UBC CENTRE FOR
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POLICY RESEARCH

An Evaluation of the Accelerated Integrated Primary and Community Care Initiatives

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Main Messages

- Accelerated integrated primary and community care (aIPCC) initiatives were introduced by the BC Ministry of Health in 2012 with the hopes of improving connections between primary and community-based health care.
- BC health authorities developed 20 individual alPCC initiatives. This project aggregated these to 10 overarching initiative groups and then assessed effects on healthcare utilization for both individual programs and initiative groups.
- Many aIPCC initiatives have been re-organized and/or rolled up into existing programs and funding structures and are no longer in their original forms. It remains important to understand the effects of these programs.
- Three primary outcomes were analyzed for each aIPCC initiative: total costs for hospitals, emergency department, physicians and pharmaceuticals; number of acute hospitalizations; and number of emergency department visits.
- There were no significant changes in healthcare utilization for the majority of aIPCC initiatives (with the caveat that this project was not able to include home and community care data, including residential care). While there were some exceptions, these tended to be increases rather than decreases in costs or utilization associated with the programs, and in some cases may reflect challenges in analysis.
- The initiatives varied, even within initiative grouping, in timing of rollout, location, supports offered, target and target populations. Not all programs implemented standardized enrolment criteria, even when such criteria were defined. The project did not have access to Home and Community Care data. All of these factors made the construction of comparison groups challenging.
- Some of the initiatives were very "light-touch" or episodic interventions, making attribution to changes in utilization challenging.
- Recommendations to enable future high-quality evaluations include: planning for evaluation at the time of program development, including evaluation of both the process of implementation and initiative outcomes; clear and measurable eligibility criteria; adherence to eligibility criteria; assurance of availability of relevant data; and avoiding pre-post evaluation without controls.
- The aIPCC initiatives overall did not reach their objective of decreasing healthcare utilization, though they may have had positive impacts that were outside the scope of this evaluation.

Executive Summary

Accelerated integrated primary and community care (aIPCC) initiatives were introduced by the BC Ministry of Health in 2012 with the hope of improving connections between primary and community-based health care. These initiatives were rolled out within BC's five geographic health authorities to provide specific needs-based care to their respective communities, using enrolment criteria to determine eligibility of patient populations. These were especially intended as partnerships between health authorities and primary care providers.

Overall there were 20 aIPCC initiatives introduced across the province, 19 of which were considered for analysis in this study. An Advisory Committee including researchers and staff from health authorities and the Ministry of Health organized these initiatives into 10 overarching initiative groups. Multiple administrative health data sources were used to analyze healthcare utilization patterns for enrolled patients and corresponding comparison groups for each initiative. Due to the lack of availability of Home and Community Care data, only 13 individual programs were assessed within our analysis.

We assessed 11 total outcomes for each initiative, with our three primary outcomes being: total costs for hospitals, emergency department physicians and pharmaceuticals; number of acute hospitalizations; and number of emergency department visits. Descriptive analysis and interrupted time series with controls were used as the main methodology for studying longitudinal changes in outcomes. Interrupted time series analysis enables the assessment of both change in the outcomes (e.g. cost) at the time of the intervention (level) and changes over time after the intervention (trend).

Changes in health care utilization for each initiative grouping and individual initiative are summarized in Table 1.

Overall, the aIPCC initiatives did not decrease utilization of hospitals, emergency departents, physicians or pharmaceuticals. This aligns with other research findings in the area of community health integration initiatives. Limitations to this evaluation include lack of access to all relevant information on participants and selection bias, meaning that participants may be selected into initiatives for reasons we cannot observe.

The conduct of this evaluation leads to several recommendations that might inform and improve future similar efforts. These include: planning for evaluation at the time of program development, including both evaluation of the implementation process and of relevant outcomes; clear and measurable eligibility criteria; adherence to eligibility criteria; assurance of availability of relevant data; and avoiding pre-post evaluation without controls.

This evaluation focused on one of the main objectives of the aIPCC initiatives, decreasing healthcare utilization. Despite the majority of the programs unsuccessfully reaching this objective there may have been other beneficial effects of the programs.

Table 1. aIPCC Grouped Initiatives and Findings

Initiative	Change in level of costs/use	Change in trend in costs/use	Significant change in healthcare utilization
COPD care (all sites combined)	None	None	None
BreatheWELL at Home (FHA)	None	None	None
BreatheWell (IHA)	Higher	Higher	Increase
Frail senior (all sites combined)	None	None	None
Home First (FHA)	None	None	None
Home First (IHA)	None	None	None
Home First (IH)	None	None	None
Home is Best (VCHA)	None	None	None
Integrated team			
Integrated Accessible Health Services (NHA)*	Increase	Decrease	Increase
Integrated network			
Care Management Strategy (VCHA)* *GP care conferencing only*	None	None	None
Community intervention			
Care Management Strategy (VCHA) *Telephonic care management only*	None	None	Increase
Mental health			
Acute Home-Based Treatment (VCHA)*	Increase	Decrease	Increase
Mental Health Integrated Care (IHA)	None	None	None
Frequent users			
Intensive Integrated Care Management (IH)	None	Decrease	None
Community reintegration			
Early Supported Discharge (VCHA)	None	None	None

* Changes are likely driven by imperfect controls given significant spike in service use only among cases.

Notes:
We use "IH" to refer to Island Health and "IHA" to refer to Interior Health Authority.
Only 13 of the 20 aIPCC initiatives are listed. One was excluded because it had been previously evaluated, and six were excluded from analysis due to a lack of appropriate data. See page 9 for more detail.

Introduction

In 2010, the BC Ministry of Health set out a three-year service plan including a goal that "British Columbians have the majority of their health needs met by high quality community based health care and support services." (1) The more specific objective was to provide "…a system of community based health care and support services built around attachment to a family physician and an extended health care team with links to local community services." (1) The objective and logic behind this goal was to integrate family physicians and community health care providers to address the increasing needs of the population by providing the best possible quality of care and service.

The vision for a health care system that has integrated primary and community care (IPCC) is "… care that provides choice, coordination and continuity, based on a relationship with the whole person, and the community in which they reside." (2) The key objectives of IPCC are: to support the development of a community-based health care system, including ensuring timely access to care; to improve outcomes for complex patients; to include patients and families in their care; and to reduce per capita costs, through reduced need for hospital and residential care services. (2) A few more specific outcomes envisioned in BC for IPCC were: improved quality of care for chronic and complex conditions; reduced hospitalizations; lower use of alternate level of care (ALC) days; reduced re-admission rates; a lower need for placement to residential care; and an increased percentage of natural deaths outside of hospital settings. (2)

In 2012 there was a commitment given to health authorities for approximately $50 million per year for three years to initiate "accelerated" integrated primary and community care (aIPCC) initiatives. The idea was that health authorities could choose their priority target population groups and the specific initiative, as long as there was resonance with the objectives of integrated primary and community care. Health authorities were required to apply for funding specific initiatives, and meet 12 specific criteria (provided in detail in Appendix A), including the need to link/align with primary care; the need to use a performance-linked funding mechanism; the need for scalability; and the focus on the patient/caregiver experience. (3)

Evaluation

In 2013 the Michael Smith Foundation for Health Research (MSFHR) released an interim evaluation report, which compares the overall IPCC approach against an externally derived set of criteria associated with successful integration. Accordingly, that report focused primarily on progress in areas such as governance structure, organizational structure and leadership, physician integration, patient focus, comprehensive care across the continuum and, geographic access. (4)

MSFHR's evaluation of IPCC led to a number of related projects. One significant advance was the development of conceptual target population definitions in order to enable comparisons to be drawn among programs, communities or regions with regards to progress or performance. In July 2013, definitions were approved by the Assistant Deputy Minister's Committee on Information Governance for three population groups: elderly people with frailty

and/or dementia; women in pregnancy and childbirth; and people with chronic conditions and patients with complex medical care needs. Similar definitional work was at least started for people with serious mental illness. (5)

All of the aIPCC initiatives that are the subject of this report aim to improve patient care by building an integrated system of well-coordinated community-based healthcare. (6) The theory was that through the delivery of these initiatives specialized care would be better-coordinated and delivered to patients and their families resulting in a decrease in total healthcare costs. If health care services are being provided in a more effective manner, then health conditions can be better monitored, resulting in decreased hospital admissions and length of stay for these patients. The purpose of this evaluation is to test this theory by producing quantitative empirical analyses of the effects of these accelerated initiatives.

The evaluation is not intended to be a "triple aim" evaluation analyzing population health, patient experience, and cost. (7) The funding call for this evaluation identified that the intended goal was to measure the effect these programs had on the utilization of healthcare services, which were limited in this case to hospitals, emergency departments, physicians and pharmaceuticals. (6) It is thus beyond the scope of this evaluation to conduct qualitative analyses of the effects these initiatives have on quality of life, coordination or care, or other non-quantitative measures.

Initiatives

There were 20 individual aIPCC initiatives launched across BC, which were intended to be partnerships between primary care providers and health authorities. Every health authority developed a unique set of initiatives that best suited the needs of patients within their communities. As a result, not all health authorities offered the same initiatives. All of the initiatives were rolled out in 2012, with the exception of the Integrated Accessible Health Services Built on a Foundation of Primary Care initiative (Northern Health Authority) that was rolled out in 2014. A full description of each of these initiatives can be found in Appendix B.

The initiatives were designed, implemented and managed by each individual health authority, with support from the Ministry of Health. There are contextual complexities to consider when looking at the development and rollout of each of the initiatives. The aIPCC initiatives were tailored to meet local needs and enhance supports for patients and their families. (6) However, each initiative was designed differently to provide and coordinate care to clients in each health authority. This included differences in the financial supports and timelines in how the initiatives were implemented.

Some initiatives faced challenges with standardized implementation across both urban and rural areas. Urban areas had more infrastructure in place and a rich supply of skilled health care workers while rural areas had to build infrastructure and had more difficulty securing skilled staff to run the programs. Urban areas also had access to a wide array of complementary agencies (e.g. housing agencies, food banks, etc.), which allowed them to provide more well-rounded

resources to patients than was always possible in more rural areas. Therefore, despite the existence of guidelines and best practices there were differences between how the programs were initially implemented.

Each initiative had enrolment criteria that staff followed when assessing whether clients were an appropriate fit for specific initiatives (see Appendix C). In some cases, initiative staff stuck strictly to enrolment criteria while in other circumstances initiatives had the liberty to broaden the enrolment criteria if they felt a patient was in need and could benefit from the program. It was the prerogative of the program to broaden the enrolment criteria for specific patients, but additional unstandardized and/or undocumented enrolment criteria were unmeasurable within our study and created some challenges for evaluation, which are discussed further below.

Our approach

A team comprised of researchers with clinical, methodological, and administrative data expertise formed the research group for this evaluation. This team was supported by an Advisory Committee comprising individuals from health authorities and the Ministry of Health who had familiarity and/or responsibility for aIPCC programs. The Advisory Committee first met in person January 2015 to confirm the approach to the evaluation, and convened intermittently after that by teleconference to hear and discuss updates on the work. The Advisory Committee members or their designates provided details about their local aIPCC initiatives. Members of the Advisory Committee are listed in Appendix D. The time delay on the project was related to very lengthy waits for delivery of data on aIPCC enrollees and then linkage and extraction of relevant administrative data.

For the purpose of this evaluation, the Advisory Committee endorsed grouping initiatives together if they targeted the same patient population with similar services. Initiative activities consisted of: home-based health care delivery, system/service delivery redesign, and clinical redesign. Through the grouping process, 10 distinct aIPCC initiative groups were identified (see Table 2). In addition, the 10 distinct initiative groups were ranked in order of the analysis to be completed, using the following criteria:

1. Clear inclusion criteria, to validate matching methodology
2. Priority (e.g. Northern Health only had one large initiative and therefore it was a priority over health authorities with multiple initiatives)
3. Sample size

There was agreement to remove the Assertive Community Treatment initiative from the evaluation, since that approach has been subject to multiple randomized control trials, (8) leaving 19 individual initiatives to be analyzed.

We did not receive the Home and Community Care data from the Ministry of Health in time to use them for analysis. This prevented us from including initiatives that required those data for appropriate selection of a comparison group. There are limitations to other comparison groups as well, which are discussed in more detail in the initiative-specific methods included in Appendix C.

Table 2. aIPCC Grouped Initiatives

Initiative	Health authority	Ranking*
COPD care		1
BreatheWELL at Home	FHA	
BreatheWell	IHA	
End of life care		2
End of Life Care**	FHA	
Frail senior		3
Home First	FHA	
Home First	IHA	
Home First	IH	
Home is Best	VCHA	
Integrated team		4
Integrated Accessible Health Services	NHA	
Integrated network		5
Care Management Strategy (GP conferencing only)	VCHA	
Community intervention		6
Tele Home Monitoring**	IHA	
Care Management Strategy (telephonic care management only)	VCHA	
Emergency intervention		7
Frail Senior/Chronic Disease Community Transitions**	VCHA	
Mental health		8
Psychosis Treatment Optimization Program**	FHA	
Acute Home Based Treatment	VCHA	
Mental Health Integrated Care	IHA	
Frequent users		9
Intensive Integrated Care Management	IH	
Mental Health and Substance Use Service – Integrated Primary Care**	IH	
Community reintegration		10
Community REDi**	FHA	
Early Supported Discharge	VCHA	

* Priority order for analysis decided on by the research team.
** Initiatives we were unable to analyze due to lack of data to create an appropriate comparison group.

Methods

Data sources

There were several data sets required to conduct this evaluation. The data sets were used to identify the relevant cohorts, identify appropriate comparators, and to create a set of relevant outcomes for analysis. These data sets were also used as a source for control variables such as age, sex and health status.

We requested data for the entire population ages 65+ and for all residents 18+ with mental health and addiction diagnoses. The population-based approach for the 65+ age group was desired because we anticipated a need to test different approaches to finding relevant comparison groups given the nature of enrolment in aIPCC programs; in this case we viewed selection of appropriate comparators as part of the research process rather than as part of data extraction. We requested data from two years prior to the start of the earliest aIPCC programs through the most recent data available at the time of the request, which translated to 2010/11 through 2013/14. The specific data sources used for these analyses are:

- **Registry:** This file includes a record for all people who are registered for health insurance in BC and eligible to receive publicly-funded health care. It provides age, sex, region of residence, income decile for neighbourhood of residence, number of days registered during the year, and the Johns Hopkins Adjust Clinical Group (ACG) and Aggregated Diagnosis Groups (ADG) variables as measures of health status. (9)
- **Medical Services Plan:** This file includes all fee-for-service payments to physicians. (10)
- **Hospital Separations:** These are records of all inpatient and day surgery separations (discharges and deaths) for BC residents, including from hospitals in other jurisdictions. The data include a Resource Intensity Weight (RIW) variable that can be used to estimate hospital expenditures for each separation. (11)
- **PharmaCare:** Records of all community-based prescriptions filled that are paid in full or in part by the Ministry of Health. The data includes cost fields that are used to calculate expenditures. (12)
- **Vital Statistics:** Records of all deaths in BC.(13)
- **Chronic Disease Registry:** This file is derived from physician, hospital and pharmaceutical data. Identifies patients who have been diagnosed with a select set of chronic conditions. Developed and maintained by the Ministry of Health. (14)
- **National Ambulatory Care Reporting System (NACRS):** This file includes information on Emergency Department visits for a subset of EDs in BC. These data complement the information we can draw from the Medical Services Plan file, as NACRS provides data for EDs staffed by non-fee-for-service physicians. (15)

One additional data set, on **Home and Community Care**, includes information on receipt of home-based services and admission to assisted living and short- and long-term residential care. (16) Unfortunately, these data were ultimately not available for analysis. The implication is that we were unable to pursue evaluations of programs that relied on these data.

Cohort and comparison groups

Our cohort consisted of all clients who were enrolled in any of the initiatives from 2010/11 through 2013/14. Start dates for all initiative participants were

provided by each health authority to the Ministry of Health and from there to the research team. The initiatives all had different medical foci and therefore it was plausible that clients could be enrolled in multiple programs. To simplify analysis and also to capture the effect from the program at the first time they enrolled we limited our analysis to the first program of enrolment for each client.

Advisory Committee members provided the research team with unique inclusion/exclusion criteria for each of the initiatives. Comparison groups were developed for each initiative group individually based on these criteria. We removed clients who did not meet these criteria from the analysis as the reasons for their enrolment were unclear, and therefore we were unable to find appropriate comparators for them. One major decision about comparators was whether they should be drawn from within the same health authority or a different health authority. Drawing from within a health authority could run the risk of either contamination (some spillover effects of programs to non-enrolled patients) or difficulty finding controls (if a high proportion of eligible individuals were enrolled). Drawing from a different health authority runs the risk of making comparisons across quite different health system environments. The final decision was to assess the reach of the program, that is the proportion of eligible patients it enrolled, and only where that was high to draw matches from a different health authority. Since some of the initiatives service individuals with similar needs and/or conditions we decided to remove all individuals who received any aIPCC initiative from the population pool(s) for comparison groups. In other words, no aIPCC cohort member is used as a match for any initiative.

It is important to understand that the analytic methodology used did not require a comparison group that was precisely the same in all respects except for the receipt of the intervention being evaluated. While that would be ideal, randomization was not part of the aIPCC process, and there was some likelihood that patients who were enrolled in initiatives would be different in ways not captured by any available data (this is a form of selection bias). Our intent was to maximize the similarity of the cohort and comparison groups in terms of their expected trajectory; it was considered more important that the pattern and trend of health care services use for the cohort and comparison group was similar in the pre-aIPCC initiative period than it was that their level of health care service use was the same. There were some differences in matching methodology across the initiatives; specific methods for each initiative are outlined in Appendix C.

In all cases we aimed for four matched comparators for each case. We first formed our comparison groups by selecting people who met the inclusion criteria for each of the initiatives. We then used propensity scores for matching, which are a useful approach when there is a desire to match across multiple criteria (18). The propensity score is the probability of being enrolled in the initiative calculated on the baseline variables (e.g. age, sex, region (local health service environment)), and health conditions (e.g. ACG) based on logistic regression. Propensity scores of enrolled patients were then compared to potential matches. We used greedy nearest neighborhood matching without replacement and with the caliper width equal to 0.2 of the standard deviation of the logit of the propensity score (16), to form matched pairs of cases and controls. Finally, we removed cases that did not find a suitable control.

Variable definition

We developed a suite of outcomes that would be assessed for each aIPCC initiative. Through discussions with the Advisory Committee, the three primary outcomes for each of the initiatives (i.e. the ones most likely / most desired to be affected by the intervention) were defined as: the sum of hospital, emergency department, physician and pharmaceutical costs; number of acute hospitalizations; and number of emergency department visits, with others serving as secondary outcomes. The following represents a list of the outcomes, all of which were measured on a monthly basis:

Visits

- **Number of physician visits:** These were calculated using physician fee-for-service payment files for medical and specialists' visits.
- *Number of emergency department visits:* These were calculated using a combination of NACRS and MSP-based fee-for-service data. We were limited to assessing ED visits in geographic areas where one or the other of these sources of data provides coverage for the ED. A preliminary assessment suggests that all but two locations were covered by one or both data sources. We developed a count of ED visits for each individual in the cohort and comparison groups.

