction in influenza related unplanned hospitalisations for the intervention group between 2016 and 2017 (see Chart 8.1).

While part of this reduction may have resulted from providers ensuring their patients received an influenza vaccination, there was also a reduction in influenza related unplanned hospitalisations for the control group. There was also no indication of an increase in influenza presentations to emergency departments in the hospital administrative data provided by CCLHD.

Chart 8.1: Trends in influenza related unplanned hospitalisations 2013 to 2017



Note: Influenza related hospitalisations comprise AR-DRG codes E62A and E62B.

Source: MUCHE based on data provided by CCLHD.

Mechanisms of impact

Patient monitoring

Both providers triaged patients into low, medium and high care needs at the first meeting with the patient and developed a care plan based on those needs. The extent to which patients were monitored differed across providers, but generally low care need patients received a phone call every quarter, while high care need patients received multiple phone calls and in-home visits.

Data collected from quarterly patient monitoring reports showed both providers documented a high level of contact in the first half of OBC, but this dropped off in the third and fourth quarters. This may be the result of reduced reporting, rather than reduced patient contact, given data from providers was incomplete for the second half of OBC.

Providers noted they sought to understand the needs and preferences of patients and developed a care plan accordingly in the first patient meeting. Results from the modified PPIC survey suggest this may not have occurred. Of all patients taking medication, 43 per cent noted that the provider never talked to them about how they were supposed to take their medication, and 75 per cent of patients noted they never talked about possible adverse reactions to medications with the provider. Similarly, 59 per cent of patients noted they were never contacted by the provider between visits, and only 23 per cent noted that providers always contacted them.

It is unclear whether the level of patient monitoring given by providers was appropriate for achieving outcomes. More monitoring was provided to people categorised with high care needs, which is expected to have improved health outcomes, but greater monitoring for patients categorised with low care needs may have helped providers to respond earlier to any increased healthcare need.

Patient behaviour

A fundamental assumption in the OBC program logic was that providers would identify health and social care needs, organise these services for their patients, and patients would access these services as recommended, with some assistance from available carers. This was particularly for patients with less care complexity, where providers encouraged patients to take an active role in self-care and limited their patient monitoring to around once every three months.

Providers noted their efforts to improve health outcomes were hampered by a lack of patient engagement and motivation to change health risk behaviours. For example, one provider organised access to wellness classes but these were not attended by patients despite the provider organising transport.

Providers noted that many patients experienced mental ill health such as anxiety and depression, which was exacerbated by social isolation. Data from the PROMIS 10 survey suggests mental health did not significantly change for enrolled patients throughout the duration of OBC, but declined for the control group, although this was not significant.

Data from patient monitoring reports suggest around three quarters of patients had access to a carer. Patient journeys suggest some patients were extremely reliant on their carer to manage their care throughout OBC, while other patients provided care to their spouse. Providers noted that some carers also required additional health and social care, including mental health treatment, which was organised by providers on occasions. Given access to quality care was not available for some patients, the ability for providers to ensure patients accessed recommended health and social care services was also reduced.

Financial incentives

OBC was developed on the assumption that greater payments to providers based on outcomes will encourage provider behaviour to reduce more unplanned public hospital bed days. Providers were encouraged to seek a greater proportion of their funding based on outcomes by increasing the unit price per unplanned bed day saved.

Both providers chose to accept all funding based on outcomes. This increased their revenue potential but also their financial risk given the providers would not receive any revenue if they did not reduce unplanned public hospital bed days for their allocated cohort. Providers could also increase their revenue through delivering services to patients that were funded through the Commonwealth Home Support Programme or Home Care packages, which reduced some financial risk given this revenue was not based on outcomes.

The strength of the incentive generated by the outcomes based payment model was the prospect of achieving outcomes, and the size of the payment attached to outcomes. This was muted in the final six months of OBC when both patient cohorts allocated to providers had experienced their expected annual number of unplanned hospital bed days in the first six months of OBC. Hospital administration data show several patients experienced a significantly greater length of stay for their unplanned hospitalisation compared to the mean. While the mean length of stay was 3.8 days, the maximum was 63 days.

As providers could no longer meet their unplanned public hospital bed day targets, there was no financial incentive for providers to continue offering coordinated care. A fundamental program logic assumption had collapsed.

CCLHD renegotiated contracts with both providers to ensure they continued to deliver care coordination for the trial period and safely handover care. However, funding was no longer based on outcomes but instead on performing specific activities negotiated by CCLHD. Consequently, only the first half of OBC was truly based on outcomes.

CCLHD could have asked providers to uphold their contractual obligations and continue to provide care coordination until the end of OBC. Interviews with the Steering Committee suggests this was not a realistic option as CCLHD had interpreted the NSW Government Model Litigant Policy for Civil Litigation as having a responsibility to not financially disadvantage a provider.(46)

It is unclear whether the change in contract terms impacted the behaviour of providers. Changes in response to questions in the modified PPIC survey between the first and second data collection points suggest providers improved in some areas in the second half of OBC but worsened in other areas.

GP involvement

One primary assumption in the program logic was that providers would work closely with their patients' GPs throughout OBC. CCLHD thought that providers would communicate with patient GPs on a regular basis, initially to develop an understanding of the patient's health condition, but to also develop a care coordination plan, monitor the patient's healthcare needs and make care decisions together with the patient. The purpose of CCLHD selecting patients from one of four GP practice groups selected prior to OBC was to help form a bridge between providers and GPs.

Both providers noted that communication with GPs was difficult to establish, which was confirmed by the quarterly monitoring reports. Providers noted in their interviews that being able to establish GP relationships before the beginning of OBC would have been useful.

While providers made efforts to set up after-hours care meetings, according to providers, GPs were not available. One provider suggested they could have spent more effort engaging with GPs by arranging meetings rather than sending letters, while the other provider suggested GPs were not comfortable with the provider being the lead care coordinator. A lack of remuneration opportunities for the time spent with providers would have also reduced GPs' incentive to participate.

While GPs attended industry briefings before OBC began, CCLHD did not receive an expression of interest from a GP among the twenty received from a mix of local and non-local organisations, not-for-profits and for-profit organisations. One potential reason noted by the Steering Group was GP funding is traditionally fee for service paid through the Medicare Benefits Schedule. It was thought GPs may be less inclined to take on a relatively large funding risk associated with not achieving outcomes given they generally operate as a small business.[19]

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[19] This is not always the case with organisations such as Healius Limited operating many large scale medical centres.

Access to services

Both providers coordinated a range of community care and home care services to patients, such as arranging transport to service providers and Meals on Wheels. Many patients also relied on access to home care services funded through Home Care packages, such as nursing. These services were also delivered by both providers, and provider handover notes to CCLHD suggest services funded through Home Care packages made up most services accessed by patients.

Results from the modified PPIC survey also suggest more than one third of patients never received help from providers to organise in-home services. Information from patient journeys suggests providers are likely to have categorised these people as low care need.

Providers also noted delayed access to Home Care packages for new patients, and for patients to access higher levels of Home Care packages. This limited their ability to coordinate care appropriately, and their ability to impact health outcomes. One provider noted it took one year for a patient to be assessed and to gain access to the Home Care package level deemed appropriate at their assessment.

Context

Communication

CCLHD sought an open communication channel with both providers. Providers and CCLHD formed a strong working relationship, with providers and CCLHD keeping in close contact. This was facilitated by the monitoring regime CCLHD had developed in their commissioning approach, including quarterly updates from providers, and data sharing where appropriate.

There were some barriers to communication. Providers were not made aware by hospitals or CCLHD when their patients visited the ED or were admitted to hospital (either planned or unplanned). Instead, providers were made aware by the patients themselves or their carers, and discharge information was only provided by the hospital on request from the provider. Interviews with the Steering Committee suggested hospital information technology infrastructure could send hospital discharge summaries directly to GPs but not to the providers.

Providers noted the lack of communication with hospitals limited their ability to respond immediately to patient needs upon either an ED visit or hospital discharge. While CCLHD provided monthly data on the number of unplanned public hospital bed days experienced by their patient cohort for the purpose of monitoring targets, providers noted this data was delayed and had limited use for responding to individual patient needs.

Commissioning

Needs assessment

Service outcomes were clearly articulated to providers in OBC. Providers were aware the primary outcome was to keep people out of hospital given their revenue was calculated on the number of unplanned public hospital bed days avoided.

However, OBC was developed to keep vulnerable older people healthy and at home. While this can be achieved by reducing unplanned public hospital bed days, keeping people out of a residential aged care facility would also meet this objective. Providers were not incentivised on this basis.

OBC also sought to increase health outcomes and patient and carer satisfaction with the healthcare system. While providers were asked to collect information on health outcomes through the PROMIS 10 survey, they were not incentivised to improve health outcomes, nor to increase patient and carer satisfaction. This meant there was some potential disconnect between service outcomes desired by CCLHD and provider intentions.

System value and chain analysis

CCLHD undertook several initiatives to gain detailed knowledge of the potential to develop a care coordination market on the Central Coast. CCLHD undertook a series of industry briefings and an Expression of Interest process to determine the level of private provider interest. This included using mandatory compliance and other weighted criteria, giving CCLHD a good understanding of each provider's capabilities in delivering the type of care coordination deemed appropriate by CCLHD.

System design

CCLHD used price and non-price criteria to evaluate tenders to ensure there was a systematic and transparent approach to assessing market value. Applicants were assessed against the mandatory, non-price based criteria and against price criteria (and any other additional non-price based criteria) and ranked accordingly.

There was no independent costing for each tender. This was because total costs were unknown, being based on the ability of providers to reduce unplanned public hospital bed days. CCLHD did not develop a business case given they received funding from the NSW Ministry of Health based on their application to be a demonstrator site.

OBC was designed by CCLHD to fit within the NSW Agency for Clinical Innovation's framework for integrating care for older people with complex health needs.(47) However, it was unclear whether each provider's coordinated care model would result in the objectives sought by CCLHD. While both providers had delivered care through Home Care packages, neither had delivered care coordination for the explicit purpose of keeping people out of hospital.

CCLHD had undertaken prior research on the success of care coordination reducing hospital use and concluded that care coordination could reduce unplanned hospitalisations significantly. This included literature on the effectiveness of the numerous public and private sector coordinated care approaches implemented in the US.(5, 48, 49) Evidence on coordinated care from the UK and New Zealand, with similar health systems to Australia (e.g., primarily publicly funded and provided), was also reviewed.(50, 51)

However, results were derived from different care coordination models compared to those proposed in OBC and with different patient needs and healthcare settings. Some studies have found care coordination increases healthcare use through identified unmet need. For example, the NSW Chronic Disease Management Program (2012–2014) was associated with an increase in unplanned hospital admissions, emergency department presentations and decreased planned acute service use.

Strategy and planning

Providers received limited information from CCLHD on patient characteristics due to privacy restrictions. This resulted in providers being unable to adequately assess the level of risk (and cost) associated with their allocated patient cohort.

While it was appropriate to use outcomes based funding to incentivise providers to deliver care coordination, providers were given too much choice in the level of risk they could adopt, with both providers taking the maximum level of risk. This exposed CCLHD to provider failure given it has ultimate responsibility for patient care.

The majority of outcomes based payment models in healthcare allocate small proportions of funding to outcomes, with the majority still funded either through block funding or activity based funding. In OBC, the same incentive to reduce unplanned public hospital bed days could have been achieved with lower risk, by requiring providers to take a large proportion of their funding based on either activity or block funding, while ensuring a significant amount was still based on outcomes.

Implementation and management

CCLHD designated significant resources to designing, implementing and overseeing OBC. The Steering Committee held monthly meetings on the project and reviewed provider monitoring data. Providers consistently delivered quarterly monitoring reports to CCLHD during the first half of the program, providing evidence that contract management was on track.

CCLHD aimed to understand the level of service quality through provider monitoring reports. CCLHD requested providers increase monitoring from quarterly to monthly reporting after contracts had been renegotiated in September 2017. This additional oversight was appropriate, along with requests for additional information from providers on patient journeys. However, providers did not comply fully with these requests, with provider quarterly reports becoming less detailed and no evidence on monthly reports. Patient journeys and handover reports were delivered several months after OBC finished, limiting their usefulness for project management.

There was adequate collaboration and partnership between CCLHD and providers. CCLHD noted the strong working relationship and level of trust developed with providers enabled them to better manage OBC and mitigate risks. A lack of IT infrastructure meant providers were not informed of their used unplanned public hospital bed days in real time, which reduced the capacity for providers and CCLHD to manage this risk.

Monitoring and evaluation

The progress of OBC was closely monitored by CCLHD through ongoing conversations and quarterly update meetings with providers, and data collected through hospital administration databases. A Governance Committee also provided oversight of the program, with members from the Central Coast Integrated Care program, the Hunter New England and Central Coast Primary Health Network, Family and Community Services, and a local GP.