Costs

- **Acute care, hospital, and day surgery costs:** Costs were calculated from the discharge abstract database, using Resource Intensity Weights (RIWs). RIWs were converted to dollar-value expenditures using the average cost per RIW for each Hospital, calculated annually by the BC Ministry of Health.
- **ED costs:** ED costs were calculated from NACRS and fee-for-service files, using the most up-to-date (2013/14) facility average cost of ED visit, which was $287 per visit.
- **Physician costs:** Costs were calculated from the fee-for-service payment files.
- **Pharmaceutical costs:** Costs were calculated from the Pharmacare files, this includes all prescription drugs that are publicly paid through the BC Ministry of Health Pharmacare program.
- **Total costs:** Cost information was summed across the physician fee-for-service payment files for medical, specialist and laboratory services, Pharmacare files for prescription drugs, discharge abstract database for hospital costs, and NACRS and MSP for ED visits.

Hospitalizations

- **Number of acute hospitalizations:** Count of all-cause admission to acute inpatient care.
- **Number of emergency department to acute admissions:** Count of non-elective hospital admissions through the ED, identified using the "admission category" field indicating urgent/emergent admissions.
- **Number of days of "ALC" days:** Count of "alternate level of care" days designation in acute care.

Patient-level longitudinal analysis

A single over-arching analytic strategy was applied in separate analyses for each of the individual aIPCC initiatives and initiative groups. Combined analysis within initiative groups was desired because it

increased the power of the analyses, but was only feasible in a few circumstances since there were so many nuanced differences in the way each program was formed and implemented.

The standard approach used was controlled interrupted time series (ITS), a strong quasi-experimental research design, to study longitudinal changes in our key outcome measures. This method has the advantage of being methodologically rigorous and easily interpretable by non-technical audiences, while also checking for and controlling for pre-existing trends in the outcome (17,18). This method has been used in numerous analyses of public policies within economics and health services research (19,20). Our models took the following general form to model each outcome measure for individual *i* in year *t*:

$$outcome_{it} = \beta_0 + \beta_1 \cdot time_t + \beta_2 \cdot intervention_i + \beta_3 \cdot intervention_i \cdot time_t + \beta_4 \cdot post_t + \beta_5 \cdot post_t \cdot time_t + \beta_6 \cdot post_t \cdot intervention_i + \beta_7 \cdot post_t \cdot intervention_i \cdot time_t + \varepsilon_{it}$$

where *intervention* is a dummy variable representing whether the individual received the intervention (no=0, yes=1), *time* is a count variable indicating the observation period at time *t* (1, 2, 3), and post is a dummy variable indicating the observation period *t* is after the program start (before=0, after=1). The parameters of interest for our analyses are β_6 and β_7, which indicate a differential change from the existing level and trend in the outcome following initiation of the program. The use of this modeling approach allowed us to separate the effects of the introduction of the program from the ongoing health changes one would expect in the populations served by the initiatives. By including two variables representing baseline trends in both the intervention and control group (through β_2 and β_3) we were able to account for differential baseline trends.

As the observations for each individual may be correlated over time, we controlled for autocorrelation using a lag variable. We also made other statistical assessments for model-parameter appropriateness.

ITS requires multiple time periods of measurement in order to establish trends both before and after the intervention (19). In this case we used monthly measurements for all outcomes across all initiatives. ITS also requires setting a time "0" for each case and control. For cases, the intent was to use the date on which the individual met the inclusion criteria for the initiation, for example a second ED visit. The assumption was that there would be little difference between the qualifying and enrolment dates, and using the qualifying date would enable us to apply the same to the controls. That is, once controls were identified, their intervention start date (time "0") would be the date at which they met the inclusion criteria.

Due to lags or errors in record keeping by the individual initiatives, some clients had a long wait time between qualifying for the program and being enrolled into the program. To account for this, we counted the lag days between the date that they qualified for the program and the date they were enrolled for each case. We then applied that same lag to the controls.

In most cases, enrolment was related to some sort of health services utilization, often an acute care stay. This creates spikes in service use and cost around time 0. Since these are temporary spikes, it is appropriate to exclude these time periods from analysis so that they do not overly influence regression results. We chose to exclude time period (study time instead of calendar time) -3 to +3 from any regression as there were usually extremely high costs in those periods.

Results

We received 85,704 records from health authorities for individuals enrolled in aIPCC initiatives. There was a fair amount of cross-over (i.e. individuals enrolled in multiple programs) and multiple-enrolment (i.e. enrolled in same program more than once) within initiatives for many individuals. Adding to the complexity, not every initiative had a clear enrolment or discharge date. As a result, we limited our analysis to one record per person per program with priority to the initiative the client was enrolled in first (n= 50,964). We then limited our analysis to those individuals who could be found in the registry data (n= 49,524) and then further to those who were present at the beginning of our study period (n= 47,801), since some might have moved in/out or died between enrolment and program roll-out. This left us with 47,801 aIPCC participants and 3,952,354 non-aIPCC participants from the registry data at the beginning of our study period.

Table 3 shows the demographics of aIPCC participants and non-participants at enrolment and at the beginning of the study period (2010/2011). aIPCC participants are more likely to be older (75+) females compared to non-aIPCC participants. There were proportionally more aIPCC participants from the Vancouver Coastal Health Authority; this is not surprising as 7 out of the 19 initiatives were located within that health authority. Compared to non-aIPCC participants, aIPCC participants are more likely to be from lower SES neighbourhoods and to be sicker, according to major ADG counts.

Comparison groups for each program were drawn from the non-aIPCC participant pool depicted in Table 3. Propensity score matching ensured that the comparison group was similar on these observed characteristics, including in some cases matching on pre-intervention health care utilization. Unobserved differences between the cohort and comparison groups may still remain.

The schematic below provides an overview of how to read and interpret a single-page summary of results for each initiative. In each case there is a summary of program information, figures showing monthly trends for each primary outcome, results of the ITS analysis on total costs for hospitals, physicians and pharmaceuticals, and a table of ITS regression parameters. In all cases we show the ITS for total costs only, as this analysis reflects the findings overall. Further details are provided in Appendix C.

Table 3. Demographics of aIPCC participants and non-participants at enrolment and at the beginning of the study period (2010/2011)

	At enrolment *aIPCC participant*	At start of study *aIPCC participant*	At start of study *non-aIPCC participant*	Chi-Square p-value
N	49,524	47,801	3,952,354	
Sex				
Female	28, 085 (56.7%)	27,109 (56.7%)	2,002,718 (50.7%)	<0.0001
Male	21,432 (43.4%)	20,685 (43.3%)	1,948,130 (49.3%)	
Age group				
0-19	1,332 (2.7%)	1,648 (3.4%)	342,406 (8.7%)	<0.0001
20-44	5,450 (11.0%)	4,660 (9.7%)	1,577,886 (39.9%)	
45-74	1,3693 (27.6%)	16,423 (34.4%)	1,714,757 (43.4%)	
75+	2,9049 (58.7%)	25,070 (52.4%)	317,305 (8.0%)	
Health authority				
Interior	2,276 (4.6%)	2,514 (5.3%)	649,560 (16.4%)	<0.0001
Fraser	9,464 (19.1%)	9,446 (19.8%)	1,357,016 (34.3%)	
Vancouver Coastal	28,944 (58.4%)	28,438 (59.5%)	988,086 (25.0%)	
Island	1,996 (4.0%)	2,123 (4.4%)	660,747 (16.7%)	
Northern	6, 784 (13.7%)	5,120 (10.7%)	240,398 (6.1%)	
Income quintile				
Lowest	12,646 (25.6%)	12,051 (25.2%)	798,380 (20.2%)	<0.0001
2nd	9,555 (19.3%)	9,358 (19.6%)	781,092 (19.8%)	
Middle	9,101 (18.4%)	8,842 (18.5%)	770,840 (19.5%)	
4th	8,300 (16.8%)	7,900 (16.5%)	765,158 (19.4%)	
Highest	9,228 (18.6%)	8,951 (18.7%)	749,332 (19.0%)	
Major ADGs				
0	7,059 (14.4%)	14,516 (30.4%)	2,702,597 (68.4%)	<0.0001
1	8,850 (18.1%)	13,347 (27.9%)	827,075 (20.9%)	
2	10,211 (20.8%)	10,051 (21.0%)	276,323 (7.0%)	
3	9,427 (19.2%)	5,854 (12.2%)	95,285 (2.4%)	
4	7,177 (14.6%)	2,679 (5.6%)	34,729 (0.9%)	
5 +	6,286 (12.7%)	353 (0.7%)	1,360 (0.0%)	

Key to results

aIPCC initiative general information

- Name
- Health authority
- Summary
- Total clients in initiative (could be multiple enrolment of same client), number of unique clients, cases used for analysis (some removed for not meeting criteria)
- Legend (blue = control; red = case)

Total costs

- Differences in total costs between control and cases
- Legend (blue = control; red = case)
- X axis = study time (months)
- Y axis: costs (dollars)

Interrupted time series graph

- Legend (blue = control; red = case; dotted line (intervention line) = initiative start time
- X axis = study time (months)
- Lines before intervention line indicate the total cost trend and level for both cases and controls
- Lines after intervention line indicate the total cost trend and level for both cases and controls, the dotted red line indicates the expected total cost trend and level if there was no initiative

Number of emergency department visits

- Differences in number of emergency department visits between control and cases
- Legend (blue = control; red = case)
- X axis = study time (months)
- Y axis: per 1,000 people

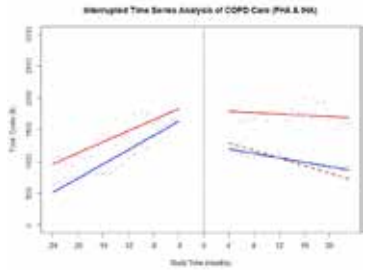
Number of acute hospitalizations

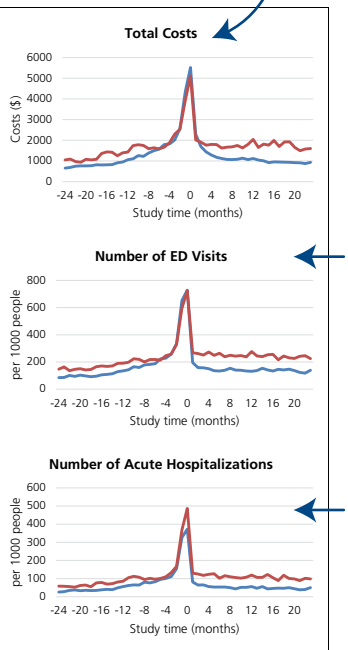
- Differences in number Differences in number of acute hospitalizations between control and cases
- Legend (blue = control; red = case)
- X axis = study time (months)
- Y axis: per 1,000 people

Participants in COPD Care
(Fraser and Interior Health Authority Combined)
A combination of the BreatheWELL at Home (Fraser) and BreatheWell (Interior) initiatives.

Total clients (N)	Unique clients (N)	Cases (N)
2412	2358	1675

Control Case





ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
Change in Level	372.44	-21.25	766.13	0.068
Change in Trend	24.79	-1.07	50.65	0.064

Results

- Total costs higher for participants compared to controls both before and after initiative
- Number of acute hospitalizations higher for participants compared to controls both before and after initiative
- Number of emergency department visits higher for participants compared to controls both before and after initiative
- No statistically significant change in level (cost) or trend (rate of cost increase) after the initiative
- No statistically significant healthcare utilization differences following introduction of the initiative

Interrupted time series results

- Change in level = change in cost
- Change in trend = change in rate of cost

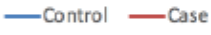
Results

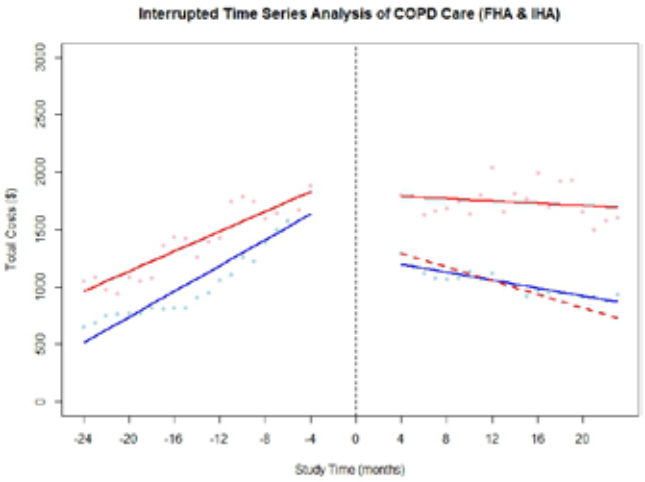
- Summary of results from the descriptive graphs and interrupted time series analysis

COPD care (all sites combined)

Participants in COPD Care
(Fraser and Interior Health Authority Combined)
A combination of the BreatheWELL at Home (Fraser) and BreatheWell (Interior) initiatives.

Total clients (N)	Unique clients (N)	Cases (N)
2412	2358	1675

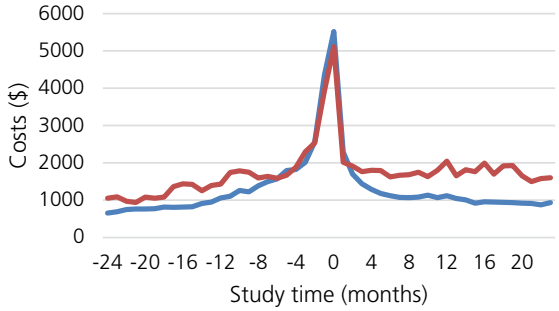




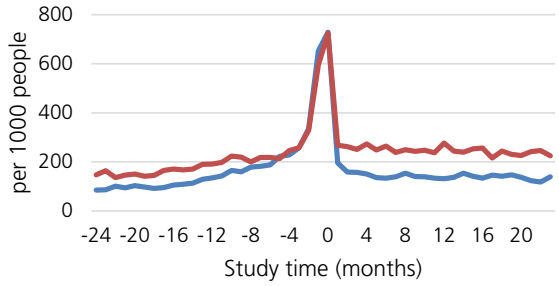
ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
Change in Level	372.44	-21.25	766.13	0.068
Change in Trend	24.79	-1.07	50.65	0.064

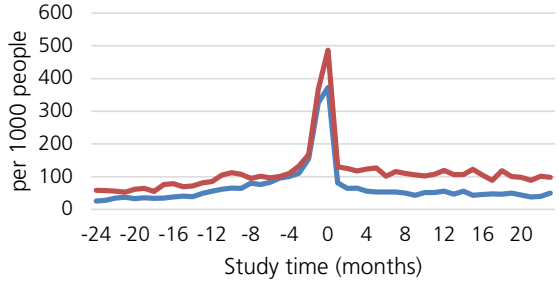
Total Costs



Number of ED Visits



Number of Acute Hospitalizations



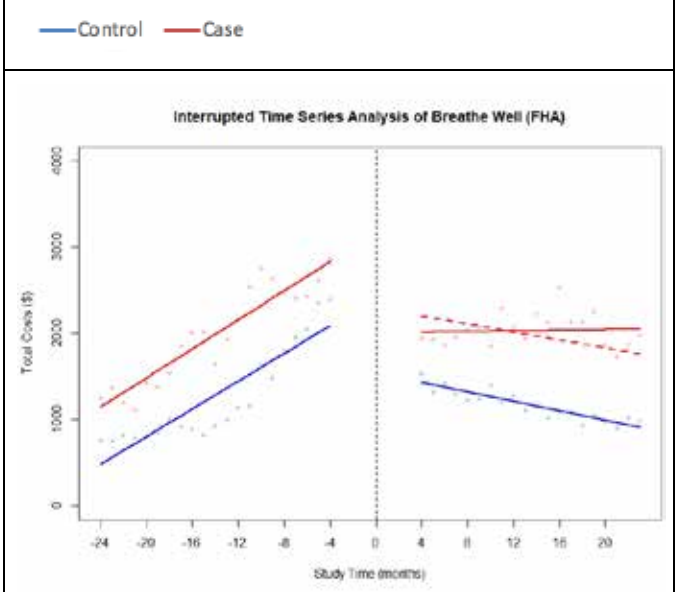
Results

- Total costs higher for participants compared to controls both before and after initiative
- Number of acute hospitalizations higher for participants compared to controls both before and after initiative
- Number of emergency department visits higher for participants compared to controls both before and after initiative
- No statistically significant change in level (cost) or trend (rate of cost increase) after the initiative
- No statistically significant healthcare utilization differences following introduction of the initiative

COPD care: BreatheWell at Home (FHA)

BreatheWell at Home
(Fraser Health Authority)
An integrated model of care that follows a COPD client's journey across acute, community and residential care sectors, and works in partnership with various health professionals.

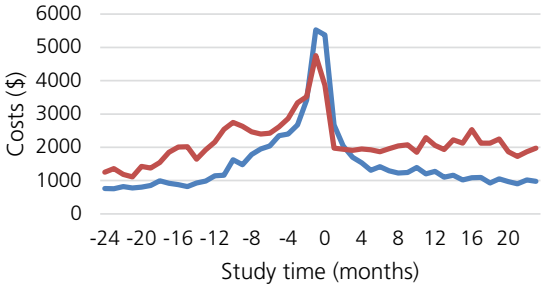
Total clients (N)	Unique clients (N)	Cases (N)
1,418	1,369	780



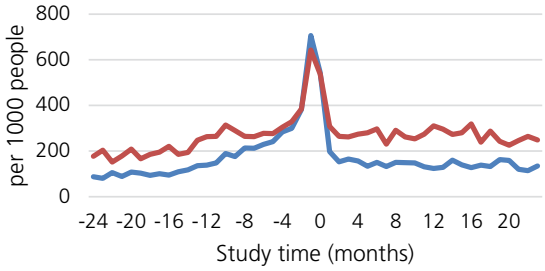
ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
Change in Level	-318.95	-984.77	348.86	0.351
Change in Trend	25.25	-18.39	68.88	0.260

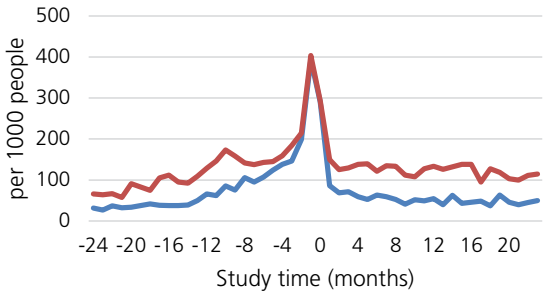
Total Costs



Number of ED Visits



Number of Acute Hospitalizations



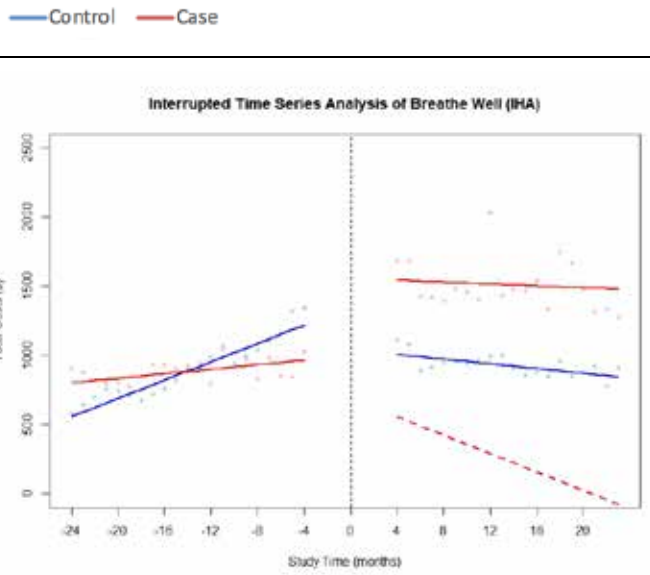
Results

- Total costs higher for participants compared to controls both before and after initiative
- Number of acute hospitalizations higher for participants compared to controls both before and after initiative
- Number of emergency department visits higher for participants compared to controls both before and after initiative
- No statistically significant change in level (cost) or trend (rate of cost increase) after the initiative
- No statistically significant healthcare utilization differences following introduction of the initiative

COPD care: BreatheWell (IHA)

BreatheWell
(Interior Health Authority)
An integrated model of care for moderate to severe COPD patients with high acute care utilization, and works in partnership with various health professionals.