CCLHD monitored unplanned public hospital bed days carefully and had informed providers they were projected to reach their targeted bed days before OBC finished. This allowed CCLHD to identify the risk of providers pulling out of their contracted agreement, explore options to mitigate the potential risk of care being removed from patients unexpectedly, and to change the commissioning design in response to the unexpected level of unplanned public hospital bed days in the first half of OBC. This demonstrated effective oversight and management by CCLHD, along with strong project management and leadership.

9. Discussion

OBC was an innovative approach developed by CCLHD to purchase care coordination for older people with chronic conditions. This chapter discusses the role of risk stratification, compares results found in this study to other commissioning and coordinated care program evaluations, highlights the study's strengths and limitations, provides recommendations to improve OBC and identifies more general policy lessons.

Risk stratification

OBC aimed to keep vulnerable older people healthy and at home by commissioning care coordination of health and community care services. Providers were remunerated based on their ability to reduce unplanned public hospital bed days.

While there was a reduction in ED visits and unplanned public hospitalisations for the intervention and enrolled groups after OBC was introduced, this also occurred for the control group. This suggests the reduction in healthcare use was due to patient selection rather than care coordination.

This 'regression toward the mean' is a common statistical phenomenon. Patients with extreme unplanned hospitalisations in one year often move towards the population mean in the following year without receiving any intervention to keep them out of the hospital. Regression toward the mean has been found in other studies that have evaluated care coordination models that have selected patients on prior healthcare experience.(7, 52).

OBC selected patients based on age, gender, the prevalence of chronic conditions and unplanned public hospital admission in the year prior. This was based on results from a study that estimated the predictive performance of specific patient characteristics on the risk of emergency hospitalisation.(53) It suggested these four characteristics were the most valuable in predicting unplanned hospital admission, along with additional variables such as average number of GP visits and at least one health status variable, represented by either self-rated health or functional limitation.

CCLHD was unable to include the average number of GP visits and health status variables in the OBC patient selection process as this type of information was not readily accessible. This reduced the ability of CCLHD to identify patients with the greatest risk of unplanned public hospital admission. However, excluding these variables was unlikely to have significantly impacted the potential effectiveness of OBC, given their marginal predictive power was small.(53)

While the purpose of risk stratifying is to identify patients most at risk of unplanned hospitalisation, they should also also have the potential to benefit from the proposed intervention. The OBC risk stratification approach selected all patients with a minimum level of unplanned public hospitalisation risk. Within that cohort there is a natural distribution from low risk to high risk patients.

People with the greatest risk of unplanned hospitalisation in OBC may not have necessarily been the best responders to care coordination offered by providers. Providers noted that their allocated patient cohort was older and more complex than initially thought, and noted some patients had little capacity to respond to care coordination, particularly those undergoing palliative care.

Providers also risk stratified their patients once enrolled to ensure care coordination activities were built around their needs. However, components missing from care coordination delivered by providers included coordinated specialist medical and GP management and comprehensive discharge management. This is likely to have reduced their ability to keep the highest risk patients out of hospital.

There is potential to extend the OBC risk stratification process to refine the initial selection of patients. This could better account for patient complexity when determining whether a patient is suitable for OBC and place patients into risk categories prior to being allocated to providers. It could provide CCLHD with the opportunity to exclude some patients deemed not suitable for care coordination but for more intense treatment.

One method is to select patients using a predictive risk model based on primary care data and hospital administrative data, coupled with the Hospital Admissions Risk Program (HARP) questionnaire. This approach is being used to select patients into Health Care Homes. It initially selects patients using a predictive risk model algorithm developed by CSIRO, and then allocates these patients to risk tiers based on their score range.(54)

The use of HARP is relatively common in Australian healthcare systems to select patients into chronic disease programs. For example, it is used extensively in the Hospital Admission Risk Program Victoria and is used in the NSW Integrated Care for Patients with Chronic Conditions program.

While the combined approach to selecting appropriate patients in the context of Health Care Homes has not been validated, a review of predictive risk models suggests better prediction results from using both primary care data and hospital administration data.(55) However, this has an additional data collection and administration burden, which may not outweigh the potential benefits from including this type of data. The NSW Agency for Clinical Innovation’s Patient Identification and Selection Handbook provides additional factors to consider when choosing a patient selection tool.(56)

Outcomes

OBC significantly increased ED visits and potentially increased unplanned public hospitalisations and reduced unplanned public hospital length of stay for the intervention and enrolled groups, compared to the control group. While health outcomes may have increased for the enrolled group, increased utility values were not statistically significant. Patients were satisfied with most aspects of provider care, but gaps in care coordination and access to care services were evident from the patient perspective.

An increase in hospital use for the intervention and enrolled groups was likely due to providers identifying unmet healthcare need when conducting a comprehensive needs assessment and developing care plans with patients. Response from the modified PPIC survey suggests patients became more aware of their health conditions, providers helped them look after themselves, and patients knew how to ask for help to take care of their health at home.

Providers also encouraged patients to assess their own health and seek additional healthcare support when needed. Patients may have become more amenable to using the emergency department when their health deteriorated. Some of these unplanned public hospitalisations may have been avoided if patients were given greater access to after-hours GP services through providers. This demonstrates the importance of embedding GPs into care coordination.

Increased unplanned public hospitalisations for people with complex conditions can have benefits as earlier access to care for a deteriorating health condition may extend the life of patients by avoiding catastrophic health events. While there was no statistical difference between deaths for the intervention and control groups, this impact may manifest beyond OBC.

Care coordination models

An increase in hospital use resulting from the introduction of care coordination has also been found in Australia and internationally. An evaluation of the NSW Chronic Disease Management Program concluded it led to an increase in ED visits, unplanned public hospital admissions and potentially preventable admissions for enrolled patients.(7)

Research on coordinated care models delivered in the US suggests coordinated care can reduce hospital service use and improve quality of care, although this is the exception rather than the rule.(48, 49, 57)

A review of 15 randomised trials involving coordinated care programs developed in the US Medicare Coordinated Care Demonstration project found that only treated groups in three coordinated care programs experienced a significant difference in hospitalisations at the 90 per cent level of significance.(57) Of these, two programs reduced hospitalisations by 17.1 per cent and 24 per cent, while the third program increased hospitalisations by 19 per cent. No program reduced overall costs.

A Commonwealth Fund review of 18 'successful' coordinated care programs relied on evidence from interviews with program managers and from non-randomised control studies.(48) The programs demonstrated decreased hospital admission rates, mixed results on reduced emergency department presentations, and reduced patient costs. The review found improvements in process indicators (e.g., decreased HBA1c levels for diabetes, improved asthma and hypertension management), reduced mortality rates, and improvements in both provider experience and patient quality of life.(48)

Increased healthcare use for patients selected into care coordination has also been found in the UK. The Partnerships for Older People Projects consisted of 29 community based care projects with 146 core interventions, which aimed to keep older people out of hospital by providing targeted interventions in their home. An evaluation of eight community based interventions selected on an increased likelihood they reduced emergency admissions to hospital concluded none had reduced emergency hospital admissions, and six interventions had increased the rate of emergency hospital admissions.(52) The evaluation also found regression toward the mean in four interventions.

A more recent study on the Age UK's Personalised Integrated Care Programme confirms the limited effectiveness of care coordination in reducing hospitalisations. It targets older people in the UK at risk of future emergency admission, by providing care coordination for three months and promoting partnerships between health and social care providers.(58) Patients are selected if they had two or more long-term conditions related to potentially avoidable admissions and had two or more unplanned hospital admissions in the previous 18 months.

An evaluation found those receiving the interventions experienced a 33 per cent increase in ED visits, a 35 per cent increase in unplanned hospital admissions and a 23 per cent increase in outpatient attendance nine months after the first conversation with the care coordinator. These were all statistically significant.(58)

Commissioning

Commissioning and contestability approaches in various forms exist in many healthcare systems notably in the UK, New Zealand and the US. There is a large literature on the experiences of commissioning, but few studies on the impact of commissioning.

A review article found seven studies, all from the UK, focusing on the impact of commissioning, with only three studies examining the impact of commissioning on outcomes, health service use and quality.(38)

One study on joint commissioning of health and social care for chronic disease management found no change in length of stay, reduced hospitalisations or delay in transfer of care.(59) These findings were attributed to local implementation issues including the challenges of jointly commissioning new services while de-funding other services.

The second study was a large time series study of GP-funding holding practices between 1991-92 to 1998-99. Using DiD analysis, the study found increased elective admissions following the removal of fundholding incentives.(60) The third study, a large population based study of commissioned service providers, found improvements in smoking rates.(61)

A more recent study examined the impact of commissioning since major reforms were introduced in the NHS England in 2012. The reform gave GPs a major role in purchasing hospital and specialist services. The before and after study based on healthcare use for the entire English population over eight years did not find evidence of a shift towards less expensive community based care models.(62) The study also found evidence of an increase in specialist visits compared to the trend in the control group (Scotland) where the policy did not occur. It concluded that the incentive level for GP commissioners may not have been strong enough to encourage greater referral to community services.

New evidence is emerging as UK commissioning shifts focus towards integrated health and social care services to better coordinate services around the individual,(63, 64) based on the Canterbury system in New Zealand.(64)

Evidence in the UK on measurable change among an early group of integrated commissioning system sites is limited.(64) There was some evidence of moderated demand for acute care, while other research indicated the changes have not yet had a measurable impact, or researchers have encountered difficulties attributing impact solely to commissioned activities.(64)

Accountable care organisations (ACOs) emerged 10 years ago in the US and more recently in the UK to provide broad healthcare and social services on a community wide population basis. ACOs are accountable to patients and third-party payers for quality and efficiency outcomes, and have used improved care coordination and outcomes based funding models to achieve performance metrics.

A recent review of ACOs found mixed evidence on their effectiveness to reduce costs, improve quality of care outcomes and patient experience.(65) For example, 36 per cent of ACOs involved in improving care outcomes for high risk patients under the US Medicare Shared Savings Program reported cost savings of more than 2 per cent, while 13 per cent reported cost increases of more than 2 per cent.(65) In studies limited to ACOs with outcome data, the review found evidence that most ACO models reported improvements in one or more quality of care indicators.(65)

Outcomes based financial incentives

Outcomes based funding primarily uses pay for performance schemes to drive efficiency, mitigate variations in clinical practice, improve productivity and deliver cost effective healthcare through mechanisms of financial incentives.(66)

Numerous systematic and rapid reviews have been undertaken to identify evidence for their effectiveness and the body of research extends to comparisons that are country-specific (e.g. US or OECD) and context-specific, such as pay for performance for a hospital, primary or community care services.(67-72)

A 'review of reviews' of pay for performance funding schemes in Europe noted that they are under-evaluated and, while potentially cost effective, the evidence is not yet convincing.(67, 73) Results have been mixed due to differences in study design, differences in incentives and targets, heterogenous program and population characteristics and small scale evaluations with limited methodological rigour.(72) Narrow definitions for costs and consequences in evaluations have also compromised the generalisability of results.(67) These findings are corroborated by many studies which have failed to find an effect distinguishable from other improvement initiatives.(67-73)

Some themes emerge for successfully implemented pay for performance schemes. One study identified that incentive structures should align with the provider's key organisational priorities. Programs that target clinically important outcomes and care processes, and specific areas of poor performance tend to incentivise greater success than those that target improved efficiency or productivity.(68) These might be identified as supporting quality improvements or minimum quality standards.(69)

Greater incentives, while at risk of 'organisational gaming', also tended to generate greater gains.(66, 68) It is recommended that pay for performance schemes be flexible to embedded evaluation, and have the capacity to change in response to provider input, data analytics and monitoring.(68) This recommendation was generated from research which incorporated evidence from 41 evaluations in the US, with a caveat to emphasise the difficulty of evaluating complex interventions such as pay for performance schemes, noting that effectiveness will vary by context, design, implementation and mechanisms of impact.

A recent study that evaluated the international evidence for outcomes based funding models, specific to hospitals but relevant here, identified that the models can improve value when optimally designed within a specific healthcare context, though effectiveness was variable.(74) Two schemes showed no impact, two schemes had mixed effects, and four schemes had small positive effects that dissipated over time. The lack of effectiveness in some schemes may also be due to short timeframes between scheme implementation and evaluation.

An evaluation of 34 pay for performance schemes in 14 OECD countries concluded that moderately positive effects could be attributed to the schemes, but the evidence remained unclear.(70) A recent evaluation of evidence in the US noted that consistently positive improvements were not demonstrated.(72)

Study limitations

Data collection

There were several limitations to data collection that may have impacted results found within this study. While changes to healthcare use outside the hospital sector were collected from those enrolled in OBC, this type of data could not be collected from those in the intervention group who chose not to enrol, nor from the control group, given they did not provide consent.

A low response rate to the modified PPIC survey resulted in incomplete information about patient experiences associated with OBC. There were also differences in timing between the administration of the first and second modified PPIC survey for patients, although these were broadly at six and 12 months. There were also some missing dates when data were collected from some patients.

While the study initially sought to measure health outcomes using EQ-5D-5L, delay in collecting health outcome data from patients meant the data collected did not represent health outcomes at the start of OBC. The study instead relied on the data collected from providers using PROMIS 10 when patients were enrolled, by converting responses to an ED-5D-5L equivalent score using a mapping algorithm developed in this study. This may have introduced some bias into measuring health outcomes.

Analysis

Effects of OBC were estimated using a controlled but non random sample of patients. While analysis took into consideration the potential bias from differences in observational characteristics between the intervention and control groups and time-invariant unobserved differences, some bias may have remained due to unobserved time-variant differences between the groups from non-randomisation. In particular, there was limited information on health related characteristics, health behaviours and risk factors such as obesity. This may have been exacerbated in the enrolled group given patients self-selected into OBC.

The sample size for statistical analysis was relatively small. This reduced the power of the hypothesis tests to find a significant result. This means some insignificant results associated with increased hospitalisation, reduced length of stay, and health outcomes may be the result of the small sample size rather than the true impact of OBC.

The economic evaluation was limited to including only program costs and costs associated with changes to hospital activity due to data limitations. This may have missed some changes in costs incurred outside hospital due to OBC, such as the increase in care coordination services and a change in the use of primary care, allied health services, changes to pharmaceutical use, and impacts on carers. These could not be accounted for in the economic evaluation due to data limitations.

Using a cost utility analysis for the economic evaluation may have missed important benefits to patients from care coordination beyond health outcomes measured through quality adjusted life years (QALYs). These include improved patient experience with care delivery and greater patient peace of mind from better understanding their health conditions and becoming better equipped to self-care.

The focus of measuring ‘within trial’ health outcomes may have missed some benefits and costs that extend beyond the OBC period. If OBC had improved health outcomes that were persistent beyond

OBC, the evaluation may have underestimated the benefits associated with OBC. Similarly, if increased hospital costs had persisted then the evaluation would have underestimated these costs.

Interpretation

There are some limitations to interpreting these study results. While there are important lessons in this study for the refinement of OBC, they may not necessarily directly translate to other LHD settings given differences in patient mix, potential market structure and healthcare context. For example, access to transport is much better for those living in the inner parts of Sydney compared to north Wyong. There will also be greater competition to provide services in more densely populated parts of NSW, which may impact the types of services delivered compared to those provided in OBC.

While this evaluation study measured relationships between OBC and healthcare use and health outcomes, and extended the econometric analysis and economic evaluation through use of a process evaluation, the contribution of individual OBC components to outcomes could not be determined. This was further complicated by the heterogeneity of care coordination models developed and implemented by the two providers. While integrated care programs should be evaluated at an aggregate level to capture potential synergies between individual components,(75) this approach limits insight into what OBC components are best changed to improve outcomes.

10. Recommendations and policy directions

OBC has provided important insights into the use of outcomes based commissioning to incentivise the delivery of care. This chapter provides recommendations to potentially improve OBC outcomes and broader policy lessons for future healthcare commissioning based on outcomes.

Recommendations to refine OBC

OBC was an innovative program developed to commission care coordination and make payments based on outcomes. While the economic evaluation results suggest OBC was not cost effective, there is potential to improve OBC to promote greater impacts on health outcomes. Table 10.1 lists 14 recommendations to help refine the delivery of OBC.

Broader policy lessons

The NSW Ministry of Health is promoting the development of care coordination programs to keep people out of hospital through the Integrated Care for Patients with Chronic Conditions program. This forms part of the NSW State Health Plan: Towards 2021 strategic direction to 'deliver truly integrated care' by helping patients take care of themselves, strengthen partnerships with the primary and community care sectors, and align financial incentives and performance.

At the same time, the NSW Government continues to explore public service provision using strategic commissioning to improve choice and productivity, ensure more decision making transparency, and to promote greater innovation and better service quality. One example is the use of commissioning and contestability for the delivery of Out-of-Home Care services in NSW. This was introduced in 2005-06 and has grown to more than 50 per cent of Out-of-Home Care services delivered by a third party.

The NSW Government's commissioning and contestability policy suggests the focus of commissioned services should be on improved outcomes for customers and the community. Results from this study of OBC in the Central Coast provide an important learning opportunity for future commissioning projects in the NSW healthcare system based on outcomes to generate better health outcomes and patient experience for every dollar spent.

However, incentivising behaviours using financial incentives is complex and there are mixed results on its effectiveness in improving service quality in a cost effective manner. Designing an outcomes based commissioning framework must consider the composition of market participants, incentive structure, outcomes measured, the risk adjustment process, information on patients, the interaction of commissioned services with patient characteristics and patient access to alternative services.

Table 10.1: Recommendations to refine OBC

	Topic	Problem	Recommendations	Potential improvement to OBC
1.	Implementation: Enrolment process	There was three months between CCLHD sending a letter to patients and providers contacting those patients to enrol. This created confusion for some patients as they were unsure of the program and why they had been selected, leading to distrust and reduced enrolment.	Ensure CCLHD notifies patients about the program less than two weeks before the provider contacts patients.	Will increase the likelihood of patients recognising the program and enrolling when providers make first contact.
2.	Implementation: Enrolment process	The number of patients enrolled was lower than expected. Patients noted they had not received a letter from CCLHD, were unaware of the program, were unsure why they were selected, and were suspicious of provider intentions.	Use GPs to enrol patients given the often high level of trust between GPs and patients. Ensure CCLHD and the Primary Health Network facilitate the development of the relationship between providers and GPs.	Will increase the likelihood of patients enrolling in the program.
3.	Implementation: Patient reach	Patients who chose not to enrol were excluded from OBC even though they may have changed their preferences (e.g., if they experienced an unplanned hospitalisation) which limited the ability of providers to improve health outcomes.	Ensure providers can enrol patients on an ongoing basis using a dynamic patient identification process. Explore the potential to offer the program as an opt-out process.	Will allow providers to better manage patient health outcomes and give patients greater flexibility in their enrolment.
4	Implementation: Patient reach	The number of patients available for enrolment at the start of OBC was less than when providers signed their contract which reduced the providers' ability to achieve economies of scale.	Ensure providers are given access to larger cohorts of the intervention group. Ensure providers are given up-to-date patient lists to minimise drop out from changed patient circumstances.	Will allow providers to refine models of care, offer greater security to employees and invest further in care infrastructure.
5.	Implementation: Patient composition	The risk stratification approach resulted in a relatively older and more complex patient cohort whose healthcare requirements were greater than expected.	Survey patients to better understand their care coordination needs and preferences before commissioning providers. Share this de-identified information with prospective providers along with administration data on hospital use and health conditions to the greatest extent allowable under ethical and privacy requirements.	Will allow providers to better predict their capacity to reduce unplanned hospital bed days, and understand the risk to their business model. Will enable providers to better align their model of care coordination with the complexity of multi-morbidity in their cohort.

	Topic	Problem	Recommendations	Potential improvement to OBC
			Work upstream with GPs to identify those patients willing to participate.	
6	Implementation: Timeframe	OBC was piloted for one year but the enrolment period took between three to six months, meaning some patients only had the program for six months. Waiting lists for Home Care packages meant some patients did not receive all services recommended by providers. Providers needed time to employ a workforce, invest in infrastructure and implement models of care.	Pilot the program for 3–5 years.	Will allow learning effects to be embedded in service models, and for coordinated care to mature in providers through investment in coordinated care models, labour and infrastructure.
7.	Implementation: Measuring outcomes	Patients were selected based on their prior use of hospital care. Patients reverted to their long run average hospital care use, which means the capacity for providers to reduce hospital use was limited.	Re-evaluate selection criteria based on the capacity to improve from coordinated care, rather than focusing on patients with high hospital use before OBC, including consultation with GPs and use of patient data from GPs to improve the risk stratification.	Will be a greater likelihood of selecting patients before they experience their peak hospital use, maximising the potential for providers to improve outcomes.
8	Implementation: Measuring outcomes	A before and after approach was used to determine whether providers had impacted unplanned hospital bed days. However, these two periods may not be the same given fluctuations in flu seasons and other communicable diseases. It therefore exposes providers to unpredictable fluctuations in the allocation of unplanned hospital bed days.	Compare measured outcomes between the intervention and control groups over the same time period to determine whether providers have impacted outcomes.	Will give increased capacity to differentiate the impact of providers on outcomes without confounding from time related factors that may also impact outcomes.
9.	Mechanism of impact: Financial incentives	While CCLHD developed a model that shifted some funding risk onto providers, ultimately CCLHD still retained the risk of program failure given poor care delivered by providers would also reflect badly on CCLHD.	Ensure there is an established plan to allow providers to fail (i.e., models of care transition) while reducing any potential impacts on patients and their care.	Will provide CCLHD with greater ability to enforce contractual arrangements.

	Topic	Problem	Recommendations	Potential improvement to OBC
10.	Mechanism of impact: Financial incentives	Providers had the opportunity to receive funding based on their capacity to reduce unplanned hospital bed days or take a proportion of funding as a block payment not attached to outcomes. Both providers took the maximum level of risk, however both used their allocated unplanned hospital bed days within six months of OBC starting, which meant there was no further incentive for them to participate in the program.	Ensure most of each provider's funding stream is received through a block payment unrelated to outcomes. Offer the block payment either at the end of the program or at specific agreed time points throughout the program.	Will allow CCLHD to reduce the total funding risk to providers, reducing the risk of program failure. Requiring providers to choose some form of outcomes based payment would incentivise providers to continue to strive to improve outcomes.
11.	Mechanism of impact: Financial incentives	Patients allocated to providers used more allocated unplanned hospital bed days than anticipated, particularly in the first six months of the program. This reduced program sustainability, leading to a renegotiated contract with payment not based on outcomes.	Enrol more people into the intervention group to smooth out fluctuations in bed days associated with outliers and reduce the overall impact of outliers on total hospital bed days. Cap unplanned hospital bed day outliers by excluding all bed days outside some boundary (e.g., one standard deviation from the expected mean). Use unplanned hospital admissions rather than bed days as the primary outcome metric to fund providers.	Will reduce funding risk to providers associated with patient outliers and additional care needs, increasing financial sustainability of OBC.
12	Mechanism of impact: GP involvement	Providers were incentivised to reduce unplanned hospital bed days. However, other activities were also valued by CCLHD, including integration of coordinated care with GPs, and participation in evaluation activities. While there was a contractual obligation for the latter, one provider did not provide adequate evaluation data throughout the program, reducing the ability to monitor the program's success.	Create incentives for providers to undertake other desired behaviours (in addition to reducing unplanned hospital bed days) through payment linked to key performance objectives. Include secondary analysis of process measures alongside primary outcome measures.	Will increase the likelihood that providers will exhibit behaviour deemed valuable, in addition to reducing unplanned hospital bed days.

	Topic	Problem	Recommendations	Potential improvement to OBC
13	Mechanism of impact: GP involvement	Both providers sought to develop a relationship with their patients' GPs, however GP were not willing to participate.	Ensure providers sign up GPs into their coordinated care programs and use a measure of GP interaction as an outcome. Ensure CCLHD and the Primary Health Network actively facilitate the relationship between providers and GPs.	Will increase the likelihood that GPs will participate in recruitment, development of care plans, and care coordination with providers.
14.	Context: Communication	Providers did not have up-to-date information on their patients' hospitalisations, nor access to discharge summaries and clinical handovers which reduced the ability of providers to care for patients immediately after they had left hospital.	Ensure providers are made aware when a patient enters hospital. Ensure providers receive hospital discharge summaries. Ensure hospitals involve providers when discussing discharge planning processes for complex patients and give clinical handovers to providers.	Will help providers update their patients' care plans, organise community services to ensure they are available close to discharge, and improve overall patient management.

Source: MUCHE.

Outcomes based commissioning should be designed to fit the local healthcare objective, local healthcare environment, workplace culture and local marketplace. These interact uniquely, adding additional complexity for LHD executives with little opportunity to test alternative design characteristics before implementation. Lessons from OBC can be used to further refine the design of outcomes based commissioning in another LHD, but its design should not be 'picked up and placed' into another LHD given likely differences in characteristics.

An outcomes based commissioning intervention should be given some time to mature before being evaluated for its success. It is difficult for providers to improve health outcomes within one year, particularly if the intervention is required to address complex patients, such as older Australians with multiple chronic conditions and ingrained health related behaviours.

Relationships between providers and patients take time to establish and mature. Providers require time to learn and patients require time to respond to services. In general, a minimum of three to five years is preferred.(76) This would ensure the effectiveness of the program on longer term outcomes and healthcare resource use are considered.

Incentives and outcomes

Two key challenges in developing an outcomes based commissioning model in NSW are determining the size and type of incentives to be used and defining the outcomes to incentivise.

Size of incentive

There is little guidance on the size of incentives required to change behaviours, although most use less than 10 per cent of total revenue as the pay for performance component,(74) and there is little use of pay for performance as a stand alone funding model. An optimal financial incentive should aim to equalise the marginal benefit of improved outcomes with the marginal cost of increased financial risk.

There are some challenges in using financial incentives to motivate provider behaviour. The effect of an incentive may weaken over time and thus reduce the effectiveness of a model unless the financial incentive is appropriately adjusted. The size of the reward or penalty must be substantial enough to generate a response, but there is often little information before implementation on what 'substantial' should represent. While incentives should be tailored to providers, this is made more complex by different starting points for providers, such as alternative financial strength and capacity to deliver care.