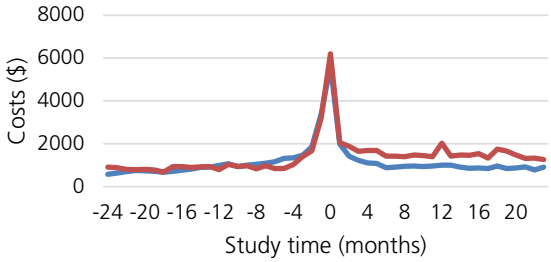
Total clients (N)	Unique clients (N)	Cases (N)
994	989	896



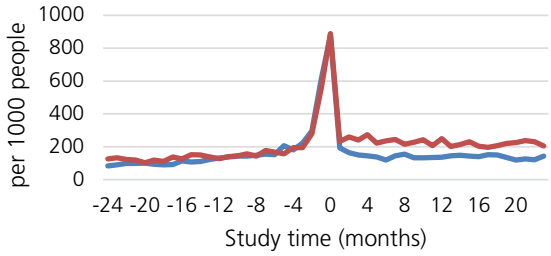
ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
Change in Level	835.62	716.89	954.35	<0.001
Change in Trend	30.09	22.31	37.88	<0.001

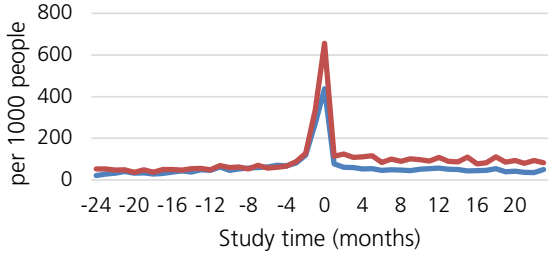
Total Costs



Number of ED Visits



Number of Acute Hospitalizations



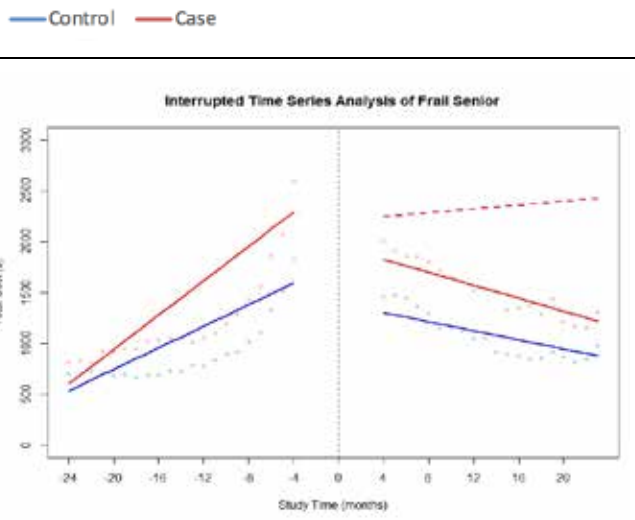
Results

- Total costs higher for participants compared to controls after initiative
- Number of acute hospitalizations costs higher for participants compared to controls after initiative
- Number of emergency department visits higher for participants compared to controls after initiative
- Significant increase in level (cost) and trend (rate of cost) after the initiative (i.e. initiative participants total monthly costs went up $836 and at a rate $30 per month faster than controls)
- Increase in healthcare utilization as a result of the initiative

Frail senior (all sites combined)

Frail Senior
(Fraser, Interior, Vancouver Coastal, and Vancouver Island Health Authorities Combined)
A combination of Home First (Fraser), Home First (Interior), Home First (Vancouver Island), and Home is Best (Vancouver Coastal) initiatives.

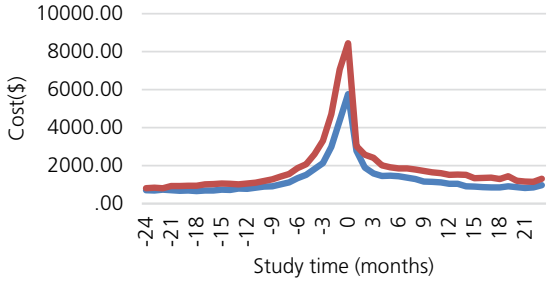
Total clients (N)	Unique clients (N)	Cases (N)
4970	4808	3670



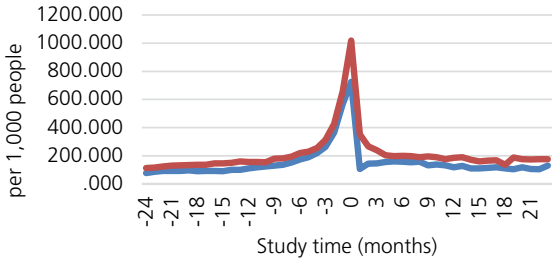
ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
Change in Level	-221.76	-1028.85	585.33	0.592
Change in Trend	-40.93	-108.35	26.49	0.238

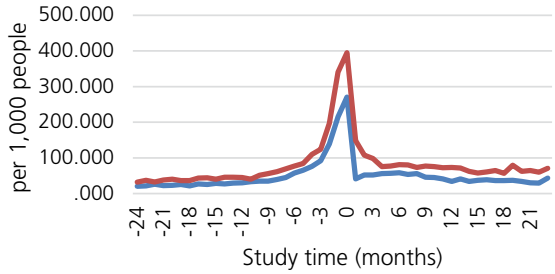
Total Costs



Number of ED Visits



Number of Acute Hospitalizations



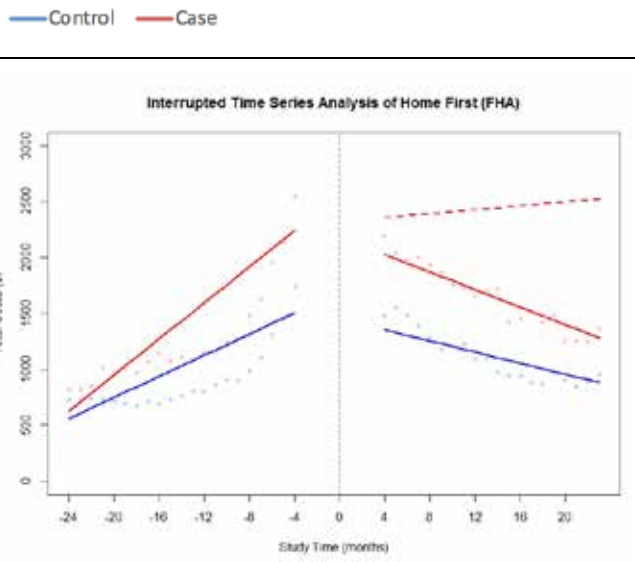
Results

- Total costs slightly higher for participants compared to controls both before and after initiative
- Number of acute hospitalizations slightly higher for participants compared to controls both before and after initiative
- Number of emergency department visits slightly higher for participants compared to controls both before and after initiative
- No statistically significant change in level (cost) or trend (rate of cost increase) after the initiative
- No statistically significant healthcare utilization differences following introduction of the initiative

Frail senior: Home First (FHA)

Home First
(Fraser Health Authority)
An integrated model of care to provide enhanced community supports to help seniors with complex health care needs to be discharged from hospital and live safely at home.

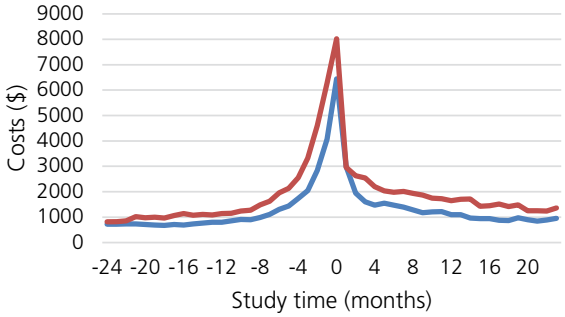
Total clients (N)	Unique clients (N)	Cases (N)
3,240	3,170	2,419



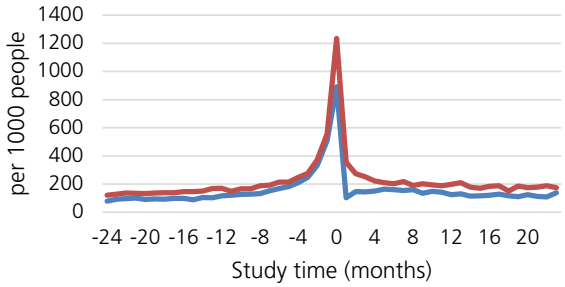
ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
Change in Level	-91.61	-869.98	686.77	0.818
Change in Trend	-47.99	-109.36	13.37	0.130

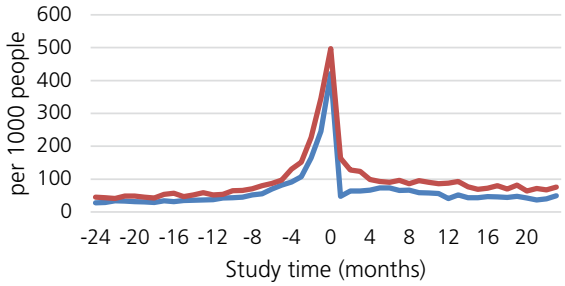
Total Costs



Number of ED Visits



Number of Acute Hospitalizations



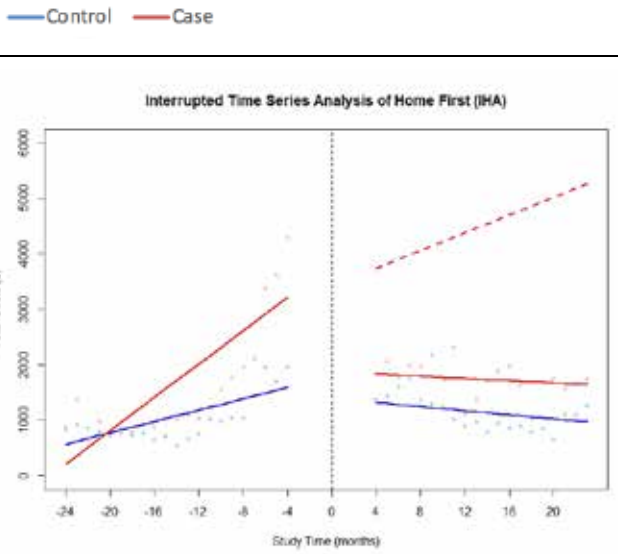
Results

- Total costs slightly higher for participants compared to controls both before and after initiative
- Number of acute hospitalizations slightly higher for participants compared to controls both before and after initiative
- Number of emergency department visits slightly higher for participants compared to controls both before and after initiative
- No statistically significant change in level (cost) or trend (rate of cost increase) after the initiative
- No statistically significant healthcare utilization differences following introduction of the initiative

Frail senior: Home First (IHA)

Home First
(Interior Health Authority)
An integrated model of care to provide enhanced services to older clients who would otherwise be moved into residential care or occupy alternate level of care (ALC) beds in hospital.

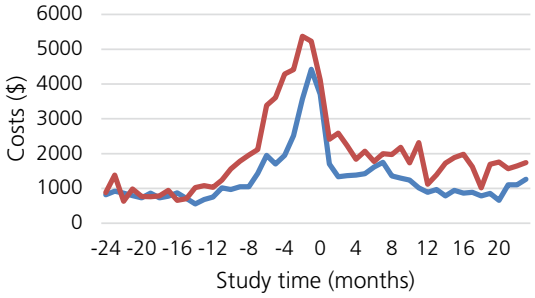
Total clients (N)	Unique clients (N)	Cases (N)
264	257	194



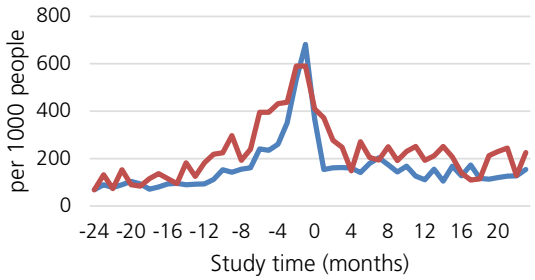
ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
Change in Level	-1449.20	-3225.18	326.79	0.114
Change in Trend	-90.56	-208.54	27.42	0.137

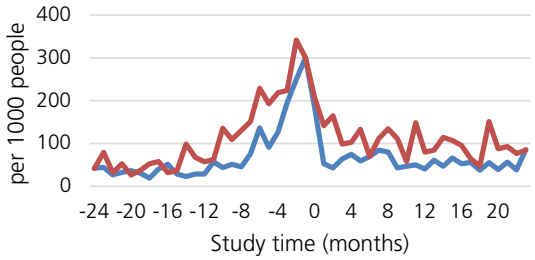
Total Costs



Number of ED Visits



Number of Acute Hospitalizations



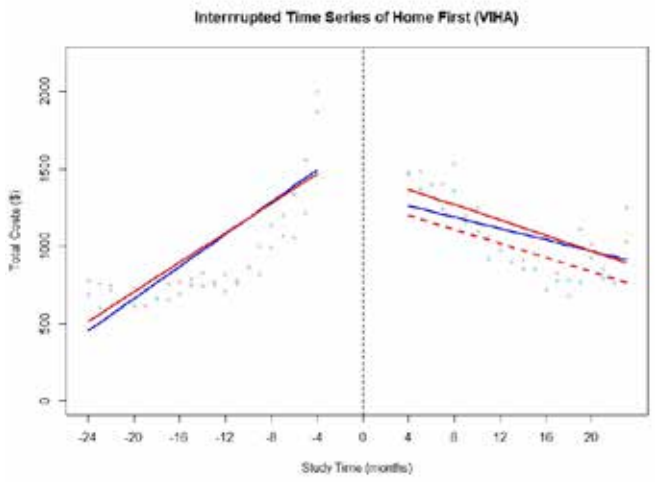
Results

- Total costs higher for participants compared to controls both before and after initiative
- Number of acute hospitalizations higher for participants compared to controls both before and after initiative
- Number of emergency department visits higher for participants compared to controls both before and after initiative
- No statistically significant change in level (cost) or trend (rate of cost increase) after the initiative
- No statistically significant healthcare utilization differences following introduction of the initiative

Frail senior: Home First (IH)

Home First
(Vancouver Island Health Authority)
An integrated model of care for frail seniors in acute care and involves early identification of discharge needs, intensive discharge and transition planning involving various health and community professionals.

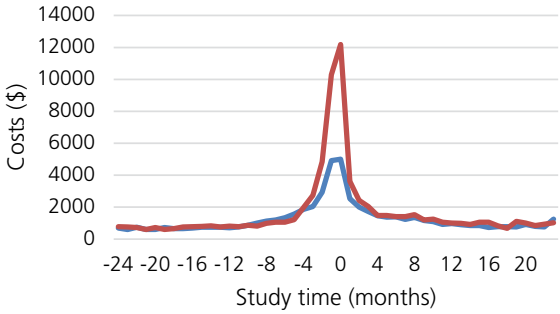
Total clients (N)	Unique clients (N)	Cases (N)
721	669	616



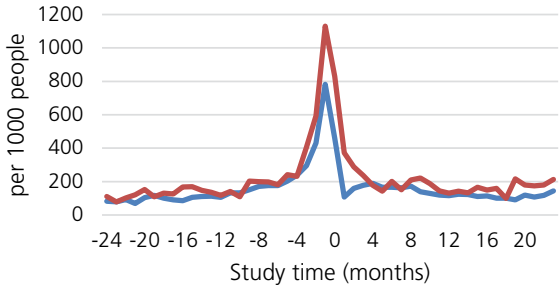
ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
Change in Level	177.91	-769.914	1125.72	0.714
Change in Trend	-2.18	-66.13	61.77	0.947

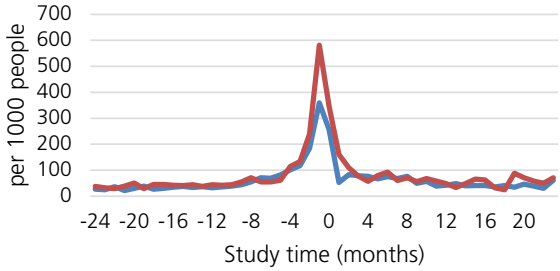
Total Costs



Number of ED Visits



Number of Acute Hospitalizations



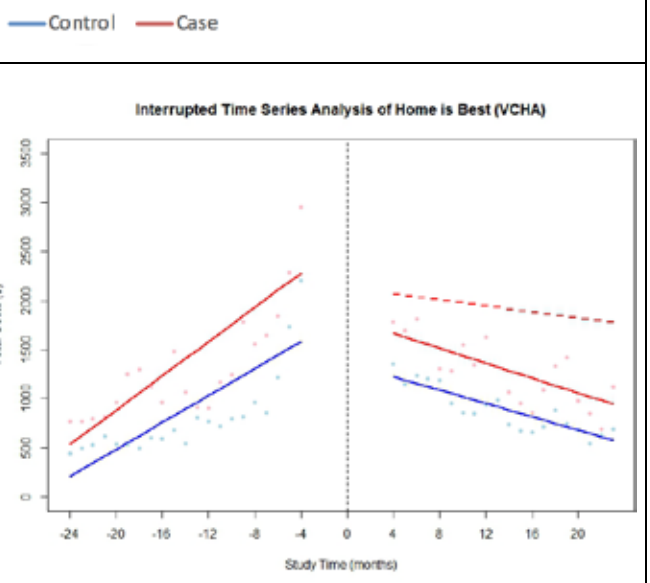
Results

- Total costs not different for participants compared to controls both before and after initiative
- Number of acute hospitalizations not different for participants compared to controls both before and after initiative
- Number of emergency department visits not different for participants compared to controls both before and after initiative
- No statistically significant change in level (cost) or trend (rate of cost increase) after the initiative
- No statistically significant healthcare utilization differences following introduction of the initiative

Frail senior: Home is Best (VCHA)

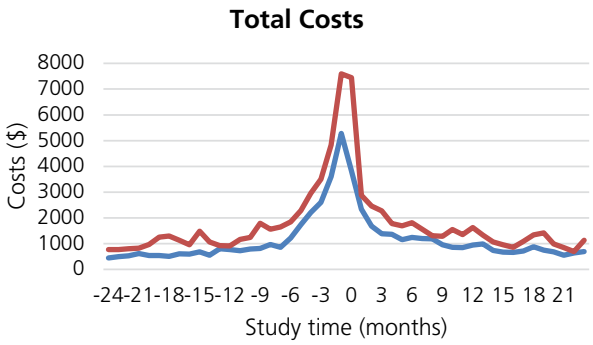
Home is Best (AURAA)
(Vancouver Coastal Health Authority)
An integrated model of care for older adults. Care is provided by an interdisciplinary team and involves an enhanced mix of community-based services.