Financial incentives based on outcomes can introduce perverse incentives that lead to counterproductive gaming and unintended consequences, although these behaviours are not widespread.(77) Incentives may not flow to where behavioural change is required (e.g., clinicians), thereby limiting their impact on behavioural change.(78)

Blended funding model

A blended funding model that includes some pay for performance component along with other funding types such as bundled payments could be better suited for funding long term conditions such as chronic disease.(79)

Bundled payments can incentivise cooperation between stakeholders (e.g., GPs and providers) better than outcomes based commissioning. Providers are incentivised to identify unnecessary procedures, work collaboratively to avoid duplication of care, and seek innovative approaches to improving health outcomes. Bundled payments move away from traditional siloed service delivery by separate medical specialties to more integrated systems, promoting continuity of care.

However, bundled payments require agreement on the allocation of payment across providers, sharing financial risk, managing a multidisciplinary team and setting up new processes. All of these may present significant challenges. It may take some time for teams to find new ways to work effectively. It may also be complex to define the bundles of care.

Price and incentive structures can be adjusted in bundled payment models to influence specific behaviours and respond to changes in the healthcare environment. How financial risk and benefits should be shared between providers and payers should be carefully considered. A bundled payment model may need to include ‘stop-gain’ and ‘stop-loss’ restrictions to reduce the financial uncertainties that may discourage some providers, especially smaller ones, from participating.

Choosing outcome metrics

While paying for health outcomes is uncommon in NSW, the shift by NSW Ministry of Health towards measuring patient outcomes and patient experiences in its Leading Better Value Care program suggests there may be scope to explore financial incentives for these types of metrics.

Outcome metrics used in a commissioning process must be valid (measuring intended outcomes), reliable (reproducible) and credible (trusted by stakeholders).(80) They must also be feasible, sensitive to the behaviours of those whose performance is being measured, and have predictive validity.(81)

Broadly, metrics are either health outcomes or process measures. OBC used unplanned public hospital bed days to remunerate providers, which is a process measure. The advantages of this indicator were easy measurement, potential sensitivity to care coordination and easy interpretation. However, it did not capture other changes valued by patients, such as changes in health outcomes (regardless of unplanned hospitalisation) or patient experience.(81)

Paying for health outcomes is one alternative for future outcomes based commissioning models. However, it could add complexity to a care coordination program that covers a range of chronic conditions given health outcomes are represented by different clinical indicators. This could be overcome to some extent by using broad health outcome changes measured using standard health related quality of life tools, although these may be insensitive to the proposed impact on health outcomes.

While health outcome measures can be more meaningful to patients, they are sometimes difficult to measure and to attribute to a specific intervention. Measuring health outcomes also takes time to collect data and requires a large sample size to identify statistically significant differences. Using health outcomes to measure healthcare system performance is best used to represent quality of homogenous interventions with a strong link between the intervention and health outcome.(81)

Supporting changes

OBC has provided valuable insights into the need to ensure any future outcomes based commissioning model is supported by LHD executives and management. It is essential that providers receive information from the LHD that allows them to manage their outcomes and financial risks.

To the greatest extent possible, information should be provided by LHDs before providers enter into a contract so they can make an informed decision on whether they can appropriately manage both. Information should include patient characteristics, previous care received and willingness to participate in the proposed intervention. Commissioning based on outcomes may not be appropriate if privacy legislation prevents this type of information exchange.

Providers should also receive timely information on their outcomes achieved throughout the commissioning process. For care coordination, this will require good communication across multiple stakeholders, including hospitals, specialists, GPs and providers. As there is currently fragmentation in communication in the NSW healthcare system, a new outcomes based commissioning approach may require an initial investment from an LHD to establish communication channels between providers and stakeholders. It may also require investment in information technology to ensure information flows between providers and stakeholders with minimal effort.

There is a need to develop and maintain trust between LHDs and providers. OBC shows this can allow providers and the LHD to manage delivery and financial risk better. As the healthcare system is built on relationships rather than transactions, a firm contractual approach to managing providers may erode trust and subsequently reduce the capacity to manage risk. This more flexible approach to commissioning requires skilled managers that can identify, assess and appropriately manage risk. This may require strong executive support and investment in education and training.

A minimum number of patients allocated to providers may increase their viability in an outcomes based commissioning approach. The more patients managed by providers the less exposed providers become to patient outliers that negatively impact outcomes and therefore viability. This could also be managed by applying caps on the proportion of revenue that could be sought through outcomes based payments using a blended approach to funding. Giving providers an opportunity to manage many patients gives them greater capacity to invest in innovative technologies given the capital costs are spread over a larger group, and potentially improve efficiencies through extracting economies of scale.

Any new outcomes based commissioning approach should be accompanied by an upfront data collection and evaluation plan. Outcomes for the intervention group and a control group should be measured before, during and after implementation. These should include health outcomes and other potential changes valued by patients, such as patient experience and improved health literacy. Process evaluation should accompany economic evaluation to better understand the mechanisms of impact and the role of healthcare system context in delivering outcomes.

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A: Literature review

Research question

A systematic literature review was undertaken to determine the most suitable framework to evaluate OBC and to gather lessons from previous process evaluations of health interventions. The research question was '*What process evaluation frameworks have been used to evaluate integrated care programs?*'

Inclusion and exclusion criteria

Table A.1: Inclusion and exclusion criteria

	Inclusion	Exclusion
Study design	Observational studies Before and after studies Randomised control trials	None
Methodology	Process evaluation theory Process evaluation framework	No process evaluation theory or framework
Publication	Full text peer-reviewed articles	Opinion pieces Editorials Abstracts only Comments Grey literature
Setting/Context	Self-care Community care Primary, Secondary and Tertiary care Social care Integrated care High income countries	Middle and low income countries
Years	2000-2018	Published before 2000
Language	English	Non-English
Target population	Chronic health conditions Elderly	Non-elderly, acute

Source: MUCHE.

Search strategy

Databases searched

Databases searched included PubMed and MEDLINE.

Search terms

Search terms used to extract articles are listed below.

1. Process evaluation [tw]
2. Integrated care [tw]
3. Complex healthcare [tw]
4. Healthcare intervention [tw]
5. Process evaluation framework [tw]
6. Outcome* based care [tw]
7. #1 AND #2
8. #1 AND #3
9. #2 AND #5
10. #3 AND #5
11. #5 AND #6

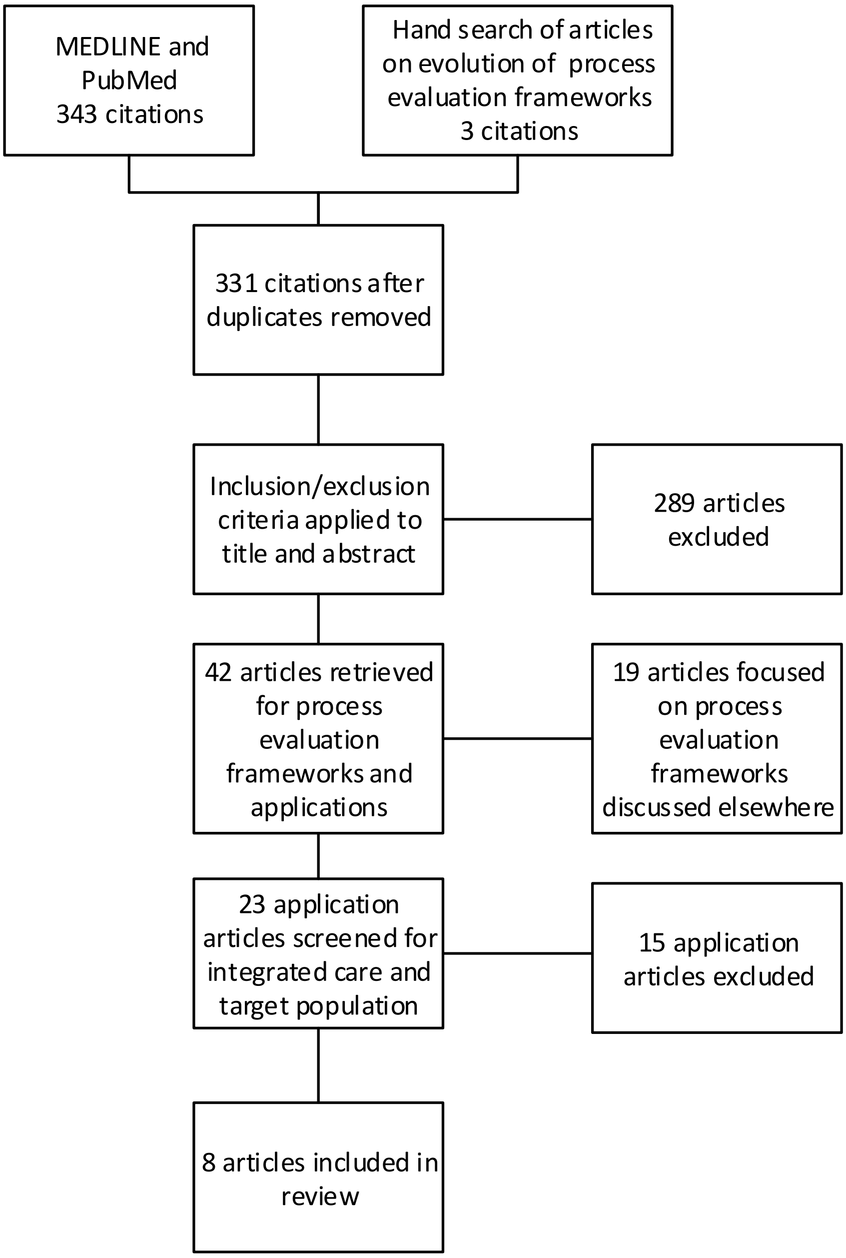
Synthesis of results

A data extraction template was developed to systematically capture information relevant to this study. Criteria included process evaluation framework adopted, intervention, intervention timeline, target population, setting, inclusion of carer, and measured components. Additional information was obtained from process evaluation frameworks referenced in the articles, while grey literature was used to further understand process evaluations for integrated care programs.

Selection of articles

The initial search resulted in 346 articles (see Figure A.2). Articles were excluded if they were opinion pieces or abstracts, had not been peer reviewed, or were published prior to 2000. Non-English articles and articles focused on middle and low income countries were excluded. This resulted in 42 articles. Another 19 articles were excluded because they had not applied a process evaluation framework to a specific intervention, and a further 15 articles were excluded because they did not focus on the elderly population. This left eight articles for a full text review (see Table A.3).

Figure A.2: Synthesis of articles



Source: MUCHE.

Table A.3: Selected articles for full text review

Article	Adopted framework	Intervention	Intervention period	Target population	Setting	Inclusion of carer	Measured components	Comments
Everink et al, 2017(82)	Saunders et al, 2005(36)	An integrated care pathway for improving communication, triage and transfers of patients between the hospital, geriatric rehabilitation and primary care	1 year	Community-living aged 65 and over with complex needs and admitted to hospital prior to admission to the geriatric rehabilitation Socio-economic status not discussed	Primary/Secondary Tertiary Geriatric rehabilitation Maastricht/Netherlands 113 patients 37 I carer 19 HC provider	Yes	The feasibility of pathway was assessed: Implementation fidelity Patients/ carer/Professionals satisfaction Implementation barriers/facilitators Comparator: Not discussed	Model of financing is not discussed
Jones et al, 2017(83) Feasibility study	MRC, Moore et al, 2015(35)	Integration of Stroke Self-Management Programme (Bridge Stroke SMP) into stroke rehabilitation sessions, consisting of individualised and patient-centred plan to increase the confidence and functional capability of stroke survivors	12 weeks	Patients diagnosed with stroke who had received at least 6 treatment sessions from community rehabilitation team/ could follow verbal/nonverbal command	Tertiary/self-care Cluster randomised 78 stroke survivors were randomly assigned to 4 intervention and control sites London/UK Assessments conducted at baseline/6/12 weeks	Not discussed	From MRC framework only the “fidelity” component is measured. How the intervention is understood by stroke survivors was investigated. Fidelity of intervention was measured based on Bridge Stroke SMP checklist	The evaluation is only qualitative The intervention found to be feasible within the existing services but no evidence of significant difference between control and intervention group was found Model of financing is not discussed
Sanchez et al, 2016(84)	RE-AIM Glasgow et al, 1999(85)	Type-2 Diabetes (T2D) prevention program(trial). Consisting of screening	2.5 years	Non-diabetic, 45-70 years old patients with high risk of developing T2D.	Primary/self-care Participants of 14 primary care centres were randomly assigned to	Not discussed	From RE-AIM, the “adoption”,” reach” components and implementation.	Feasibility study/ Paper does not discuss health outcomes; only

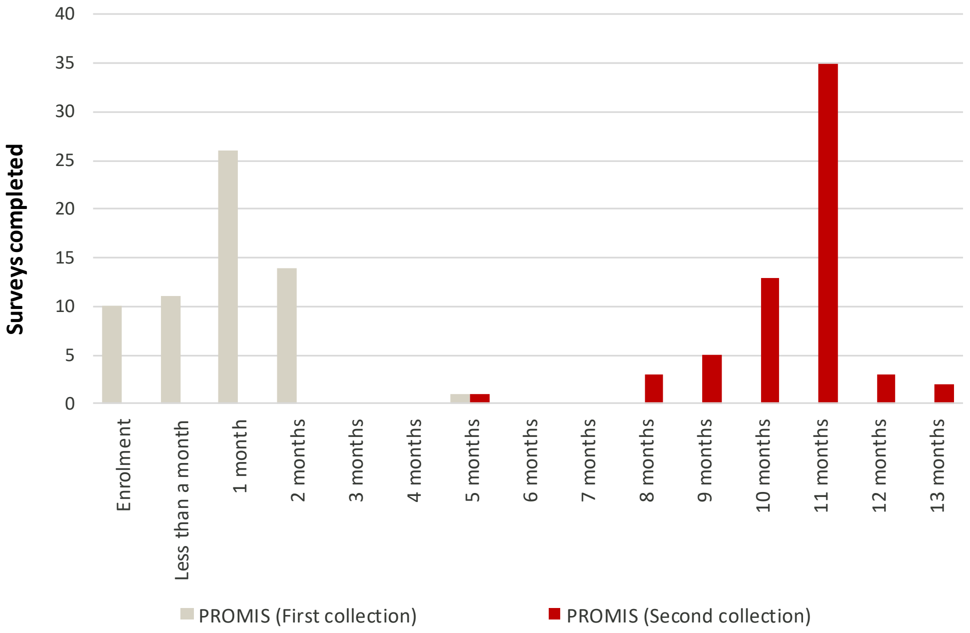
Article	Adopted framework	Intervention	Intervention period	Target population	Setting	Inclusion of carer	Measured components	Comments
		and recruitment, education/ training on healthy lifestyle and follow up. Intervention had 3 phases: intensive education/ discussion within small groups, another 3 educational reinforcement sessions, and every 6 weeks follow up and reinforcement through phone calls.		Diabetic risk score => 14.	intervention (n=454)/control group(n=636). Cluster randomised Basque/Spain		Adoption (practice level): the proportion of health centre staff that accepted to involve in the program Reach: reach of screening and patient identifying process and also reach of program to eligible patients Implementation: implementation of 3 steps of program, participation rate and rate of receiving follow up.	discusses the participation rate and success of implementation
Fens et al, 2015(86)	Saunders et al, 2005(36)	Post-stroke follow-up Intervention consists of a maximum of 5 home-visits to patients and carer during 18 months post-discharge. Data collected at 1,6,12,18 months of follow up	18 months	Stroke patients (mean age 72)	Home-care/primary Maastricht/Netherlands 77 patients 59 caregivers 4 stroke care coordinator (SCC) Nonrandomised controlled trial design	Yes	Reach: availability of intervention Fidelity/dose delivered: performance of the intervention Follow-up care based on assessment Exposure/dose received: patients/caregivers/SCCs opinion Comparator: regular care in Eindhoven area	Model of financing is not discussed Intervention had a positive effect on levels of social activities of stroke patients No significant differences between intervention/control groups were found on quality of life, activities of daily life, depression and anxiety, or caregiver strain

Article	Adopted framework	Intervention	Intervention period	Target population	Setting	Inclusion of carer	Measured components	Comments
Stijnen et al, 2014(87)	Mixed framework: Saunders et al, 2005(36) Normalisation Process Model for "context" component May, 2006(88)	Nurse-led, patient-centred home visitations for frail older people, consisting of a comprehensive geriatric assessment during a home visit and follow-up over time	18 months	Community-living frail people aged 75 and over	Home-care/primary Maastricht/Netherlands 13 practices offer the intervention to 721 patients 11 practices offer regular care Nonrandomised controlled trial design	Not discussed	Fidelity (implementation quality) Dose delivered (completeness) Dose received (exposure) Dose received (satisfaction) Reach (participation rate) Recruitment Context Interactional workability Relational integration Skill-set workability Contextual integration	Model of financing is not discussed No major improvement in care for recipients
Metzelthin et al, 2013(89)	Mixed framework: Baranowski & Stables, 2000(32) Linnan & Steckler, 2002(33)	A pilot, nurse-led, 6 stepped interdisciplinary approach including tailor-made care, case management and long-term follow-up to decrease the risk of disability	10 months	Community-living frail people aged 70 and over (defined by Groningen Frailty Indicator) Socio-economic status not discussed	Primary Netherlands 6 GP practices 194 patients 7 nurses 12 GPs 26 physical /occupational therapists	Yes	Reach: extent reaching target group Dose delivered: amount of delivered care Fidelity: extent of fidelity to 6 planned steps Exposure: extent of active engagement of patients and carer Satisfaction: patients/ carers / HC providers' satisfaction Barriers	Model of financing is not discussed The paper does not discuss health outcomes High satisfaction among patients, carers, GP practices.

Article	Adopted framework	Intervention	Intervention period	Target population	Setting	Inclusion of carer	Measured components	Comments
							Comparator: not discussed	
Breedveld-Peters et al, 2012(90) Feasibility study	Saunders et al, 2005(36)	Face to face/ phone call personalised nutritional counselling and providing oral nutritional supplements after hip fracture surgery The intervention started from hospital and continued when patient transferred to rehabilitation/nursing home or home	3 months	Patients over 55, after hip fracture surgery (mean age 76)	Primary/secondary/tertiary/home-care/self-care Patients admitted to 3 hospitals in Netherlands randomly assigned to intervention (n=66) Multicentre randomised Control group received usual nutrition care	Not discussed	The assessed component included: Dieticians and HC staff adherence to the study protocol (no. and type and content of contacts and follow ups) The extent that patients followed the given nutritional recommendation	Feasibility study/ The paper does not discuss health outcomes The evaluation does not fully follow the framework Model of financing not discussed
Scuffham et al, 2017(91) Pilot study protocol	Not discussed	4-years pilot, Gold Coast Integrated Care (GCIC) for patients with chronic diseases or high risk of hospitalisation, consisting of managing patients in collaboration with GPs to reduce presentations to ED, improve the capacity of specialist hospital outpatient, and decrease planned/ unplanned hospital admission rates	4 years 2015-18	Adults ≥18 who are Gold Coast residents, diagnosed with at least one International Classification of Disease(ICD)	Primary 1500 patients in intervention group, 3000 in control group residents of Gold Coast region/Australia Nonrandomised controlled trial design	Not discussed	Did GCIC improve clinical service delivery according to guidelines? To what extent was GCIC implemented as intended? Which elements of GCIC were seen to be most useful by staff and patients? To what extent did GCIC improve continuity of care? Comparator: regular care in the same region	Model of financing not discussed

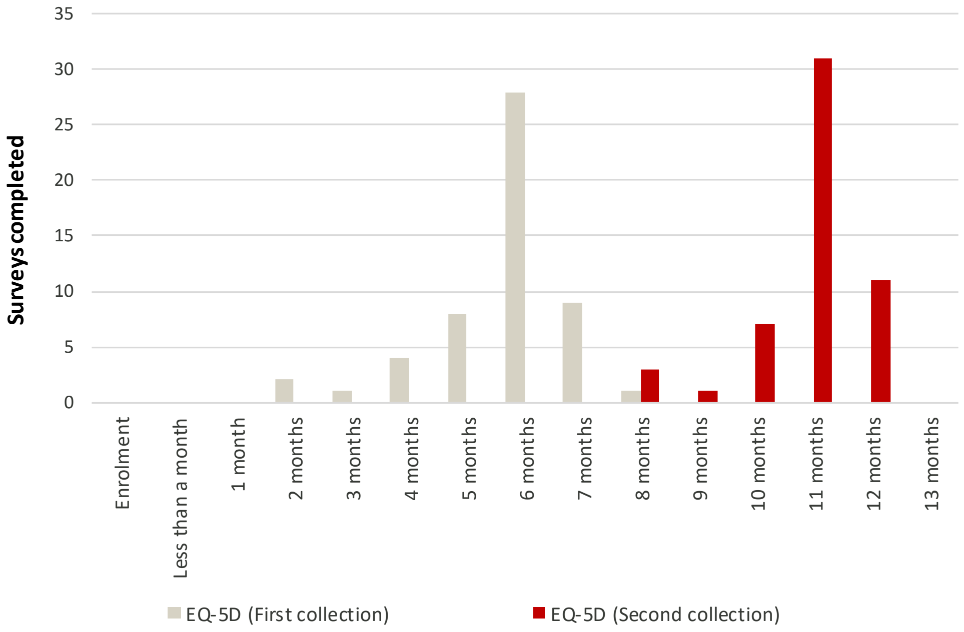
B: Survey timing

Chart B.1: Timing of data collection for PROMIS 10 survey



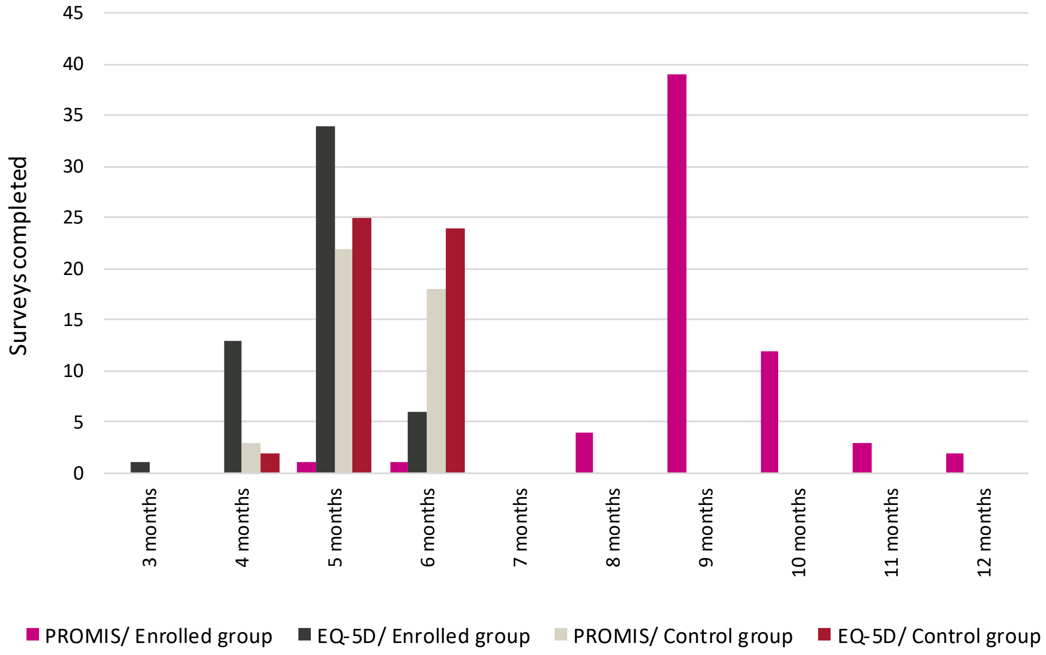
Source: MUCHE based on data provided by CCLHD.

Chart B.2: Timing of data collection for EQ-5D-5L



Source: MUCHE based on data provided by CCLHD.

Chart B.3: Elapsed time between first and second survey response

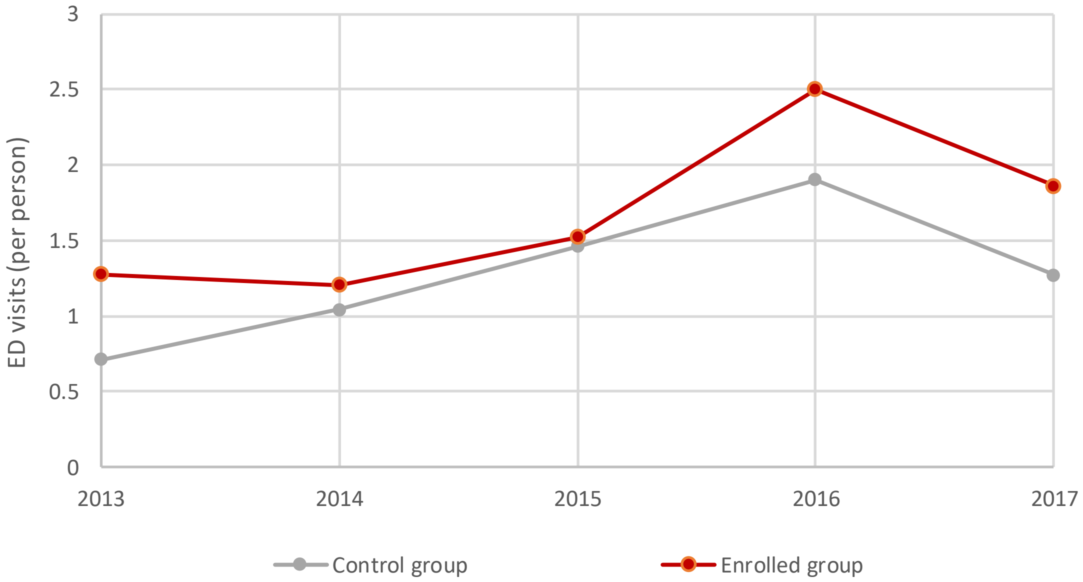


Source: MUCHE based on data provided by CCLHD.