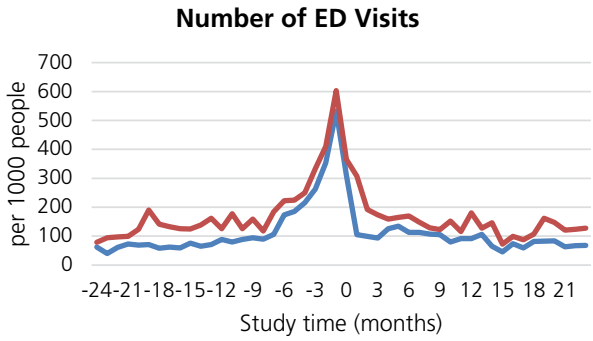
Total clients (N)	Unique clients (N)	Cases (N)
745	712	441

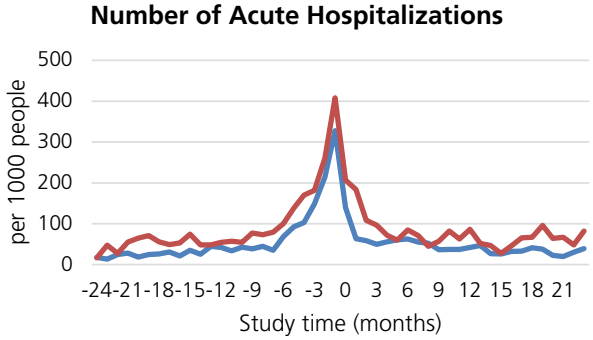


ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
Change in Level	-291.73	-1391.58	808.13	0.605
Change in Trend	-22.78	-95.29	49.74	0.540







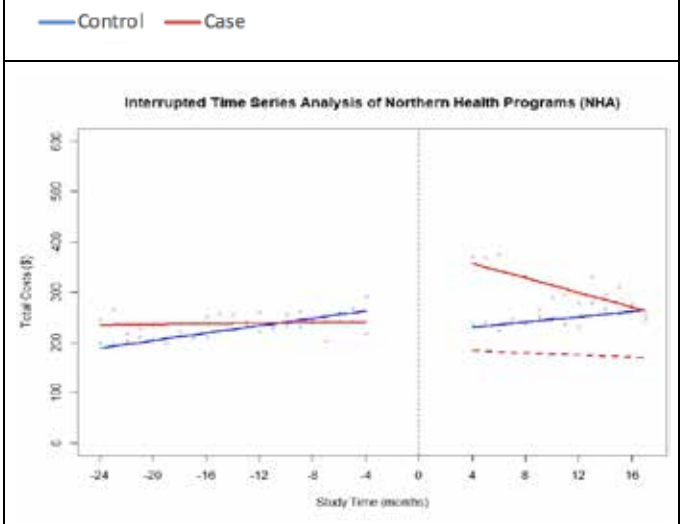
Results

- Total costs higher for participants compared to controls both before and after initiative
- Number of acute hospitalizations care costs higher for participants compared to controls both before and after initiative
- Number of emergency department visits higher for participants compared to controls both before and after initiative
- No statistically significant change in level (cost) or trend (rate of cost increase) after the initiative
- No statistically significant healthcare utilization differences following introduction of the initiative

Integrated team: Integrated Accessible Health Services (NHA)

Integrated Accessible Health Services
(Northern Health Authority)
An integrated model of care providing care in the primary care home for the frail and elderly, people with mental health and substance use challenges, people with chronic diseases, and moms and babies.

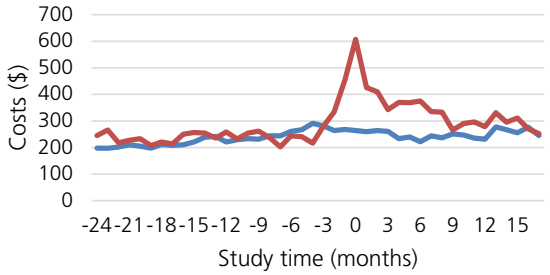
Total clients (N)	Unique clients (N)	Cases (N)
4,454	7,298	4,730



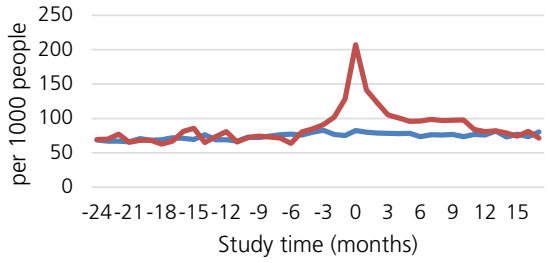
ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
Change in Level	208.90	167.31	250.49	<0.001
Change in Trend	-6.41	-9.8	-3.01	<0.001

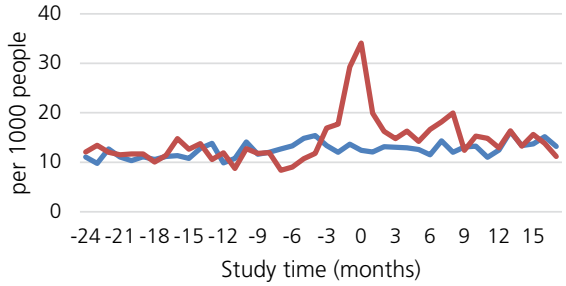
Total Costs



Number of ED Visits



Number of Acute Hospitalizations



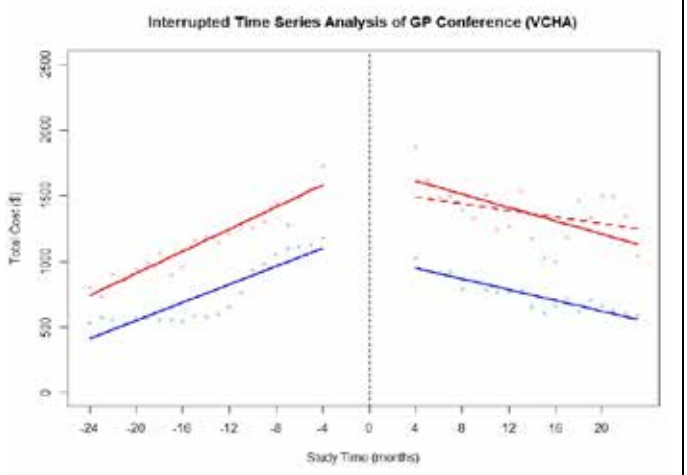
Results

- Total costs higher for participants compared to controls after initiative but coming together over time
- Number of acute hospitalizations higher for participants compared to controls after initiative but coming together over time
- Number of emergency department visits higher for participants compared to controls after initiative but coming together over time
- Significant increase in level (cost) and significant decrease in trend (rate of cost) after the initiative (i.e. initiative participants total costs went up $209 and at a negative rate -$6 per month compared to controls)
- Apparent increase in healthcare utilization as a result of the initiative, with compensating downward trend, but both likely driven by imperfect controls given significant spike in service use only among cases

Integrated network: Care Management Strategy (GP conf. only) (VCHA)

Care Management Strategy – GP care conferencing only
(Vancouver Coastal Health Authority)
An integrated model of care aimed at redesigning VCH Home Health services to align with the provincial care management strategy and integrate our teams with primary care in each community.

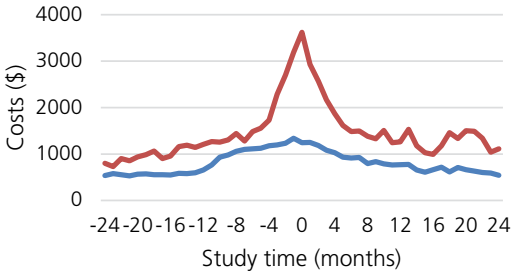
Total clients (N)	Unique clients (N)	Cases (N)
1,794	1,632	1,572



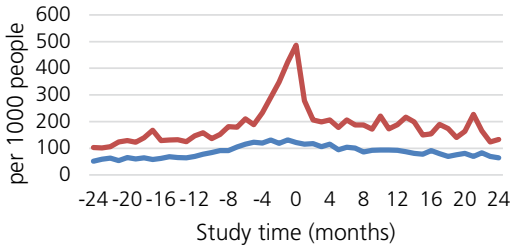
ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
Change in Level	184.32	-247.49	616.12	0.406
Change in Trend	-12.48	-40.78	15.82	0.390

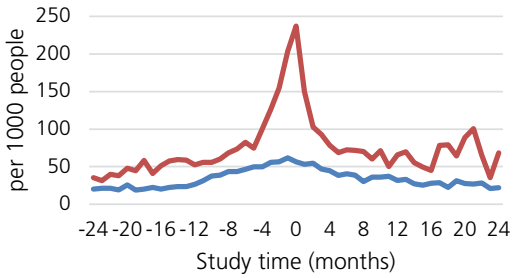
Total Costs



Number of ED Visits



Number of Acute Hospitalizations



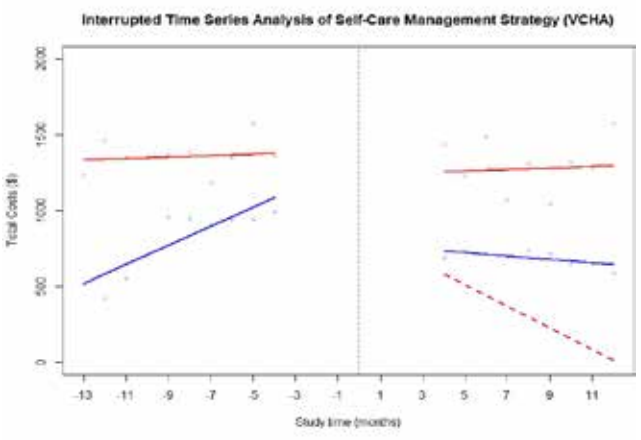
Results

- Total costs higher for participants compared to controls both before and after initiative
- Number of acute hospitalizations higher for participants compared to controls both before and after initiative
- Number of emergency department visits higher for participants compared to controls both before and after initiative
- No statistically significant change in level (cost) or trend (rate of cost increase) after the initiative
- No statistically significant healthcare utilization differences following introduction of the initiative

Community intervention: Care Management Strategy (telephonic care management only) (VCHA)

Care Management Strategy – telephonic care management only
(Vancouver Coastal Health Authority)
An integrated model of care redesigning VCH Home Health services to align with the provincial care management strategy and integrate our teams with primary care in each community.

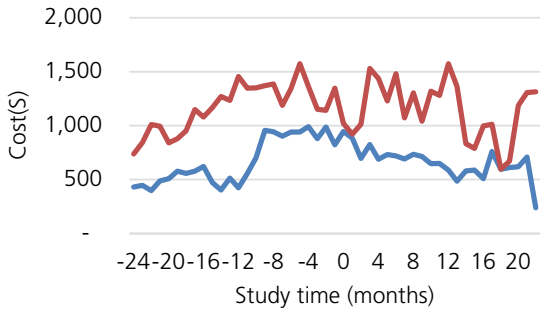
Total clients (N)	Unique clients (N)	Cases (N)
369	334	328



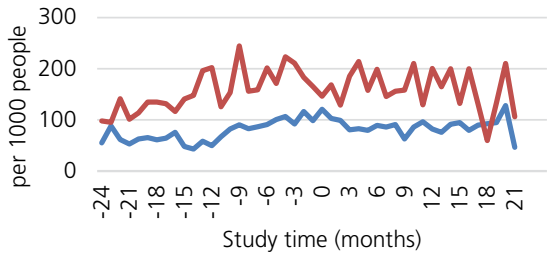
ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
Change in Level	324.84	-28.1	677.78	0.081
Change in Trend	73.51	33.74	113.29	0.001

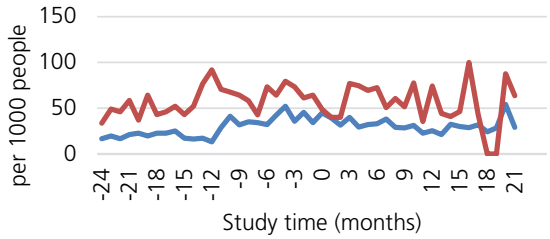
Total Costs



Number of ED Visits



Number of Acute Hospitalizations



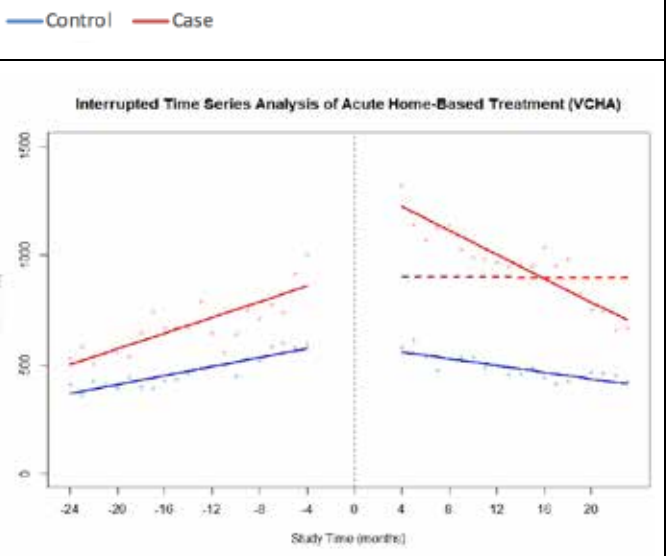
Results

- Total costs higher for participants compared to controls both before and after initiative
- Number of acute hospitalizations higher for participants compared to controls both before and after initiative
- Number of emergency department visits higher for participants compared to controls both before and after initiative
- No significant change in level (cost) or trend (rate of cost) after the initiative
- Significant increase in trend (rate of cost increase) after the initiative (i.e. initiative participants total costs increased at a rate of $74 per month compared to controls)
- No significant healthcare utilization differences as a result of the initiative, but trends could have been affected by small sample size

Mental health: Acute Home Based Treatment (VCHA)

Acute Home Based Treatment
(Vancouver Coastal Health Authority)
An integrated model of care aimed at providing home-based treatment for mental health and addictions clients as an alternative to hospitalization.

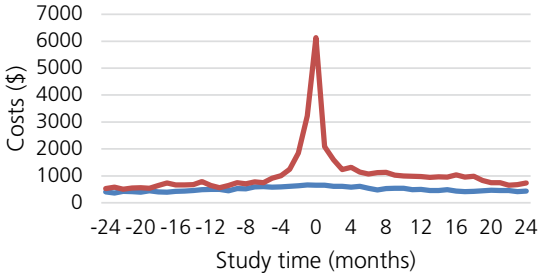
Total clients (N)	Unique clients (N)	Cases (N)
1,588	1,574	1,396



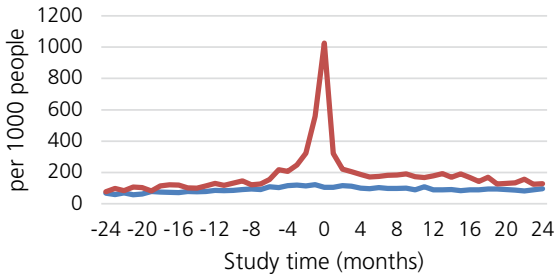
ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
Change in Level	457.48	271.54	643.42	<0.001
Change in Trend	-27.17	-39.40	-14.93	<0.001

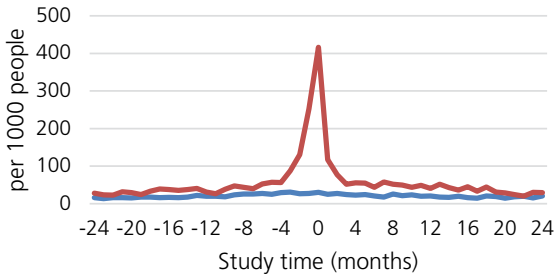
Total Costs



Number of ED Visits



Number of Acute Hospitalizations



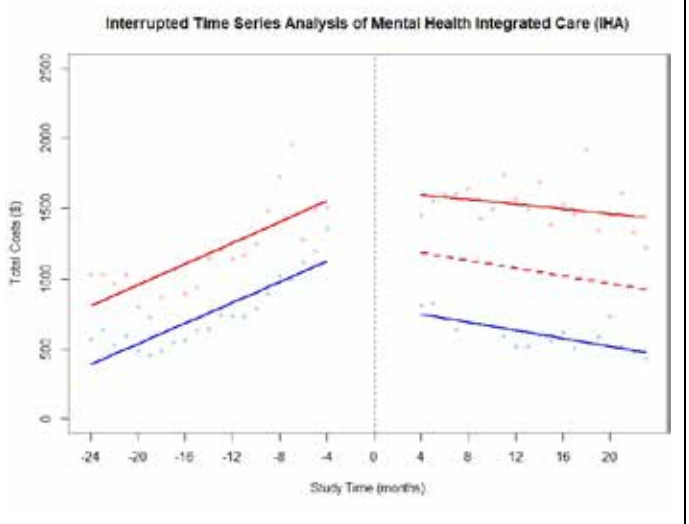
Results

- Total costs slightly higher for participants compared to controls both before and after initiative
- Number of acute hospitalizations slightly higher for participants compared to controls both before and after initiative
- Number of emergency department visits slightly higher for participants compared to controls both before and after initiative
- Significant increase in level (cost) and significant decrease in trend (rate of cost) after the initiative (i.e. initiative participants total costs went up $457 and at a negative rate -$27 per month compared to controls)
- Apparent increase in healthcare utilization as a result of the initiative, with compensating downward trend, but both likely driven by imperfect controls given significant spike in service use only among cases

Mental health: Mental Health Integrated Care (IHA)

Mental Health Integrated Care
(Interior Health Authority)
An integrated model of care to co-locate MHSU staff with psychiatrists and primary care physicians in order to better serve persons with severe psychiatric and/or substance use disorders and co-occurring medical concerns.

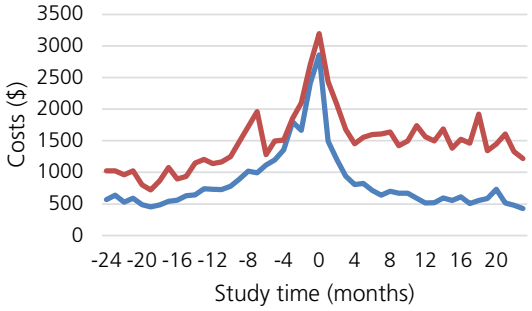
Total clients (N)	Unique clients (N)	Cases (N)
639	638	384



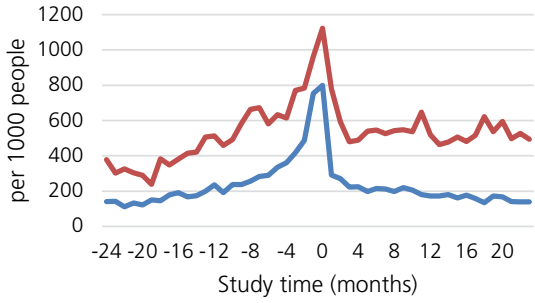
ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
Change in Level	388.33	-29.95	806.62	0.073
Change in Trend	5.14	-22.51	32.79	0.717

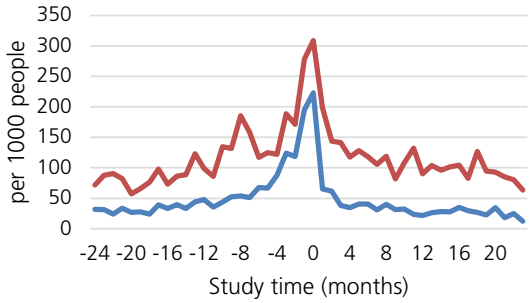
Total Costs



Number of ED Visits



Number of Acute Hospitalizations



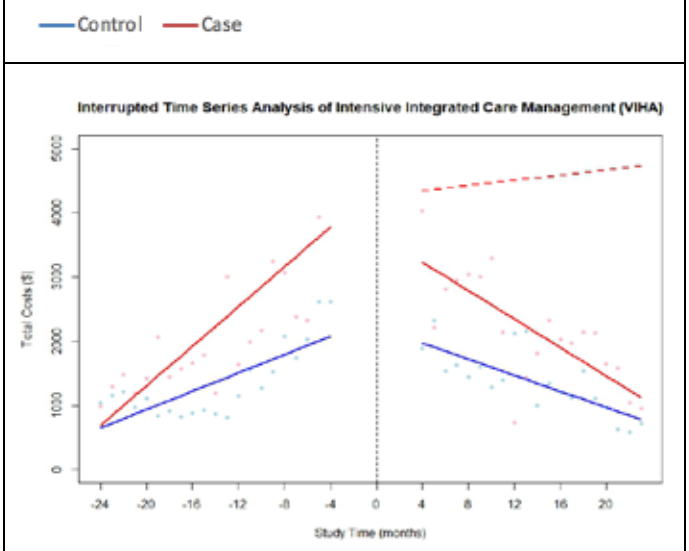
Results

- Total costs higher for participants compared to controls both before and after initiative
- Number of acute hospitalizations higher for participants compared to controls both before and after initiative
- Number of emergency department visits higher for participants compared to controls both before and after initiative
- No statistically significant change in level (cost) or trend (rate of cost increase) after the initiative
- No statistically significant healthcare utilization differences following introduction of the initiative

Frequent users: Intensive Integrated Care Management (IH)

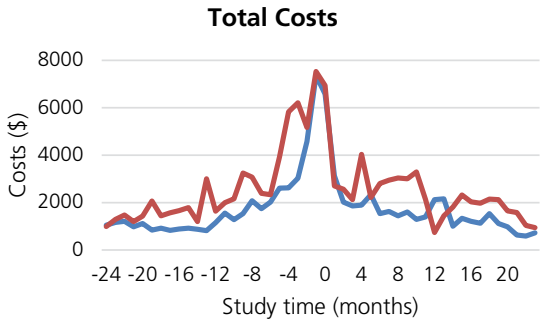
Intensive Integrated Care Management
(Island Health Authority)
An integrated model of care providing targeted, multi-disciplinary care management services to address patient's needs, to engage clients in changing their behaviours to improve their health outcomes.

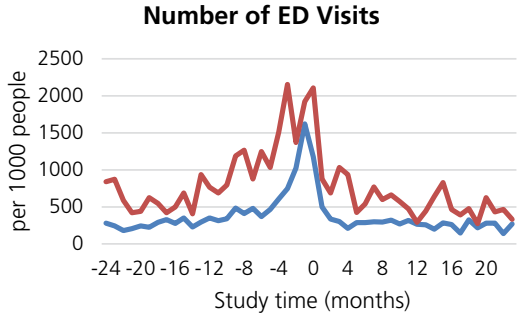
Total clients (N)	Unique clients (N)	Cases (N)
114	94	65

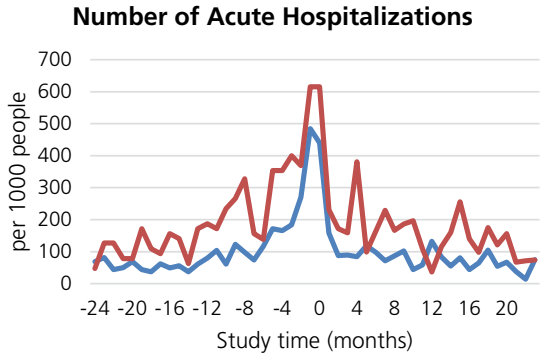


ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
Change in Level	-451.84	-2072.29	1168.62	0.586
Change in Trend	-131.47	-238.45	-24.50	0.018







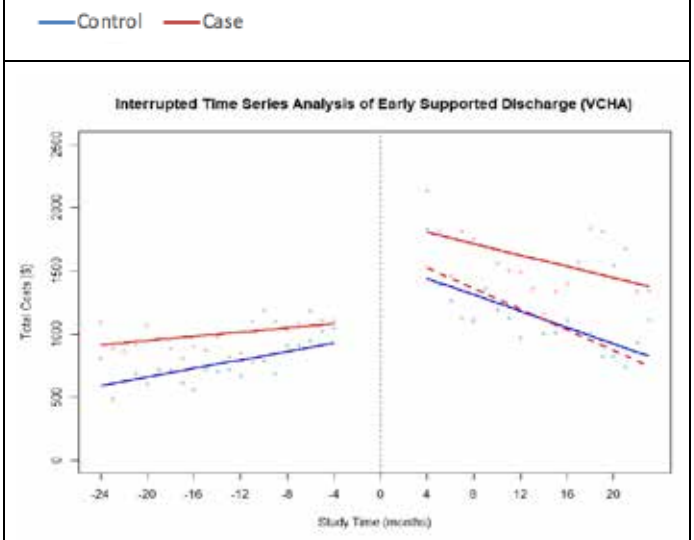
Results

- Total costs higher for participants compared to controls both before and after initiative
- Number of acute hospitalizations higher for participants compared to controls both before and after initiative
- Number of emergency department visits higher for participants compared to controls both before and after initiative
- No significant change in level (cost) but a significant decrease in trend (rate of cost) after the initiative (i.e. initiative participant total costs went down at a negative rate of -$131 per month compared to controls)
- No significant healthcare utilization differences as a result of the initiative

Community reintegration: Early Supported Discharge (VCHA)

Early Supported Discharge
(Vancouver Coastal Health Authority)
An integrated model of care to support patients diagnosed with heart failure, chronic obstructive pulmonary disease, or a new stroke through an early discharge from acute care.

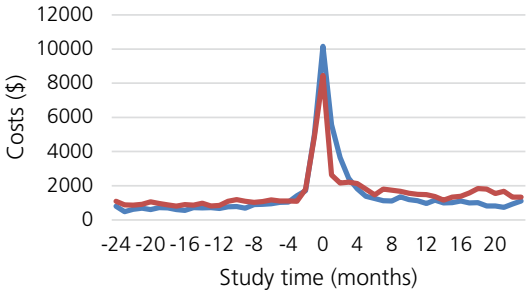
Total clients (N)	Unique clients (N)	Cases (N)
2,091	2,069	711



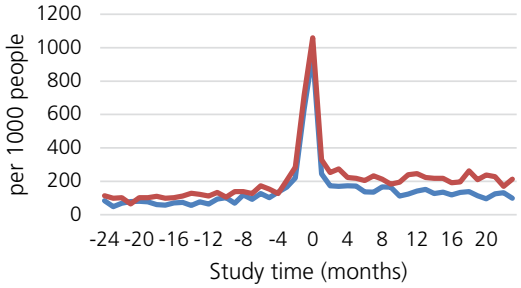
ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
Change in Level	186.76	-331.02	704.54	0.482
Change in Trend	18.56	-15.45	52.58	0.288

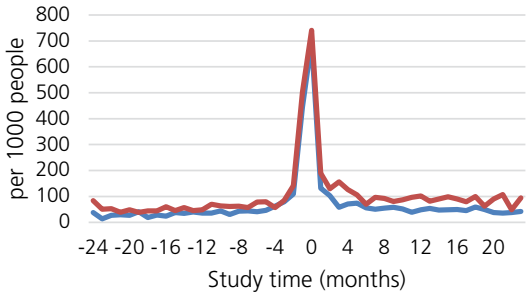
Total Costs



Number of ED Visits



Number of Acute Hospitalizations



Results

- Total costs slightly higher for participants compared to controls both before and after initiative
- Number of acute hospitalizations slightly higher for participants compared to controls both before and after initiative
- Number of emergency department visits slightly higher for participants compared to controls both before and after initiative
- No statistically significant change in level (cost) or trend (rate of cost increase) after the initiative
- No statistically significant healthcare utilization differences following introduction of the initiative

Discussion

One of the main goals of the aIPCC initiatives were to reduce health care utilization and in turn reduce costs within the healthcare system. (2) While other outcomes were also contemplated, the aim of this evaluation was to assess changes in health care service use as a result of the alPCC initiatives. Despite the intent, hospital, emergency department, physician and pharmaceutical use patterns were not altered significantly during the study period for the majority of the initiatives that were analyzed. In cases where there was change there was often an increase in costs. In a few select initiatives the cases showed spikes in use around the time of the intervention that were not mirrored in the controls. This likely reflects selection criteria that were different from what was described to the research team.

Initiatives such as the aIPCC initiatives in BC have been implemented in other provinces and jurisdictions. (22) Effects have been variable, but an analysis of 85 interventions shows that these types of integration initiatives are more likely to produce positive patient-reported health outcomes (55.4% of cases) rather than cost savings (17.9% cost savings). (22) It is sometimes hard to disentangle health outcomes from cost savings, for example if a patient was not seeing their physician enough and an initiative increased their number of physician visits, the cost of physician visits would increase, but patient health outcomes could also improve. In our results, we do not see significant decreases in any of the outcomes for the majority of our initiatives, regardless of whether patient health or satisfaction was potentially increasing.

Within BC, the goal of these initiatives was to improve the integration of community and primary care with the long-term goals of improving health outcomes of patients. The C-TraIn study in Portland, Oregon found that transitional care quality improved from a single intervention despite no improvements to patient experience or reduction in healthcare utilization and costs. (23) Other authors have noted that it is unrealistic to think an individual intervention can significantly affect all of these components simultaneously. (24) It is important when planning these types of initiatives to be specific about the type of change that is intended and to take a systematic approach to implementation that is tailored to the unique needs of the patient population of focus. (22)

Health authorities reported to the research team that many of the initiatives restructured the way health professionals worked. The initiatives were intended to create shared goals around chronic condition management and open communication between health authority staff and physicians. In order to receive funding for these initiatives the Ministry of Health made clear that health authorities had to create partnerships with primary care, specifically home health and family physicians. It was beyond the scope of this research to analyze whether these types of working relationships and processes were established.

Findings from this study are arriving after health authorities have made changes to the initiatives studied. Since funding expired, some programs have been reorganized and/or rolled up into existing programs and funding structures, and others are no longer being offered. Regardless, it remains important to understand the effects of these programs, and to extrapolate lessons to future program planning.

These types of programs are not unique to BC, and as BC and other provinces continue to move towards redesigning their health care delivery systems to better support primary and integrated community care it is important to learn from each other. Research shows that the evidence base for the effect of integrated care initiatives is still evolving, and we need to more fully understand the complex dynamics of these initiatives to understand how we might maximize their effects for patients, families and the healthcare system. (22)

Reflections on this evaluation

In addition to empirical results, we offer a few reflections that relate to the undertaking of this evaluation. These are not intended as critiques of the aIPCC initiatives, but as food for thought for future program development and implementation including but not limited to the newly-developing primary care networks.

1. Designing implementation and evaluation

None of the programs were framed as quality improvement, which would require a more formative, developmental approach. Nevertheless, there is a need to facilitate implementation of initiatives in a way that provides flexibility to adapt and define interventions to fit the context and setting; evaluations should be designed to evaluate not only the research outcomes, but also the process for achieving the outcomes. (25)

Where evaluation is intended, care should be taken to consider design both of the program (more on this below) and of implementation in a way that will support evaluation. For example, programs that are to occur in more than one location can use design delay as a way to protect against secular trends. (18) There should also be consideration of identification of controls which would mitigate the concerns in this evaluation about appropriate matching criteria.

2. Clear eligibility criteria

Eligibility criteria for all of the initiatives was supplied to the research team by each of the health authorities. Some of the initiative criteria were very strict (e.g. specific diagnosis, 2+ ED visits) while others were less precise (e.g. living with a responsible adult, homebound). These criteria may be important for determining the client's need, but it is difficult and sometimes impossible to capture these types of criteria within existing data sets. If criteria for enrolment are not routinely available in existing data, it is even more important to identify a comparison group at the same time, to ensure more accurate comparability. Clear and measurable eligibility criteria will help ensure the most methodologically rigorous and sound evaluations can be conducted.

3. Adherence to eligibility criteria

Eligibility criteria are important for the standardization of initiative enrolment both within and between health authorities. Through interviews with the aIPCC leads it was clear that not all initiatives adhered strictly to the eligibility criteria, or the criteria were adapted over time. In many cases the eligibility criteria were relaxed and initiative staff had flexibility to enroll participants who they felt would benefit from the program, even if they did not meet the criteria. While it may be appropriate to adapt the intervention to a specific context and setting, lack of rigorous documentation of criteria changes limited the potential for robust evaluation because of the difficulty of identifying appropriate comparators.

4. Evaluation measures established prior to implementation

A pre-determined evaluation framework should include agreement on primary outcomes, and some mechanism for monitoring those outcomes during the course of program delivery. The aIPCC initiatives were developed with the general goal of "reduce[ing] health care utilization and in turn reduce[ing] costs within the healthcare system." (2). The main outcomes identified by the health authorities were: emergency room admission reduction; hospital admission reduction; average length of stay reduction; and re-admission within 30 days of discharge reduction, for the majority of the intiatives. However, interviews with initiative leads revealed that the main outcome was often to reduce other outcomes (e.g. delay admission to residential care or improve quality of life measures). Formulating a theory of change or setting a step-wise plan on how each initiative will work to achieve the goals desired would make the evaluation process more clear.

5. Collect needed data for evaluation during program implementation

Interviews with aIPCC leads indicated that many of them wanted our evaluation to include quality of life outcomes, since they believe that patients' quality of life would be greatly improved by the programs. It was beyond the scope of this project to look at quality of life outcomes, but in order to properly evaluate quality of life outcomes it would have been imperative to collect data before, during, and after enrolment in the initiative. Defining plans for evaluation up front can help ensure that appropriate data will be available (or can be collected) to meet those objectives.

6. Avoid pre-post evaluation studies

Pre-post evaluation studies should be avoided, particularly those without controls. Pre-post evaluations do not control for differences in baseline trends between the initiative recipients and those who do not receive services (the controls). Pre-post designs also do not protect against regression to the mean, which can occur in cases where people are selected for and enrolled in initiatives at or soon after times of health crisis. It is important to understand the baseline trends in both the intervention and control groups because the groups could be different in other ways other than just receiving the incentive. In all cases the concern is that changes in healthcare utilization may be attributed to a program when in fact they are due to other unobserved factors.

Limitations

Selection bias is an issue in this analysis since people who end up in these programs may be somehow different from individuals who did not get the intervention. In some cases these systematic differences are unmeasured (e.g. housing instability, unavailability of informal care, etc.) and there is no possibility to match on them. More rigorous and diverse data on these factors might be able to help address selection bias, as would clear criteria, and identification of a control group at the time of enrolment of program recipients. The power of the models to detect difference is dependent on the sample size, and those conditions should be understood before implementation. There was a range in size of aIPCC programs and power may be a factor in some of the results.

We are unsure whether initiative discharge date was reliably coded, since in some cases there was no discharge date for a client. This could be either because people are still in the program or it could reflect inaccurate record keeping. In cases where all clients did not have discharge dates, we assumed that it was a one-off program where entering discharge date would have been redundant and unhelpful for the individual program.

We did not include all costs, and all health care utilization. It may be that cost and utilization changed in ways that we did not measure.

As mentioned earlier, it was beyond the scope of the project to look at clinical outcomes or quality of life indicators (e.g. management of disease, self-efficacy, etc.). It may be that clinical outcomes and/or quality of life indicators improved because of the implementation of the program. If we had access to RAI data, it might have been possible to consider some clinical outcomes. In addition, we were unable to analyze whether work-flow, communication, and integration between health authority silos (e.g. physicians, nurses, home-health providers) improved either.

Conclusions

The aIPCC initiatives were intended to build "a system of community based health care and support services built around attachment to a family physician and an extended health care team with links to local community services." (3). There were specific health-care utilization and cost outcomes outlined as well for each of the initiatives, which was the focus of this evaluation. Our results showed that the initiatives did not significantly decrease healthcare utilization or costs for patients for the measures we evaluated.

Various recommendations are proposed for future design and implementation of these types of programs to ensure that it is possible to perform a more robust evaluation. If changes in health care delivery are contemplated, it is important to have a rigorous evaluation method in place prior to implementation of the initiatives. This will allow care providers and policy makers to use the results to improve current initiatives or plan future ones.