C: Trend analysis

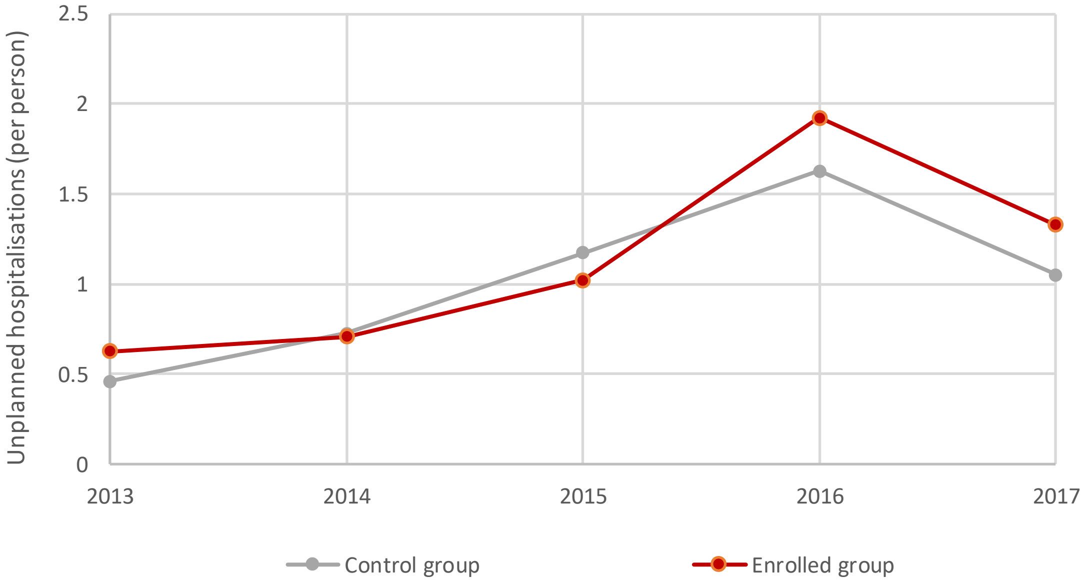
Trends before entropy balancing

Chart C.1: Trends in mean ED visits per person



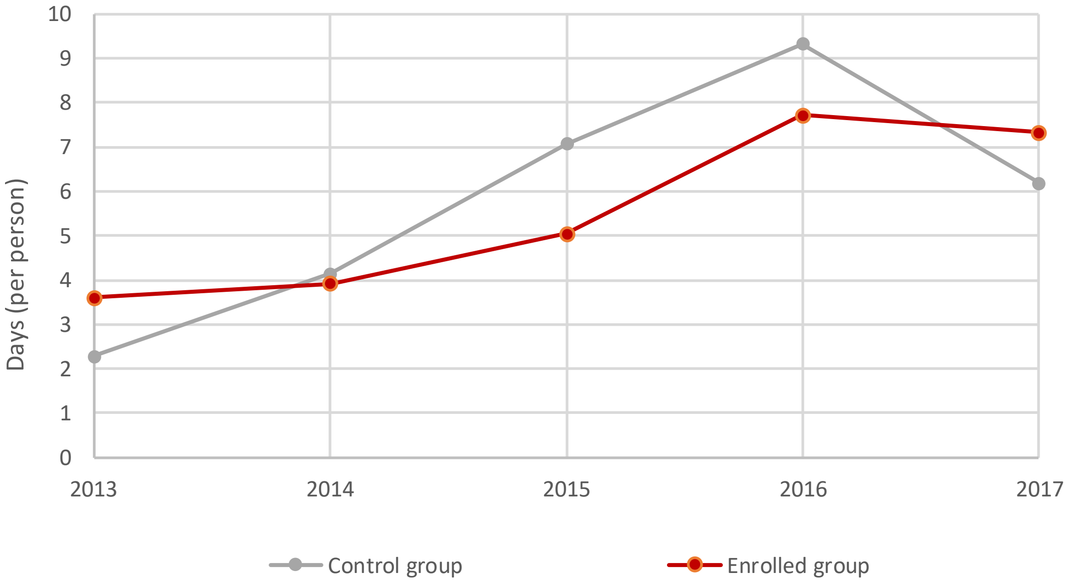
Source: MUCHE based on data provided by CCLHD.

Chart C.2: Trends in mean unplanned hospitalisations per person



Source: MUCHE based on data provided by CCLHD.

Chart C.3: Trends in mean length of stay per person

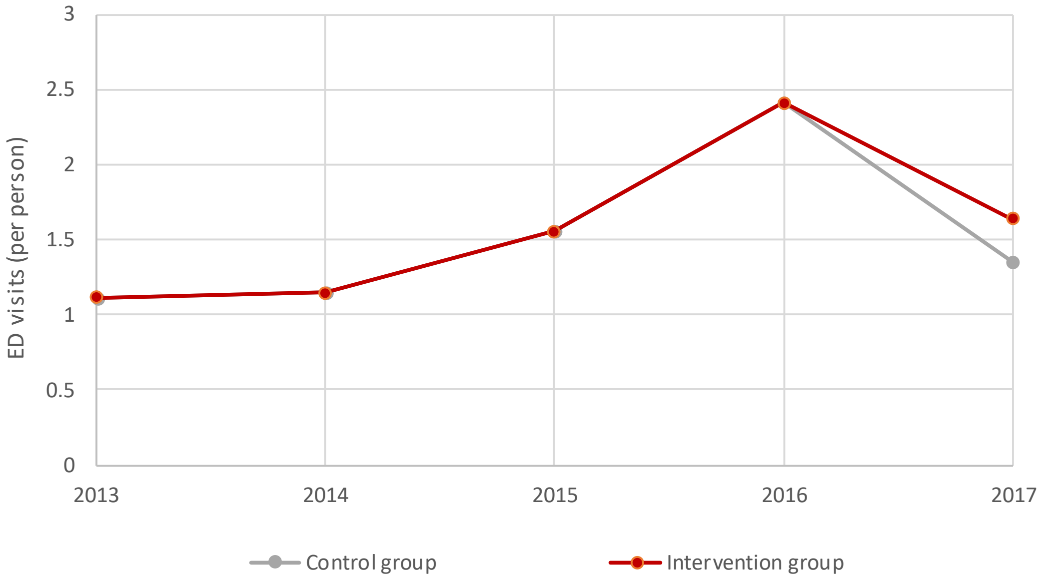


Source: MUCHE based on data provided by CCLHD.

Trends after entropy balancing

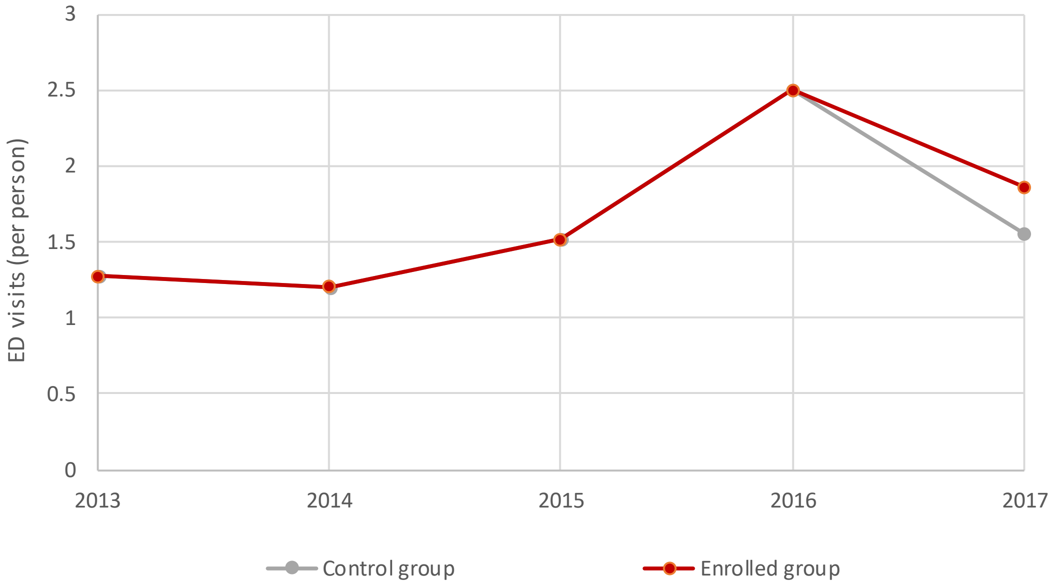
Emergency department (ED) visits

Chart C.4: Trends in mean ED visits (intervention and control groups) after entropy balancing



Source: MUCHE based on data provided by CCLHD.

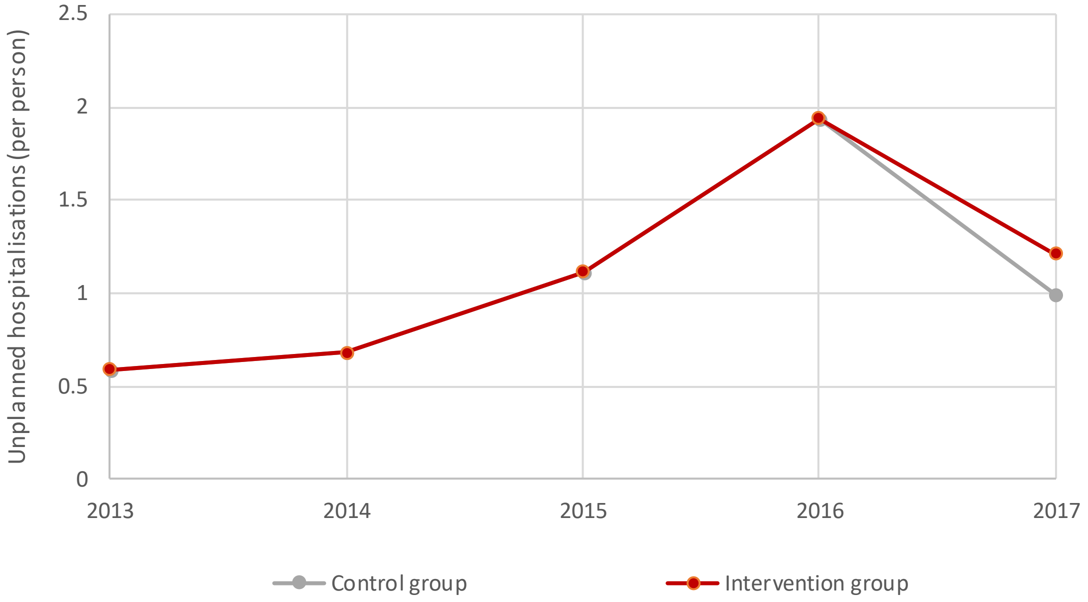
Chart C. 5: Trends in mean ED visits (enrolled and control groups) after entropy balancing



Source: MUCHE based on data provided by CCLHD.

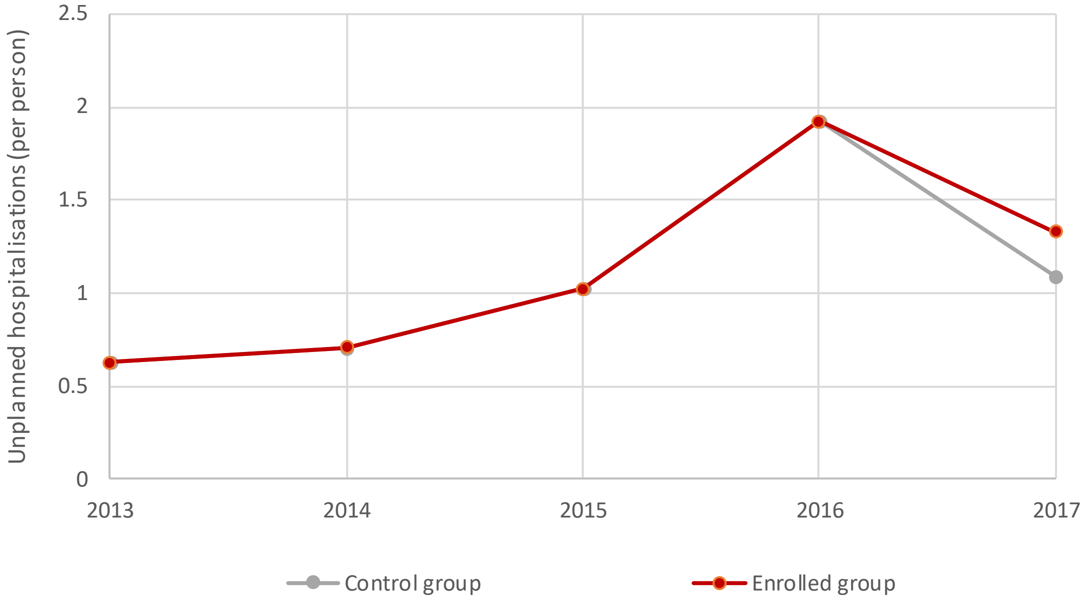
Unplanned hospitalisation (UH)

Chart C.6: Trends in mean UH (intervention and control groups) after entropy balancing



Source: MUCHE based on data provided by CCLHD.