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Appendix A: Criteria for aIPCC Initiatives Proposed by Health Authorities (3)

- Dimensions of quality of care (including access) to be maintained or improved
- Approach was evidence based and would improve patient outcomes/experience.
- Value could be quantified (expressed as a per-patient fee).
- Patient/caregiver engagement in care, redesign and improvement
- Active engagement of primary care/family physicians demonstrating shared decision making/responsibility with the Divisions of Family Practice
- Historical baseline could be established for number and types of services provided in previous years, and anticipated targets for the proposal
- Services could be counted and reported regularly using existing information systems
- Health authorities would commit to sustaining new services if they were evaluated as successful
- The new services had to be aligned with the objectives and priorities of aIPCC, Ministry of Health Key Results Areas (KRAs) and the Bilateral Agreements
- There would be savings in hospital days, residential care demand, emergency visits, and/or overall patient costs
- The degree to which clients would have care needs managed safely and efficiently in the community
- Had to be implemented without significant capital costs

Appendix B: Details on Initiatives

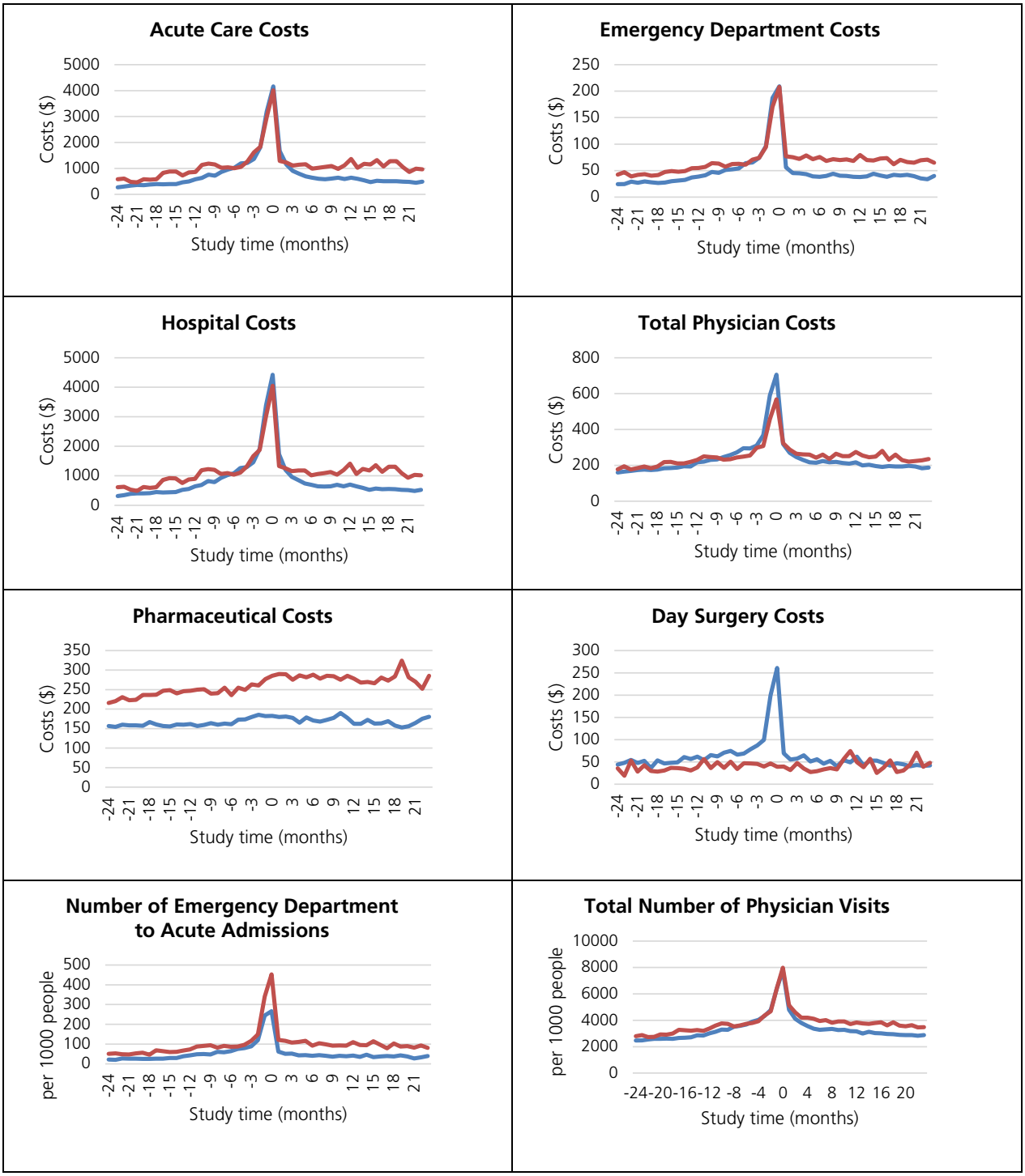
Type of Program	aIPCC Initiative	Health Authority and Sites	Initiative Description
COPD care	BreatheWELL at Home	Fraser Health: Burnaby Hospital, Royal Columbian Hospital, Langley Memorial Hospital, Chilliwack General Hospital, Medicine, Home Health, Residential Care, and Primary Care Programs with client home setting	BreatheWELL is an integrated model of care that follows a COPD client's journey across acute, community and residential care sectors, and works in partnership with various health professionals. The program provides medical oversight; acute care practice/protocols; COPD care pathway; and various other forms of health management.
	BreatheWell (BW)	Interior Health: Williams Lake, Kamloops, Salmon Arm, Vernon, Kelowna, Penticton, Trail, Cranbrook	To operationalize a model of integrated care management for moderate to severe COPD patients with high acute care utilization. This integrated service is a collaborative relationship between family physicians, specialists, IH allied health professionals and community partners.
End of life care	End of Life Care *(not analyzed)*	Fraser Health: Tri-Cities	The End of Life (EOL) aIPCC Project (initiated as a prototype within the Tri-Cities) will provide enhanced palliative care for clients in their final months of life, support an increased number of clients who wish to die at home, and avoid/delay admissions to acute or hospice residence and reduce ER visits.
Frail senior	Home First	Fraser Health	Across Fraser Health, Home First provides enhanced community supports to help seniors with complex health care needs to be discharged from hospital and live safely at home, avoiding further hospitalization and delaying or avoiding admission to residential care.
	Home First	Interior Health: Kamloops, Kelowna, Vernon, Penticton, Trail	IH proposes to shift the utilization of acute and residential care services by providing enhanced services to clients who would otherwise be moved into residential care or occupy alternate level of care (ALC) beds in hospital.
	Home First	Island Health: Greater Victoria, Nanaimo, Oceanside	Home First is for frail seniors in acute care and involves early identification of discharge needs, intensive discharge and transition planning involving family, client, physician and the health care team, intensive interdisciplinary care management in the community, expanded community support services and ready access to Home and Community Care programs and services.
	Home is Best (or AURAA "Avoidance of Unnecessary Residential Care and Acute Admissions")	Vancouver Coastal Health: Vancouver, Richmond, Coastal (North Shore, Powell River, Sechelt, Squamish)	VCH has embraced a philosophy of "Home is Best" for older adults. Care is provided by an interdisciplinary team and involves an enhanced mix of community-based services designed to meet the needs of clients with multiple, complex and interacting chronic diseases and/or social and environmental factors.
Integrated team	Integrated Accessible Health Services Built on a Foundation of Primary Care	Northern Health	Integrated accessible health services situated in healthy communities supporting care in the primary care home for the frail and elderly, people with mental health and substance use challenges, people with chronic diseases, and moms and babies. Developing and implementing the infrastructure and system design that would enable the implementation of intensive care management and coordination in the primary care home to provide intensive care management.
Integrated network	Care Management Strategy (GP care conferencing portion only)	Vancouver Coastal Health: Vancouver, Richmond, Coastal	This project will be phased over three years and is aimed at redesigning VCH Home Health services to align with the provincial care management strategy and integrate our teams with primary care in each community.

Type of Program	aIPCC Initiative	Health Authority and Sites	Initiative Description
Community intervention	Tele Home Monitoring *(not analyzed)*	Island Health: Greater Victoria, Sidney, Sooke, Nanaimo	This funding request supported the implementation of the Telus Telehome Monitoring (Home Health Monitoring) system to provide remote monitoring and enhanced self-management for persons with heart failure living in the community.
	Care Management Strategy (Telephonic care management portion only)	Vancouver Coastal Health: Vancouver, Richmond, Coastal	This project will be phased over three years and is aimed at redesigning VCH Home Health services to align with the provincial care management strategy and integrate our teams with primary care in each community.
Emergency intervention	Frail Senior/ Chronic Disease Community Transitions *(not analyzed)*	Vancouver Coastal Health: Vancouver General Hospital, Richmond Hospital, Lions Gate Hospital; Providence Health Care: St Paul's Hospital, Mount Saint Joseph's Hospital	This initiative facilitates a comprehensive regional approach aimed at expanding and sustaining interdisciplinary teams who address the community transition needs of older adults (70+ years) who present to the emergency department (ED), many of whom are frail or have complex, co-morbid chronic disease diagnoses.
Mental health	Psychosis Treatment Optimization Program *(not analyzed)*	Fraser Health	The purpose of this program is to assess and treat patients with Treatment Resistant Psychosis (TRP) in Fraser Health to reduce their admissions to hospital, visits to the emergency departments, and to improve their quality of life.
	Acute Home Based Treatment	Vancouver Coastal Health: Vancouver, Richmond, North Shore	Acute home based treatment is a comprehensive regional strategy aimed at providing home-based treatment for mental health and addictions clients as an alternative to hospitalization to avert presentation to emergency, decrease the average length of stay, reduce unnecessary acute care admissions, expedite discharge, and reduce the average cost per case while providing recovery oriented care and support for clients and their families in their home.
	Mental Health and Substance Use Primary Care (MHSU PC)	Interior Health: Williams Lake/100 Mile House, Salmon Arm, Kamloops, Kelowna, Penticton, Trail, Nelson, Cranbrook	Creation of a program model that would co-locate MHSU staff with psychiatrists and primary care physicians in order to better serve persons with severe psychiatric and/or substance use disorders and co-occurring medical concerns.
	Assertive Community Treatment *(not analyzed)*	Vancouver Coastal Health: Vancouver	The ACT program involves a team that works across VCH in urban sites in addition to the current DTES ACT team. ACT services are individually tailored with each client and address the preferences and identified goals of each client.
Frequent users	Intensive Integrated Care Management	Island Health: Nanaimo, Oceanside (Parksville, Qualicum)	Intensive Integrated Care Management (IICM) supports the Home is Best philosophy by providing targeted, multidisciplinary care management services to address patients needs, and reduce avoidable hospital admissions and/or emergency department visits. It includes behavioural health clinical supports to effectively engage clients in changing their behaviours to improve their health outcomes.
	Mental Health and Substance Use Services-Integrated Primary Care Initiative *(not analyzed)*	Island Health: Port Alberni, Tofino, Campbell River, Port Hardy, Port McNeil	The intent of the three MHSU client centered initiatives is to strengthen the continuum of mental health services for clients with serious and persistent mental illness (SPMI) and substance use disorders and to bridge the gap between primary, secondary and tertiary services. Assertive Community Treatment (ACT) teams and Integrated Care Teams (ICT) aim to provide integrated community and primary care supports for SPMI clients. Cognitive Behavioural Interpersonal Skills training (CBIS) aims to equip GPs (and other front line workers) with practical, time efficient assessment tools and basic supportive self-management skills to support SPMI clients.

Type of Program	aIPCC Initiative	Health Authority and Sites	Initiative Description
Community reintegration	Community REDi (Formerly Community Reintegration and Rehabilitation (CRRS)) *(not analyzed)*	Fraser Health	Community REDi provides community based rehabilitation services to support early discharge and transition of patients needing rehabilitation, from a hospital setting to their home and community.
	Early Supported Discharge	Vancouver Coastal Health: Vancouver, Richmond, Coastal, Providence Health Care	This program is comprised of an interdisciplinary community reintegration team working in collaborative partnership with GPs to support patients diagnosed with heart failure, chronic obstructive pulmonary disease, or a new stroke through an early discharge from acute care.

Appendix C: Detailed Results by Initiative

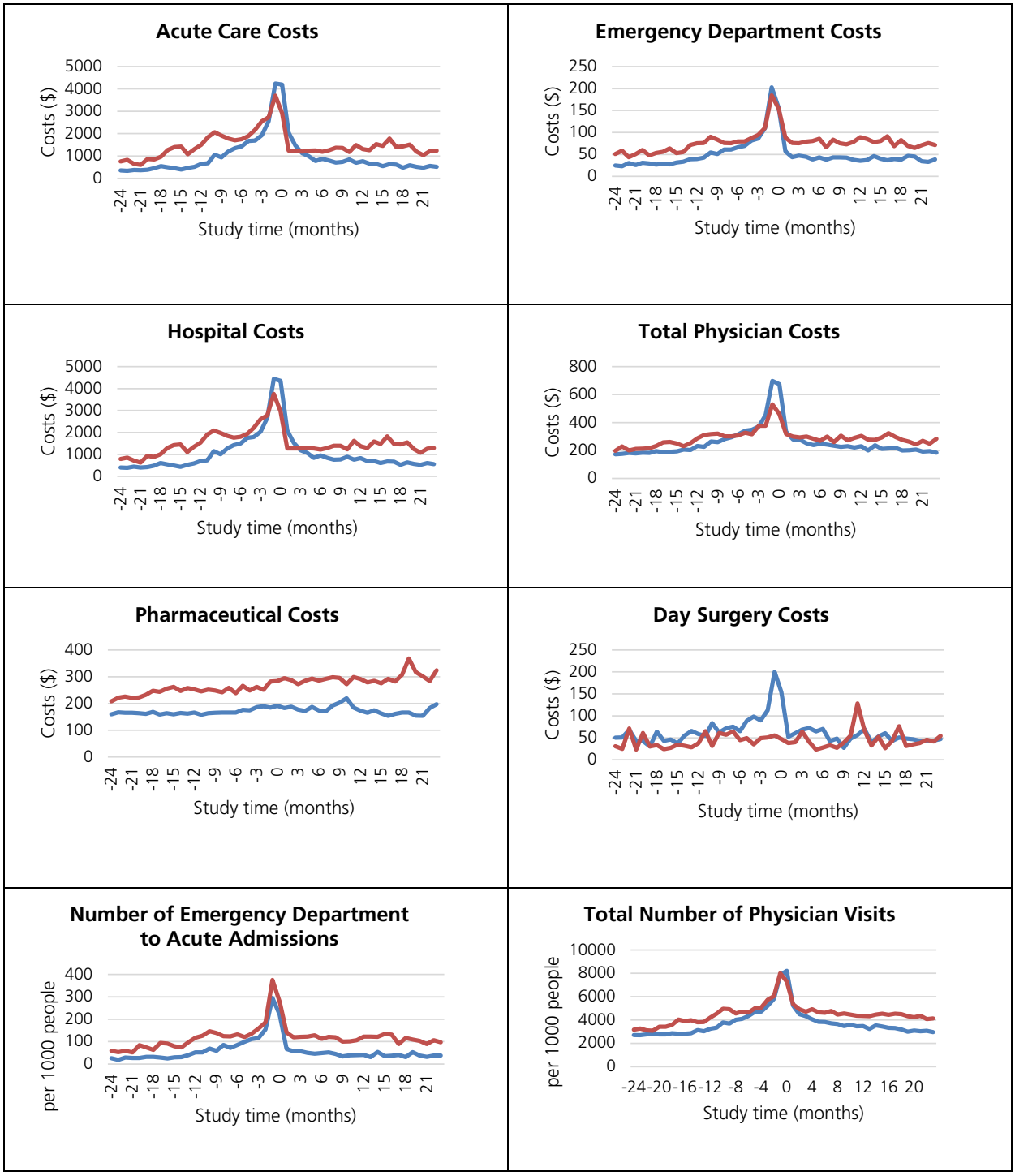
COPD care (all sites combined)



ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
(Intercept)	458.09	298.15	618.04	<0.001
time	56.03	43.55	68.51	<0.001
group	462.81	236.62	689.01	<0.001
level	-517.63	-796.01	-239.25	<0.001
trend	-73.28	-91.56	-55.00	<0.001
time:group	-12.65	-30.30	5.00	0.164
group:level	372.44	-21.25	766.13	0.068
group:trend	24.79	-1.07	50.65	0.064

COPD care: BreatheWell at Home (FHA)



ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
(Intercept)	398.02	126.56	669.47	0.005
time	80.36	59.30	101.43	<0.001
group	660.67	276.77	1044.56	0.001
level	-759.89	-1230.69	-289.08	0.002
trend	-107.73	-138.59	-76.88	<0.001
time:group	3.95	-25.84	33.74	0.796
group:level	-318.95	-984.77	348.86	0.351
group:trend	25.25	-18.39	68.88	0.260

Inclusion criteria supplied by site

- Health status: Patients with clinical diagnosis of COPD
- Health care utilization: In the past year prior to enrolment had 3 or more visits to the ER and at least one hospital admission.
- Location of residence: Burnaby Hospital (BUH), Royal Columbian Hospital (RCH), Langley Memorial Hospital (LMH), Chilliwack General Hospital (CGH), Medicine, Home Health, Residential Care, and Primary Care Programs with client home setting.
- Other: Home bounded

Inclusion criteria used for case selection and matching

Case/control selection

- Health status: COPD diagnosis
- Healthcare utilization: ≥ 3 emergency room visits (All visits/admissions had to have occurred within one year (same year as client)), OR; ≥ 1 hospital acute admission (All visits/admissions had to have occurred within one year (same year as client))

Matching

- Geography: similar health system environment (LHA --> health system environment) within FHA
- Time dimension: match on intervention time (year)
- Age: 5-year age ranges
- Sex
- Health status: major ADGs
- Anchor point: utilization
- Criteria not being used: home-bounded

Case/control match

- We matched the 780 eligible cases (out of 1369) to 2355 controls, with the final case-control ratio being 1:3.02.

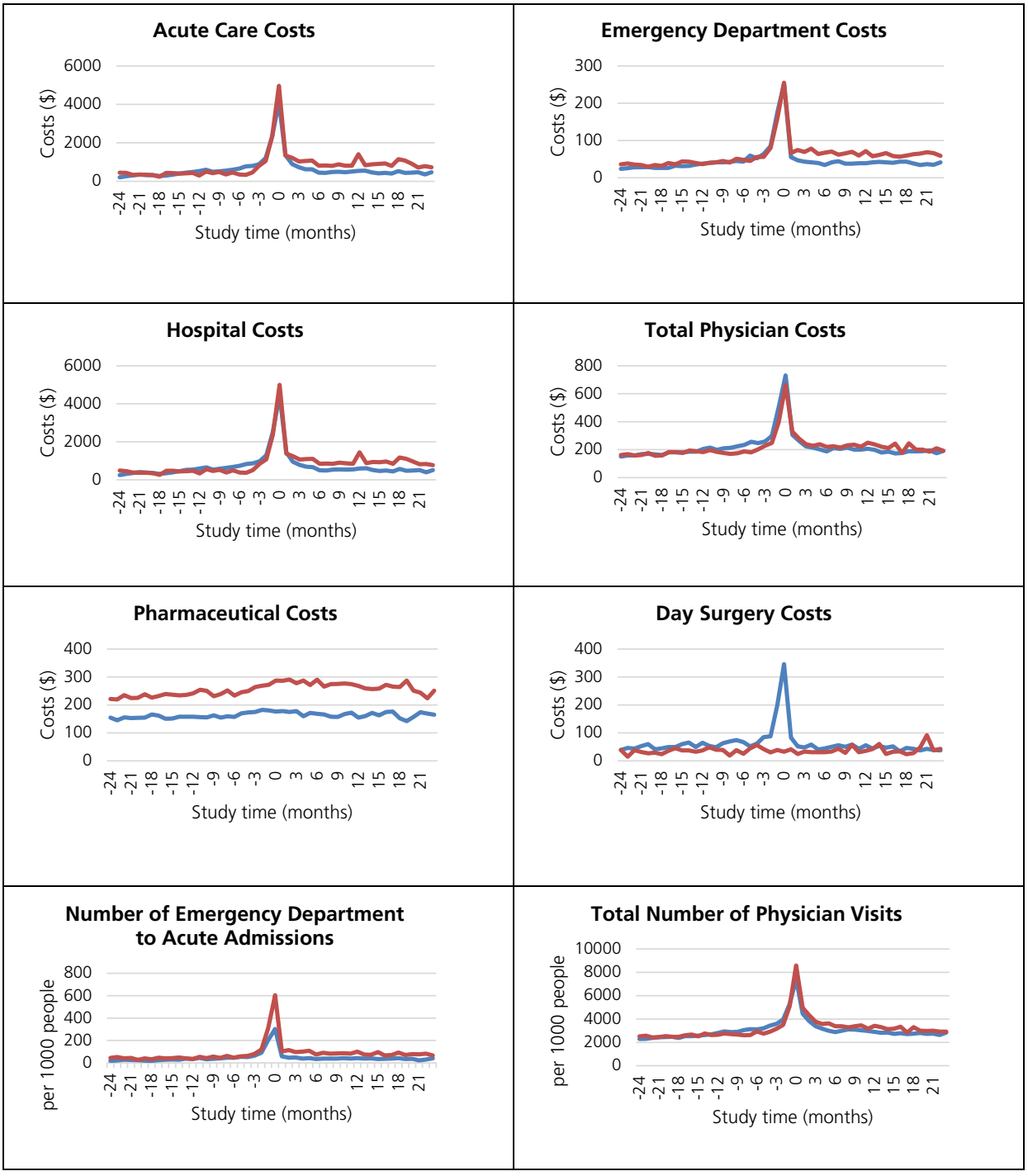
Methodology differences

- The Fraser Health BreatheWELL program had 39.15% of participants enrolled who did not meet the inclusion criteria. As a result, the research team decided to exclude any patient for the analysis that did not meet the inclusion criteria. The graph below shows that for the individuals who did not meet the inclusion criteria their total costs were much different than those who met the criteria, further justification for excluding these individuals who did not meeting the criteria from analysis.
- In the matching process, we first limited to people who met the inclusion criteria to form the potential control group. However, one of the inclusion criteria for this program- 3 ED visits/1 acute care admission within 12 months prior to enrolment, which is not a fixed time period, as the cases started at different dates (years). As a result, some controls we found here were ineligible controls for some cases. We still put all these controls together and created a pool of all potential controls, 1 record

per control for propensity score matching. Meanwhile, we also created a list that recorded all potential controls that met inclusion criteria for each of the cases.

- We added fiscal year as an exact matching variable to avoid cases were enrolled in later years to be matched to a control had service use in earlier years (e.g. patient enrolled in 2014 matched to controls had service use in 2011). However, even matching in the same year, it's still possible that the matched control is not an eligible control for the matched case (e.g. Case A enrolled in April, while control B only met the service use criteria in November the same year etc.). Therefore, we dropped those controls don't appear as eligible controls to their specific matched case using the full list of potential controls for each of the cases after matching. We at the end found approximately 3 controls for each case (case-control ratio = 1:3.02). We also used this same method for all the other programs that used service use as inclusion criteria.

COPD care: BreatheWell (IHA)



ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
(Intercept)	522.30	476.57	568.03	<0.001
time	33.08	29.29	36.86	<0.001
group	270.87	206.19	335.55	<0.001
level	-264.89	-348.84	-180.94	<0.001
trend	-41.69	-47.19	-36.18	<0.001
time:group	-24.91	-30.26	-19.55	<0.001
group:level	835.62	716.89	954.35	<0.001
group:trend	30.09	22.31	37.88	<0.001

Inclusion criteria supplied by site

- Health status: Moderate to severe COPD Clients (Medical Research Council Dyspnea Scale of 4-5)
- Health care utilization: COPD clients who have required 2 emergency department (ED) visits and/or one hospital admission related to COPD in the last 12 months
- Location of facility: Williams Lake, Kamloops, Salmon Arm, Vernon, Kelowna, Penticton, Trail/Nelson, Cranbrook.
- Source of referral: The majority of the referrals (72%) for the BreatheWell program have come from acute care within IH
- Other: Complex COPD clients with little existing supports in the community who are at risk for further deterioration upon discharge

Inclusion criteria used for case selection and matching

Case/control selection

- Health status: COPD diagnosis
- Healthcare utilization: ≥ 2 emergency room visits (All visits/admissions had to have occurred within one year (same year as client)), OR; ≥ 1 hospital acute admission (All visits/admissions had to have occurred within one year (same year as client))

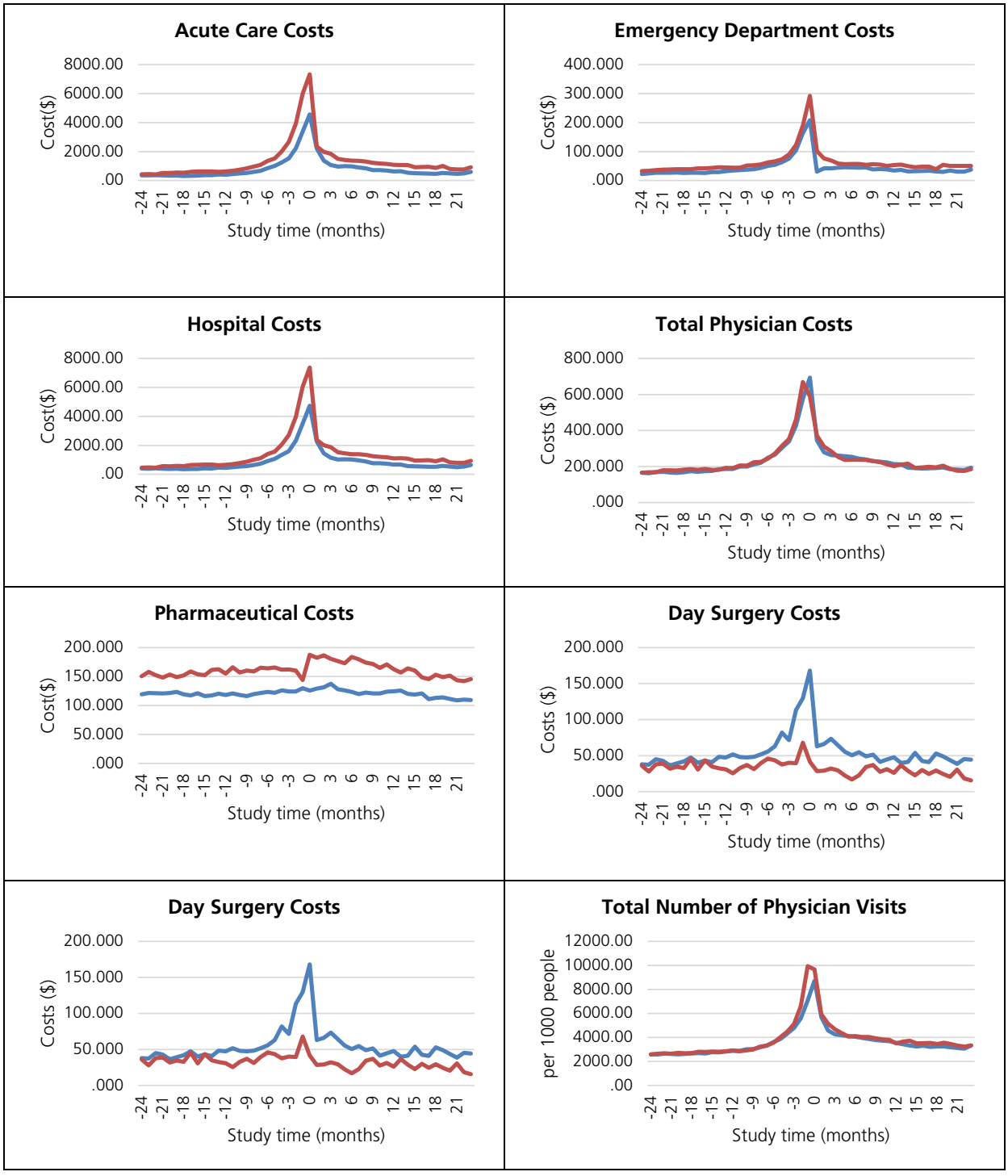
Matching

- Geography: Similar health system environment (LHA --> health system environment) within IHA
- Time dimension: match on intervention time (year)
- Age: 5 year age ranges
- Sex
- Health status: major ADGs
- Anchor point: utilization
- Criteria not being used: little existing supports in the community who are at risk for further deterioration upon discharge, dyspnea scale (Moderate to Severe – Dyspnea Scale 4-5)

Case/control match

- We matched the 896 eligible cases (out of the 989 cases) to 2640 controls, which the final case-control ratio is 1:2.95.

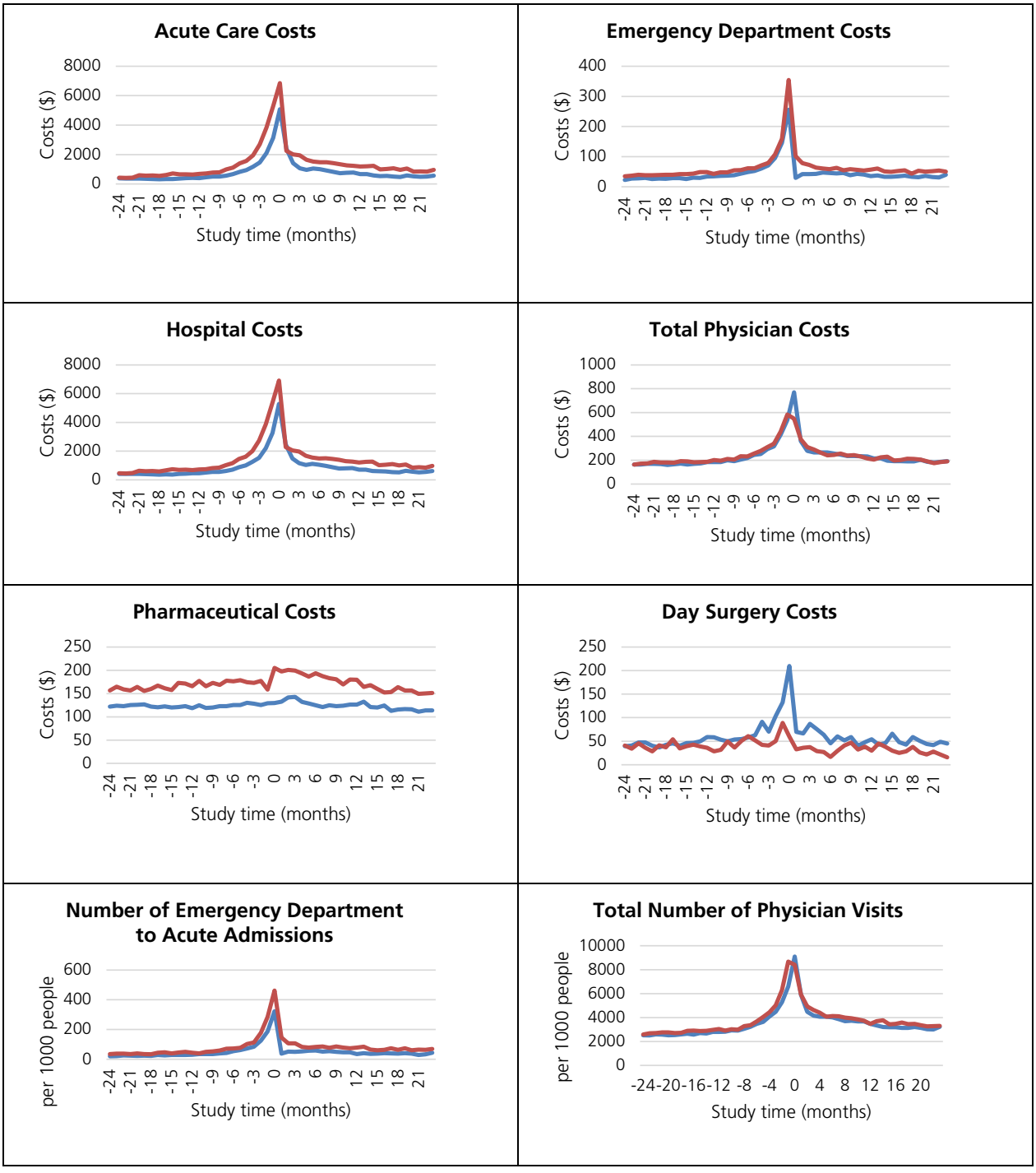
Frail senior (all sites combined)



ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
(Intercept)	479.89	5.47	954.31	0.051
time	52.97	22.87	83.08	0.001
group	39.15	-631.78	710.08	0.909
level	-338.01	-908.71	232.69	0.249
trend	-75.27	-122.94	-27.60	0.003
time:group	31.41	-11.17	73.99	0.152
group:level	-221.76	-1028.85	585.33	0.592
group:trend	-40.93	-108.35	26.49	0.238

Frail senior: Home First (FHA)



Nursing home admissions*

- 27.24% (n=629) of cases entered a nursing home after enrolment, and the average time to entry was 11.20 months from enrolment in Home First
- 13.12% (n=731) of controls entered a nursing home after enrolment, and the average time to entry was 11.79 months from their assigned enrolment date

ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
(Intercept)	479.89	5.47	954.31	0.051
time	52.97	22.87	83.08	0.001
group	39.15	-631.78	710.08	0.909
level	-338.01	-908.71	232.69	0.249
trend	-75.27	-122.94	-27.60	0.003
time:group	31.41	-11.17	73.99	0.152
group:level	-221.76	-1028.85	585.33	0.592
group:trend	-40.93	-108.35	26.49	0.238

Inclusion criteria supplied by site

- Home First screening tool used mainly focused on functional abilities and informal caregiving

Inclusion criteria used for case selection and matching

Case/control selection

- At least 1 ED visit/acute care admission within 6 months prior to enrolment

Matching

- Time dimension: match on intervention time (year)
- Age: 5-year age ranges
- Sex
- Health status: ACGs
- Geography: Similar health system environment (LHA --> health system environment) within FHA
- Other:
- Anchor point: utilization
- Criteria not being used: home first screen tool, alternative living environment - residential care - ALE - RC, receive services from home health professionals in Fraser Health

Case/control match

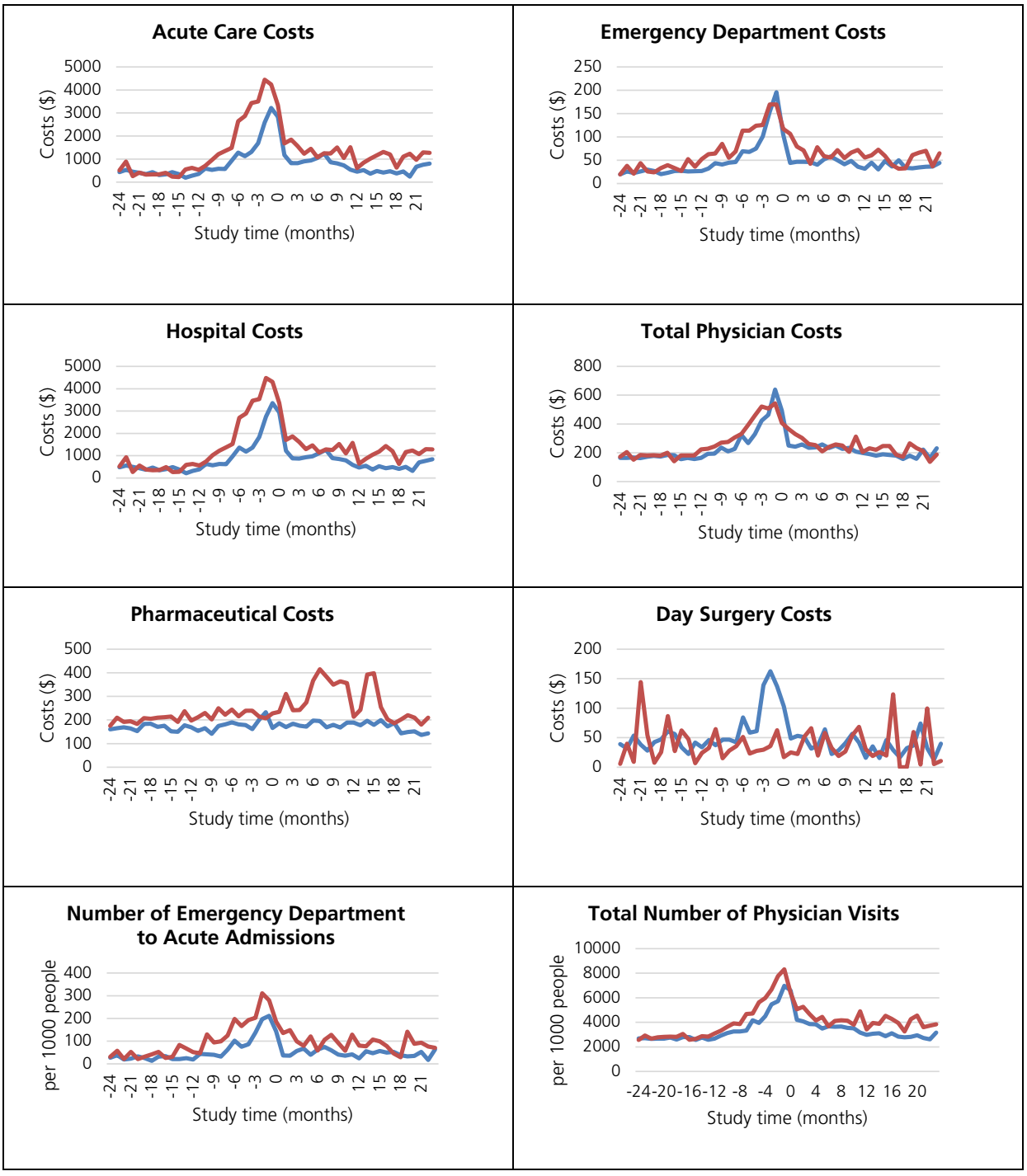
- We matched the 2419 eligible cases (out of the 3170 cases) to 6103 controls, with the final case-control ratio being 1 :2.52.

Methodology differences

- Some of the inclusion criteria (i.e. MAPLe Score) need to be identified using HCC/RAI data. We were unable to apply these criteria in finding controls. Instead, we looked for ED/acute care admission within 6 months prior to enrolment as we know many of them had ED/acute care admission before entering the programs. For Home First in FIHA, 80.16% of clients had at least 1 ED visit/acute care admission within 6 months prior to enrolment. We used the same criteria for the rest of Home First Programs as – 84.76% for FHA, 97.91% for IH. For the Home is Best program in VCHA, 68.82% of clients had at least 1 ED/acute care admission within 6 months prior to their enrolment.
- We also did additional analysis for this program to see the number of entries of residential care after enrolment into these programs among the cases/controls We identified residential care from MSP data and used the first service use date identified as the entry date to residential care. In this sub-analysis, we excluded people who had residential care service use records prior to program enrolment.

* We had not received RAI/HCC data at the time we analyzed these programs. Therefore, the entry to nursing home results were identified through fee items billed by physicians and the service location in MSP data only.