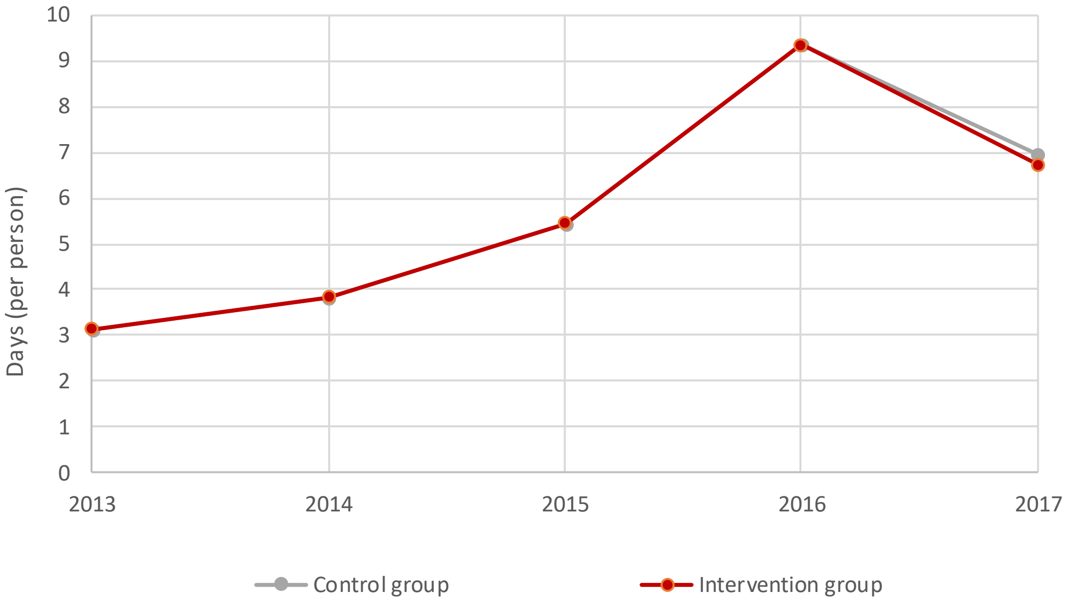
Chart C.7: Trends in mean UH (enrolled and control groups) after entropy balancing



Source: MUCHE based on data provided by CCLHD.

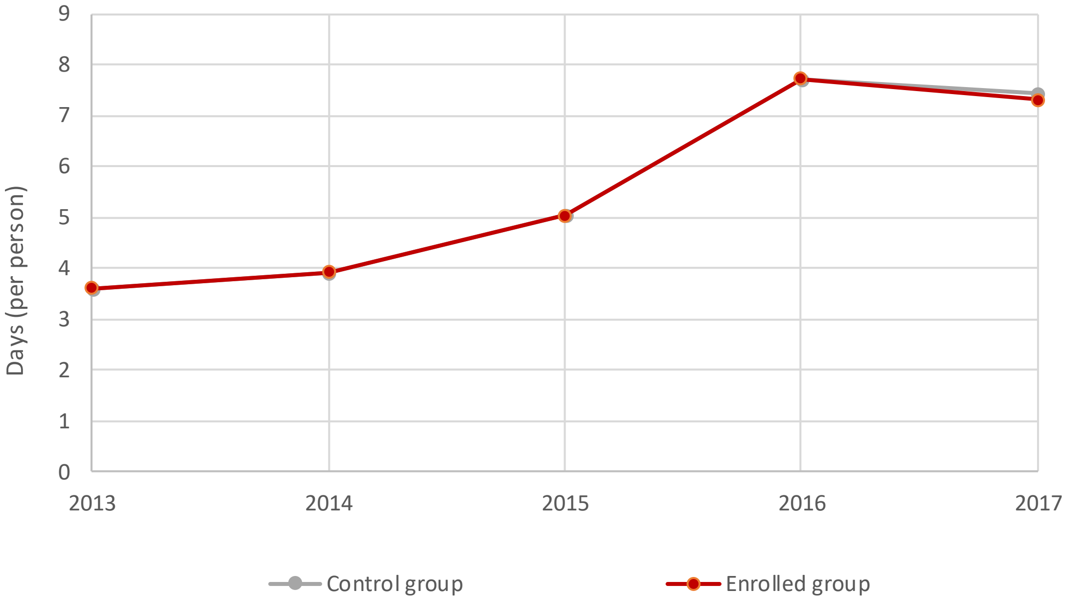
Unplanned length of stay

Chart C.8: Trends in mean length of stay per person (intervention and control groups) after entropy balancing



Source: MUCHE based on data provided by CCLHD.

Chart C.9: Trends in mean length of stay per person (enrolled and control groups) after entropy balancing



Source: MUCHE based on data provided by CCLHD.

D: Mapping PROMIS 10

The cost utility analysis undertaken in the evaluation of OBC required estimating changes in health utilities in both the enrolled and control groups. While utility values were sought through administering EQ-5D-5L to patients in the enrolled and control groups, there were delays to data collection, reducing the usefulness of this data as it was unlikely to represent health outcomes that existed at the start of receiving care coordination.

The PROMIS Global Health 10 (PROMIS 10) survey was collected by providers for most patients in the enrolled group when each person enrolled. However, PROMIS 10 cannot be used directly to estimate utility values.

To circumvent this problem, PROMIS 10 responses were mapped to EQ-5D-5L utility values using a statistical technique that has been established in the literature to link outcomes from a non-preference based measure to a utility measure.(92, 93) The EQ-5D-5L utilities were then used for the cost utility analysis.

Data collection

Data was collected from an online survey of 2,015 Australians conducted 14–26 February 2018. Patients were asked to complete four questionnaires:

- PROMIS 10 (94)
- EQ-5D-5L (95)
- Australian Quality of Life (AQoL-8D) (96)
- Charlson Comorbidity Index (CCI).(97)

The CCI was included to test the sensitivity and robustness of the algorithm across different disease groups. Demographic information including age, gender, state and postcode was also collected.

Data from the online survey were combined with data from 119 *Outcome Based Care* patients (from both the enrolled and control groups) who responded to PROMIS 10 and EQ-5D-5L. This increased the sample size of patients with lower utilities, thus improving the mapping algorithm. The final sample consisted of 2,134 patients (see Table D.1).

Two summary scores of physical and mental health were derived from PROMIS 10. The EQ-5D-5L utilities were estimated using Australian tariffs reported by Norman et al (2017).(98)

Table D.1: Descriptive statistics of final sample

Variables	General population survey	OBC program patient data	Combined data
No. of observations	2,015	119	2,134
Age (years)			
Mean (SD)	48.31 (17.8)	79.47 (7.1)	50.04 (18.8)
Range	18 to 89	65 to 98	18 to 98
Female (%)	1,076 (53.4%)	61 (51.3%)	1,137 (53.3%)
States and Territories (%)			
ACT	23 (1.1%)	0 (0%)	23 (1.1%)
NSW	581 (28.8%)	119 (100%)	700 (32.8%)
NT	8 (0.4%)	0 (0%)	8 (0.4%)
QLD	441 (21.9%)	0 (0%)	441 (20.7%)
SA	183 (9.1%)	0 (0%)	183 (8.6%)
TAS	67 (3.3%)	0 (0%)	67 (3.1%)
VIC	515 (25.6%)	0 (0%)	515 (24.1%)
WA	197 (9. 8%)	0 (0%)	197 (9.2%)
EQ-5D-5L utilities			
Mean (SD)	0.82 (0.2)	0.59 (0.4)	0.81 (0.3)
Range	-0.43 to 1	-0.28 to 1	-0.43 to 1
Utilities < 0	38 (1.9%)	14 (11.7%)	52 (2.4%)
Utilities =1	440 (21.8%)	6 (5%)	446 (20.9%)
Utilities > 0.9	1,120 (55.6%)	29 (24.4%)	1,149 (57 %)

Note: SD= standard deviation.

Source: MUCHE.

Analytic method

Several analytical methods mapping PROMIS 10 to EQ-5D-5L were tested. Direct and indirect[20] mapping was conducted, which included a combination of standard econometric methods and machine learning techniques. These included the following.

- Standard econometric methods
  1. ordinary least squares (OLS) regression
  2. generalised linear models (GLM)
  3. tobit regression
  4. censored least absolute deviation(CLAD)
  5. quantile regression (QR)
  6. ordered logit (OLOGIT).
- Machine learning methods
  1. classification and regression tree analysis (CART)
  2. bagging
  3. random forests.

The use of machine learning techniques avoided the need to presume distributions and relationships between PROMIS 10 and EQ-5D-5L and enabled the determination of the model and interactions effortlessly.(99, 100)

A 10-fold cross-validation[21] method was used to assess the predictive performance of models.(101) Predictive accuracy was compared using Mean Absolute Error (MAE), the Mean Squared Error (MSE), the proportion of utilities less than zero, and equal to one (full health) based on averaged 10-fold cross-validation. The ability of each model to predict lower utilities was emphasised given patients in OBC are expected to have a lower utility value than the general population given they suffer from chronic conditions. A mapping algorithm was developed using the best performing model.

Results

Estimation results

The analysis used 27 different models and specifications to map from PROMIS 10 to EQ-5D-5L. The best model was the QR model with the predictor set that included PROMIS 10 items as categorical variables, along with age and age squared variables. This resulted in the lowest MAE and MSE, and was

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[20] Mapping can be ‘direct’ where utility values are directly estimated from explanatory variables or ‘indirect’ where the probabilities for each response are predicted, and the relevant tariff is used to convert them into utility values.

[21] 10-fold cross-validation involved dividing the dataset randomly into k=10 subsamples, k-1 subsamples were used as the “estimation sample”, and one subsample was used as the “validation sample” to test the accuracy of the predictions. This process was repeated ten times with each of the ten subsamples used once as the validation sample.

the most accurate model in predicting the lower tail utilities. Table D.2 presents the coefficients for converting PROMIS 10 responses to EQ-5D-5L utilities.

Table D.2: Suggested algorithm to map PROMIS 10 to EQ-5D-5L

Predictor variables	Coefficients
PROMIS Q-1	
Level-1	0.163
Level-2	0.017
Level-3	-0.008
Level-4	-0.004
PROMIS Q-2	
Level-1	0.048
Level-2	0.015
Level-3	0.010
Level-4	0.004
PROMIS Q-4	
Level-1	0.125
Level-2	0.012
Level-3	-0.008
Level-4	-0.002
PROMIS Q-5	
Level-1	0.006
Level-2	0.000
Level-3	0.003
Level-4	0.001
PROMIS Q-6	
Level-1	0.305
Level-2	0.150
Level-3	0.031
Level-4	0.019
PROMIS Q-7	
Level-1	0.019
Level-2	0.040
Level-3	0.048
Level-4	0.057
Level-5	0.076
Level-6	0.098
Level-7	0.147

Predictor variables	Coefficients
Level-8	0.395
Level-9	0.550
Level-10	0.500
PROMIS Q-8	
Level-1	0.008
Level-2	0.064
Level-3	0.008
Level-4	0.006
PROMIS Q-9	
Level-1	0.088
Level-2	-0.001
Level-3	0.001
Level-4	-0.002
PROMIS Q-10	
Level-1	0.222
Level-2	0.057
Level-3	0.022
Level-4	0.002
Age	-0.026
Constant	0.0005

Note: The suggested algorithm is based on the QR model. This algorithm generates disutility values. Disutility values are then deducted from one to estimate utility values. For all PROMIS questions except question 7, the reference level is level-5 which reflects "excellent" or "having no problem". For question 7, the reference level is level-0 which represents "no pain at all".
Source: MUCHE.

E: Results of mPPIC survey

Table E.1: Allocation of mPPIC survey questions to study themes

Themes	Questions
1. Provider engagement	
Quality of administration process	3,4,5
Knowledge of patient's health and medical history	6,7,8
Quality of communication	9,10,11,12
Effort to better understand patient preferences	13,14,15,16
2. Care received from the provider	
Care planning	17,18,19,20
Organising care	21
Increasing capacity to self-care	22,23,24,25,26,27
Supporting self-care	28,29,30
3. Care from specialists	
Understanding care received from specialists	31,32,33
Helping with medications	34,35
4. Care after hospitalisation	
Helping with post hospital care	40,42,45
5. Overall experience	
Self-care management	47
Help with medications	48, 49
Understanding patient preferences	50
Health information	52

Note: mPPIC = Modified Patient Perception of Integrated Care

Source: MUCHE based on data provided by CCLHD.

Table E.2: Results from the modified Patient Perception of Integrated Care (mPPIC) survey

	First collection		Second collection	
Questions	**Response**	**n =**	**Response**	**n =**
Provider engagement				
Q.3. Before your most recent appointment with this provider, did you get a reminder from this provider's office about the appointment?	Yes (56%) No (44%)	45	Yes (46%) No (54%)	46
Q.4. Before your most recent appointment with this provider, did you get instructions telling you what to expect or how to prepare for the visit?	Yes (39%) No (61%)	44	Yes (39%) No (61%)	46
Q.5. Since enrolled with this provider, how often did this provider cancel or change the date of an appointment?	Never (77%) Sometimes (23%) Usually (0%) Always (0%)	44	Never (76%) Sometimes (24%) Usually (0%) Always (0%)	46
Q.6. Since enrolled with this provider, how often did you have to repeat information to the provider that you had already provided?	Never (77%) Sometimes (23%) Usually (0%) Always (0%)	44	Never (89%) Sometimes (2%) Usually (0%) Always (9%)	46
Q.7. Since enrolled with this provider, how often did this provider seem to know the important information about your medical history?	Never (35%) Sometimes (14%) Usually (30%) Always (21%)	43	Never (30%) Sometimes (17%) Usually (11%) Always (41%)	46
Q.8. Since enrolled with this provider, how often did this provider ask about things in your work or life at home that affect your health?	Never (31%) Sometimes (10%) Usually (31%) Always (29%)	42	Never (37%) Sometimes (9%) Usually (0%) Always (54%)	46
Q.9. Since enrolled with this provider, how often did this provider explain things in a way that was easy to understand?	Never (12%) Sometimes (5%) Usually (26%) Always (57%)	42	Never (35%) Sometimes (7%) Usually (2%) Always (57%)	46
Q.10. Since enrolled with this provider, how often did this provider listen carefully to you?	Never (12%) Sometimes (7%) Usually (16%) Always (65%)	43	Never (22%) Sometimes (11%) Usually (4%) Always (63%)	46
Q.11. Since enrolled with this provider, how often did this provider show respect for what you had to say?	Never (7%) Sometimes (7%) Usually (16%) Always (70%)	43	Never (22%) Sometimes (2%) Usually (2%) Always (74%)	46
Q.12. Since enrolled with this provider, how often did this provider spend enough time with you?	Never (5%) Sometimes (7%) Usually (26%) Always (62%)	42	Never (22%) Sometimes (11%) Usually (0%) Always (67%)	46

	First collection		Second collection	
Questions	Response	n =	Response	n =
Q.13. Since enrolled with this provider, how often did this provider ask whether you had ideas about how to improve your health?	Never (28%) Sometimes (14%) Usually (21%) Always (37%)	43	Never (37%) Sometimes (11%) Usually (11%) Always (41%)	47
Q.14. How would you rate this provider's knowledge of your values and beliefs that are important to your health care?	Poor (5%) Fair (8%) Good (46%) Excellent (41%)	37	Poor (11%) Fair (9%) Good (43%) Excellent (37%)	47
Q.15. Since enrolled with this provider did this provider talk with you about setting goals for your health	Yes, definitely (43%) Yes, sometimes (20%) No (38%)	40	Yes, definitely (41%) Yes, sometimes (17%) No (41%)	46
Q.16. Since enrolled with this provider, did the care you received from this provider help you meet your goals?	Yes, definitely (60%) Yes, sometimes (27%) No (13%)	30	Yes, definitely (75%) Yes, sometimes (8%) No (17%)	24
Care received from the provider				
Q.17. Since enrolled with this provider, were there things that made it hard for you to take care of your health?	Yes, definitely (14%) Yes, sometimes (19%) No (67%)	42	Yes, definitely (24%) Yes, sometimes (14%) No (62%)	42
Q.18. Since enrolled with this provider, did someone from this provider ask you about these things that make it hard for you to take care of your health?	Yes (69%) No (31%)	16	Yes (83%) No (17%)	18
Q.19. Since enrolled with this provider, did someone from this provider come up with a plan to help you deal with the things that make it hard for you to take care of your health?	Yes, definitely (35%) Yes, sometimes (35%) No (29%)	17	Yes, definitely (69%) Yes, sometimes (13%) No (19%)	18
Q.20. Since enrolled with this provider, how often did this provider help you to identify the most important things for you to do for your health?	Never (31%) Sometimes (18%) Usually (21%) Always (31%)	39	Never (43%) Sometimes (13%) Usually (0%) Always (43%)	46
Q.21. Since enrolled with this provider, how often did someone from this provider help you get these services at home to take care of your health?	Never (37%) Sometimes (10%) Usually (12%) Always (41%)	41	Never (37%) Sometimes (15%) Usually (2%) Always (46%)	46
Q.22. Since enrolled with this provider, did someone from this provider give you instructions about how to take care of your health?	Yes (41%) No (33%)	41	Yes (59%) No (67%)	45
Q.23. Since enrolled with this provider, how often did the instructions you received help you take care of your health?	Never (27%) Sometimes (23%) Usually (32%) Always (18%)	22	Never (19%) Sometimes (13%) Usually (31%) Always (38%)	16

	First collection		Second collection	
Questions	**Response**	**n =**	**Response**	**n =**
Q.24. Since enrolled with this provider, if you had any trouble taking care of your health at home, would you know who to ask for help?	Yes, definitely (70%) Yes, sometimes (16%) No (14%)	44	Yes, definitely (83%) Yes, sometimes (4%) No (13%)	46
Q.25. Since enrolled with this provider, did you take any prescription medicine?	Yes (84%) No (16%)	43	Yes (87%) No (13%)	45
Q.26. Since enrolled with this provider, how often did someone from this provider talk with you about how you were supposed to take your medicine?	Never (71%) Sometimes (18%) Usually (6%) Always (6%)	34	Never (43%) Sometimes (10%) Usually (13%) Always (35%)	40
Q.27. Since enrolled with this provider, how often did someone from this provider talk with you about what to do if you have a bad reaction to your medicine?	Never (85%) Sometimes (6%) Usually (9%) Always (0%)	33	Never (75%) Sometimes (5%) Usually (8%) Always (13%)	40
Q.28. Since enrolled with this provider, how often did someone from this provider contact you between visits to see how you were doing?	Never (31%) Sometimes (45%) Usually (5%) Always (19%)	42	Never (59%) Sometimes (14%) Usually (5%) Always (23%)	44
Q.29. Since enrolled with this provider, did you try to contact this provider's office with a medical question after regular office hours?	Yes (2%) No (98%)	42	Yes (4%) No (96%)	45
Q.30. Since enrolled with this provider, when you tried to contact this provider's office after regular office hours how often did you get an answer to your medical question in a timely manner?	Never (80%) Sometimes (0%) Usually (0%) Always (20%)	5	Never (80%) Sometimes (0%) Usually (0%) Always (20%)	5
Care from specialists				
Q.31. Since enrolled with this provider did you receive care from any specialists outside the office of the provider?	Yes (76%) No (24%)	45	Yes (59%) No (41%)	46
Q.32. In general, how often does someone from the provider seem informed and up to date about the care you get from specialists?	Never (56%) Sometimes (22%) Usually (14%) Always (8%)	36	Never (56%) Sometimes (7%) Usually (11%) Always (26%)	27
Q.33. In general, how often do you have to remind someone from the provider about the care you receive from specialists?	Never (78%) Sometimes (19%) Usually (3%) Always (0%)	36	Never (93%) Sometimes (4%) Usually (0%) Always (4%)	27
Q.34. Since enrolled with this provider, did any specialists outside the office of the provider prescribe medicine for you?	Yes (64%) No (36%)	36	Yes (59%) No (41%)	27
Q.35. In general, how often does someone from this provider talk with you about medicines prescribed by these specialists?	Never (67%) Sometimes (17%)	24	Never (47%) Sometimes (6%)	17

Questions	First collection Response	n =	Second collection Response	n =
	Usually (8%) Always (8%)		Usually (24%) Always (24%)	
Q.36. When you see the specialist, does he or she seem to know enough information about your medical history?	Yes, definitely (89%) Yes, sometimes (3%) No (8%)	37	Yes, definitely (93%) Yes, sometimes (7%) No (0%)	29
Q.37. When you see this specialist, how often do you have to repeat information to the provider?	Never (72%) Sometimes (25%) Usually (3%) Always (0%)	36	Never (88%) Sometimes (4%) Usually (4%) Always (4%)	28
Q.38. When you see this specialist, how often does this specialist seem to know your important test results from other specialists?	Never (19%) Sometimes (3%) Usually (33%) Always (44%)	36	Never (10%) Sometimes (3%) Usually (0%) Always (86%)	29
Care after hospitalisation				
Q.39. Since enrolled with this provider, were you admitted to hospital overnight or longer?	Yes (51%) No (49%)	45	Yes (40%) No (60%)	47
Q.40. After your most recent hospital stay, did someone from the provider contact you to see how you were doing?	Yes (19%) No (81%)	27	Yes (8%) No (92%)	24
Q.41. After your most recent hospital stay, were you prescribed any medications?	Yes (69%) No (31%)	26	Yes (42%) No (58%)	24
Q.42. After your most recent hospital stay, did someone from the provider contact you to check if you were able to follow instructions about any medicines you were prescribed?	Yes (14%) No (86%)	22	Yes (5%) No (95%)	19
Q.43. After your most recent hospital stay, were you given instructions about caring for yourself at home?	Yes (75%) No (25%)	28	Yes (54%) No (46%)	24
Q.44. After your most recent hospital stay, were the instructions you were given easy to understand?	Yes, definitely (78%) Yes, sometimes (4%) No (17%)	23	Yes, definitely (92%) Yes, sometimes (0%) No (8%)	12
Q.45. After your most recent hospital stay, did someone from the provider seem to know the important information about this hospital stay?	Yes, definitely (35%) Yes, sometimes (12%) No (54%)	26	Yes, definitely (22%) Yes, sometimes (0%) No (78%)	23
Q.46 What number would you use to rate all your health care in the last 6 months?	0 (worst health) (2%) 1 (0%) 2 (2%) 3 (4%) 4 (0%) 5 (17%) 6 (2%)	46	0 (worst health) (0%) 1 (0%) 2 (0%) 3 (2%) 4 (2%) 5 (4%) 6 (2%)	48

	First collection		Second collection	
Questions	Response	n =	Response	n =
	7 (7%) 8 (24%) 9 (9%) 10 (best health) (33%)		7 (2%) 8 (25%) 9 (23%) 10 (best health) (40%)	
Q.47. What number would you use to rate how easy it was for you to manage your medical care in the last 6 months?	0 (hard to manage) (0%) 1 (4%) 2 (2%) 3 (2%) 4 (0%) 5 (9%) 6 (7%) 7 (4%) 8 (9%) 9 (4%) 10 (easy to manage) (59%)	46	0 (hard to manage) (0%) 1 (0%) 2 (2%) 3 (0%) 4 (0%) 5 (17%) 6 (2%) 7 (15%) 8 (21%) 9 (13%) 10 (easy to manage) (31%)	48
Q.48 Since enrolled with this provider, did someone from the provider know about all your medical needs?	Yes, definitely (27%) Yes, sometimes (24%) No (49%)	45	Yes, definitely (45%) Yes, sometimes (28%) No (28%)	47
Overall experience				
Q.49. Since enrolled with this provider, did someone from this provider know about all the medicines you were taking?	Yes, definitely (16%) Yes, sometimes (31%) No (53%)	45	Yes, definitely (40%) Yes, sometimes (19%) No (40%)	47
Q.50. Since enrolled with this provider, did someone from this provider know you well as a person?	Yes, definitely (18%) Yes, sometimes (27%) No (56%)	45	Yes, definitely (34%) Yes, sometimes (26%) No (40%)	47
Q.51. In the next six months, what do you think will happen to your overall health?	It will get much better (7%) It will get somewhat better (27%) It will not change (47%) It will get somewhat worse (20%) It will get much worse (0%)	45	It will get much better (0%) It will get somewhat better (21%) It will not change (44%) It will get somewhat worse (35%) It will get much worse (0%)	48
Q.52 (a). Do you have any problems with lack of information about your medical conditions?	Not a problem (74%) Small problem (8%) Moderate problem (15%) Big problem (0%) Very big problem (3%)	39	Not a problem (95%) Small problem (2%) Moderate problem (2%) Big problem (0%) Very big problem (0%)	44
Q.52 (b). Do you have any problems with lack of information about treatment options?	Not a problem (79%) Small problem (8%) Moderate problem (13%) Big problem (0%) Very big problem (0%)	39	Not a problem (98%) Small problem (0%) Moderate problem (2%) Big problem (0%) Very big problem (0%)	44

	First collection		Second collection	
Questions	**Response**	**n =**	**Response**	**n =**
Q.52 (c) Do you have any problems with bringing up concerns about your health or health care with your provider?	Not a problem (87%) Small problem (5%) Moderate problem (3%) Big problem (5%) Very big problem (0%)	38	Not a problem (95%) Small problem (2%) Moderate problem (2%) Big problem (0%) Very big problem (0%)	44

Note: There were 209 people in the enrolled group. mPPIC was administered to the 66 patients who gave their consent to be surveyed. Not all questions were answered by these patients.

Source: MUCHE based on data provided by CCLHD.