Frail senior: Home First (IHA)



Nursing home admissions*

- 31.01% (n=49) of cases entered a nursing home after enrolment, and the average time to entry was 11.26 months from enrolment
- 11.59% (n=54) of controls entered a nursing home, and the average time to entry was 7.94 months from their assigned enrolment date

ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
(Intercept)	519.51	-230.76	1269.79	0.179
time	51.07	-5.30	107.45	0.080
group	-454.99	-1516.04	606.07	0.403
level	-328.65	-1584.47	927.16	0.610
trend	-69.64	-153.074	13.78	0.106
time:group	99.00	19.27	178.73	0.017
group:level	-1449.20	-3225.18	326.79	0.114
group:trend	-90.56	-208.54	27.42	0.137

Inclusion criteria supplied by site

- Health status/utilization: Frail adults, and/or clients with dementia, and/or clients with complex chronic disease who are at high-risk for residential care admission, homebound, with no home-visiting primary care physician. Indicator: MAPLe Score = 4-5 and meet one or more of the client characteristics for long term residential care services as outlined in the Home and Community Care (HCC) Manual and/or; Patients admitted to Acute Care facilities with a MAPLe Score = 3 and meet one or more of the client characteristics for long term residential care services as outlined in the HCC Manual and/or: Patients enrolled in the Home Support Program with a MAPLe Score = 3, and with 2+ ED visits or acute care admissions in past 6 months and meet one or more of the client characteristics for long term residential care services as outlined in the HCC Manual.
- Location of residence: Kamloops, Kelowna, Vernon, Penticton, Trail.
- Source of referral: The majority of the referrals 71% have come from Home & Community Care
- Secondary criteria: Client is eligible for or already receiving At-home Supports Indicator: Self Reliance Score = 0

Inclusion criteria used for case selection and matching

Case/control selection

- At least 1 ED visit/acute care admission within 6 months prior to enrolment

Matching

- Time dimension: match on intervention date (year)
- Age: 5-year age ranges
- Sex
- Health status: ACG
- Geography: Similar health system environment (LHA --> health system environment) with IHA
- Anchor point: utilization
- Criteria not being used: homebound, no home-visiting primary care physician, MAPLe scores, residential care services

Case/control match

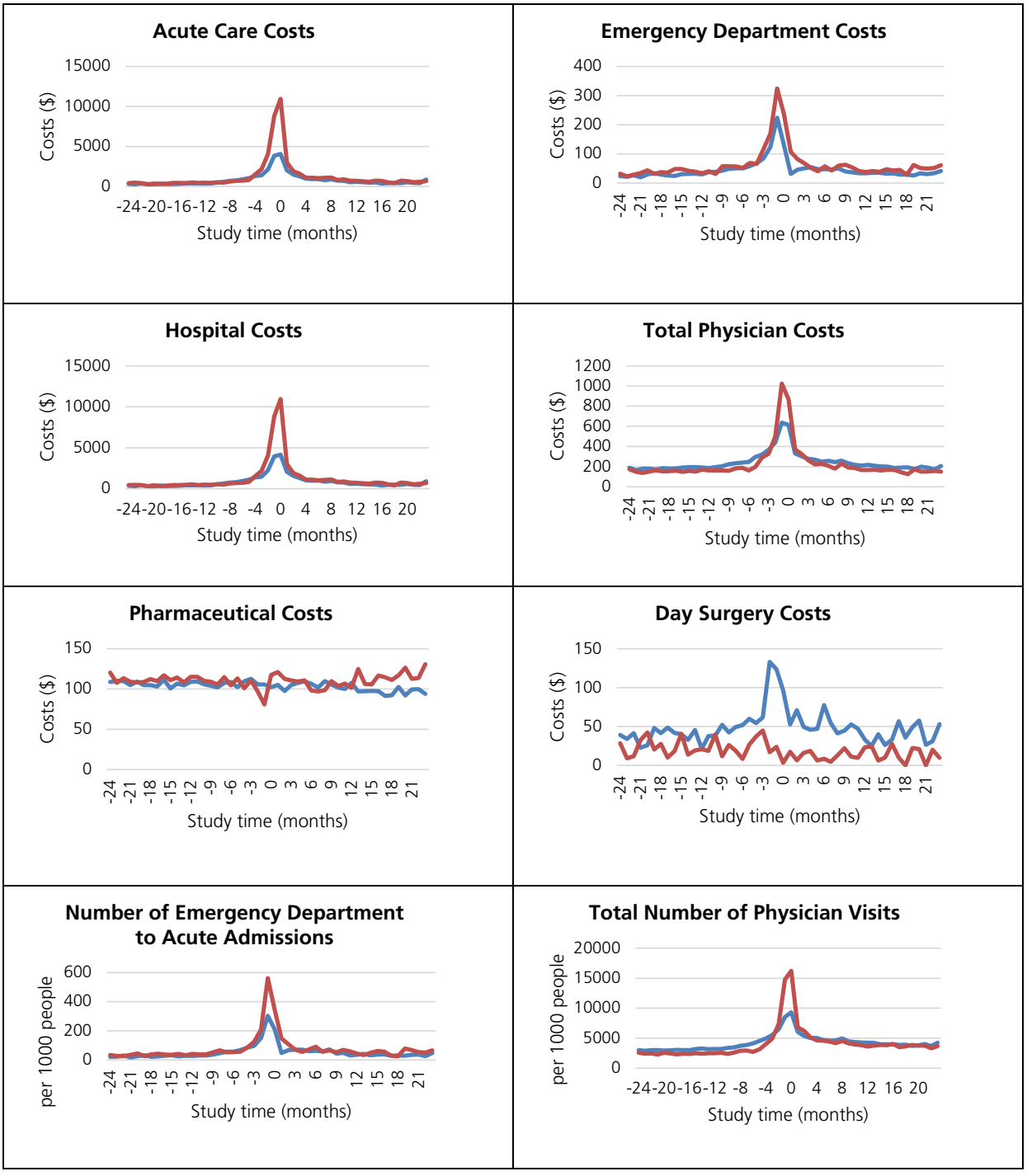
- We matched the 194 eligible cases (out of the 257 cases) to 530 controls, which the final case-control ratio is 1:2.73.

Methodology differences

- We also did additional analysis for this program to evaluate the number of entries of residential care after enrolment into these programs among the cases/controls using the same method with the above program.

* We had not received RAI/HCC data at the time we analyzed these programs. Therefore, the entry to nursing home results were identified through fee items billed by physicians and the service location in MSP data only.

Frail senior: Home First (IH)



Nursing home admissions*

- 47.64% (n=273) of cases entered a nursing home after enrolment, and the average time to entry was 6.77 months from enrolment
- 17.78% (n=256) of controls entered a nursing home after enrolment, and the average time to entry was 8.03 months from their assigned enrolment date

ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
(Intercept)	400.80	-8.23	809.84	0.059
time	52.04	21.71	82.37	0.001
group	66.15	-512.31	644.62	0.823
level	-296.05	-966.26	374.16	0.389
trend	-70.40	-115.62	-25.18	0.003
time:group	-4.37	-47.27	38.52	0.842
group:level	177.91	-769.914	1125.72	0.714
group:trend	-2.18	-66.13	61.77	0.947

Inclusion criteria supplied by site

- Health status: Frail elderly and frail elderly with chronic/co-morbid conditions. Individuals designated as, or may become designated as Alternate Level of Care-Assessed Awaiting Placement Pending Home and Community Care (ALC-AAPP/HCC), Assessed and Awaiting Placement (AAP) and ALC-Activation (ACT) in acute care with specific RAI profile (informal support available or functional at IADL).

Inclusion criteria used for case selection and matching

Case/control selection

- At least 1 ED visit/acute care admission within 6 months prior to enrolment

Matching

- Time dimension: match on intervention time (year)
- Age: 5 year age ranges
- Sex
- Health status: ACG
- Geography: Similar health system environment (LHA --> health system environment) within IH
- Anchor point: utilization
- Criteria not being used: home-bounded, home and community care assessment, RAI profile

Case/control match

- We matched the 616 eligible cases (out of the 669 cases) to 1637 controls, with the final case-control ratio being 1:2.66.

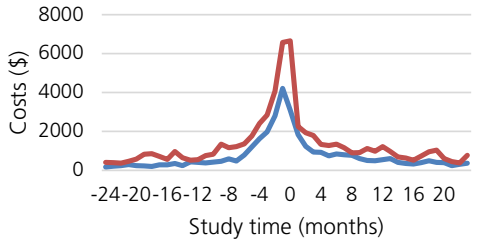
Methodology differences

- We also did additional analysis for this program to evaluate the number of entry of residential care after enrolment into these programs among the cases/controls using the same method with the above program.

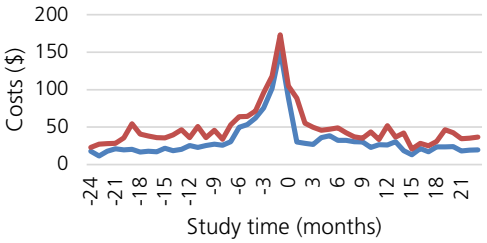
* We had not received RAI/HCC data at the time we analyzed these programs. Therefore, the entry to nursing home results were identified through fee items billed by physicians and the service location in MSP data only.

Frail senior: Home is Best (AURAA) (VCHA)

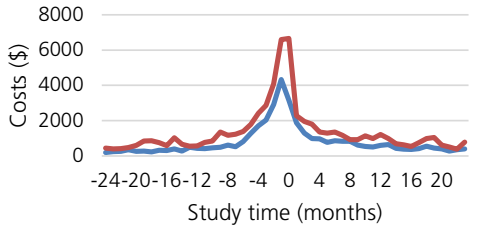
Acute Care Costs



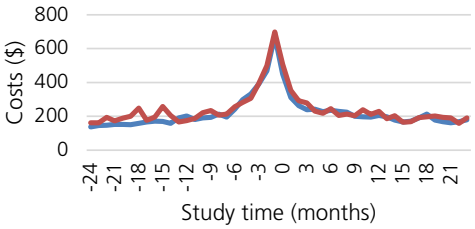
Emergency Department Costs



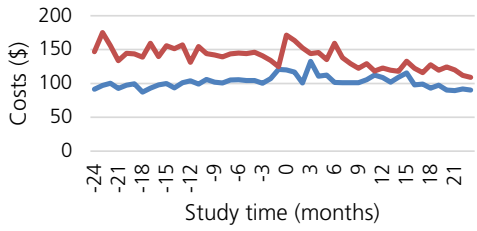
Hospital Costs



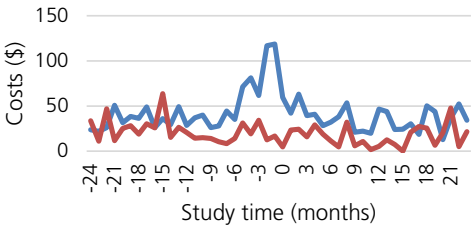
Total Physician Costs



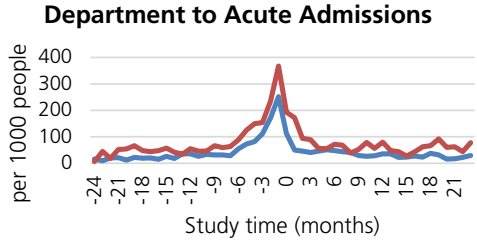
Pharmaceutical Costs



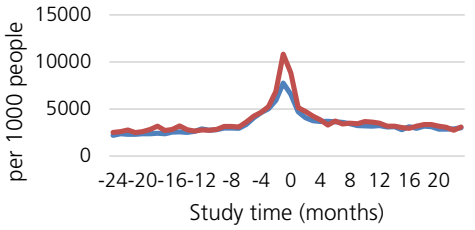
Day Surgery Costs



Number of Emergency Department to Acute Admissions



Total Number of Physician Visits



ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
(Intercept)	142.28	-316.84	601.40	0.545
time	68.60	33.80	103.39	<0.001
group	305.90	-343.39	955.19	0.359
level	-393.61	-1171.32	384.11	0.324
trend	-102.54	-153.81	-51.26	0.000
time:group	18.70	-30.50	67.91	0.459
group:level	-291.73	-1391.58	808.13	0.605
group:trend	-22.78	-95.29	49.74	0.540

Nursing home admissions*

- 42.89% (n=184) of cases entered a nursing home after enrolment, and the average time to entry was 10.13 months from enrolment
- 12.80% (n=116) of controls entered a nursing home after enrolment, and the average time to entry was 11.84 months from their assigned enrolment date

Inclusion criteria supplied by site

Health status/utilization

- Frail adults, and/or clients with dementia, and/or clients with complex chronic disease who are at high-risk for residential care admission, homebound, with no home-visiting primary care physician. Indicator: MAPLe Score = 4-5 and meet one or more Complex Care Groupings A B C D E; or Patients admitted to Acute Care facilities with a MAPLe Score = 3 and meet one or more Complex Care Groupings A B C D E; or Patients enrolled in the Home Vive Plus program (Vancouver only) with a MAPLe Score = 3, and has had 3+ ED visits or acute care admissions in past 6 months and meet one or more Complex Care Groupings A B C D E; and;
- Secondary Criteria: Client is eligible for or already receiving At-home Supports Indicator: Self Reliance Score = 0

Location of residence

- Vancouver Coastal Health Authority at Vancouver, Richmond, Coastal (North Shore, Powell River, Sechelt and Squamish)
- Other: home-bound

Inclusion criteria used for case selection and matching

Case/control selection

- At least 1 ED visit/acute care admission within 6 months prior to enrolment

Matching

- Time dimension: match on intervention time (yr)
- Age: 5-year age ranges
- Sex
- Health status: ACG
- Geog.: Similar health system environment (LHA --> health system environment) within VCHA
- Anchor point: utilization
- Criteria not being used: No home-visiting care physician, client is eligible for or already receiving at-home supports indicator: self-reliance score = 0, home bound, MAPLe Scores

Case/control match

- We matched the 441 eligible cases (out of the 712 cases) to 1072 controls, which the final case-control ratio is 1:2.43.

Methodology differences

- Home is Best enrolled clients both from acute and residing at home in the community, and we have insufficient information to find comparable control groups. Therefore, we analyzed those having ED/acute care records only.
- We did additional analysis to evaluate the number of entries to residential care after enrolment into these programs among the cases/controls using the same method as with the above program.

* We had not received RAI/HCC data at the time we analyzed these programs. Therefore, the entry to nursing home results were identified through fee items billed by physicians and the service location in MSP data only.

Integrated team: Integrated Accessible Health Services (NHA)

ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
(Intercept)	185.41	172.41	198.41	<0.001
time	3.69	2.63	4.75	<0.001
group	48.85	30.47	67.24	<0.001
level	-56.65	-86.06	-27.24	<0.001
trend	-1.12	-3.52	1.28	0.3642
time:group	-3.41	-4.91	-1.91	<0.001
group:level	208.90	167.31	250.49	<0.001
group:trend	-6.41	-9.8	-3.01	<0.001

Inclusion criteria supplied by site

Rapid Mobilization

- Location of residence: Fort St. John or surrounding areas
- Location of facility: Fort St. John primary care homes and Fort St. John hospital
- Source of referral: Physicians or specific staff in primary care homes or the Fort St. John hospital inpatient and emergency department

Prenatal Clinic

- Age: child-bearing (female)
- Health care utilization: prenatal care
- Location of residence: Fort St. John and surrounding areas
- Location of facility: Fort St. John Hospital (considered a community program/service)
- Source of referral: Physician, public health or self-referral

Unattached Patient Clinic

- Health care utilization: no attachment to primary care home
- Location of residence: Fort St. John
- Location of facility: Fort St. John Unattached Patient Clinic
- Source of referral: no formal referral required

Interprofessional Teams (Prince George)

- Health care utilization: High utilization, focus on priority populations: chronic disease, frail elderly, mental health & addictions, child & youth, perinatal
- Location of residence: Prince George
- Location of facility: multiple: 6 primary care homes, Highland Health Centre, UHNBC
- Source of referral: physician referral

Interprofessional Teams (Fraser Lake)

- Health care utilization: all access to Fraser Lake Health Centre
- Location of residence: Fraser Lake and surrounding areas (those accessing Fraser Lake Health Centre)
- Location of facility: Fraser Lake Health Centre

Inclusion criteria used for case selection and matching

- Time dimension: Match on intervention time (year)
- Age: 5-year age ranges)
- Sex
- Health status: ACG
- Geography: Similar health system environment (LHA --> health system environment) within NHA
- Anchor point: n/a
- Criteria not being used: prenatal care (see below)

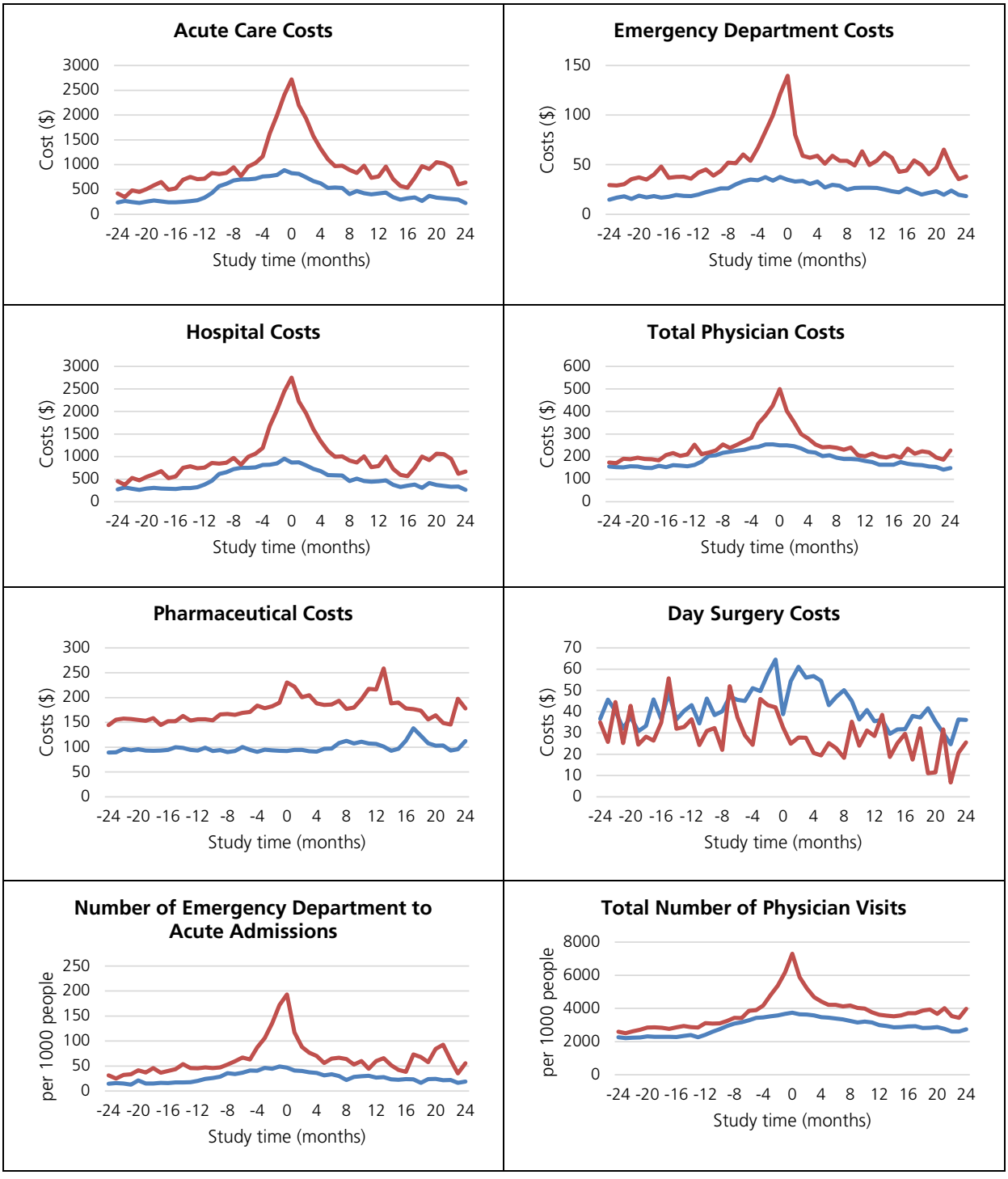
Case/control match

- We matched the 4730 eligible cases (out of 7298 cases) to 18843 controls, which the final case-control ratio is 1:3.98.

Methodology differences

- The Northern Health Authority had 4 programs (rapid mobilization, prenatal clinic, un-attached patient clinic, interprofessional teams – 2 locations) with one of them being rolled out in two locations for a total of five programs; all focusing on integrated accessible health services built on a foundation of primary care. It was plausible for patients to be enrolled in multiple programs and therefore for the analysis we only counted the first program in which people were enrolled and excluded them from the other programs. We also removed prenatal clinic program from our analysis as it looked for some different health outcomes from other programs (i.e. vaginal delivery rate). We have insufficient information to identify in our data and this was inappropriate to be analyzed together with other programs.
- In the ITS analysis, we only included 18 months after enrolment as this program started in year 2013/14 and many of them were enrolled in 2014/15 which resulted in a lack of data in the later follow-up period as we only requested data till 2015/16.

Integrated network: Care Management Strategy (GP conf. only) (VCHA)



ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
(Intercept)	377.42	201.34	553.51	<0.001
time	34.40	20.74	48.06	<0.001
group	321.57	72.55	570.59	0.013
level	-151.97	-457.30	153.36	0.332
trend	-54.83	-74.84	-34.82	<0.001
time:group	7.60	-11.72	26.91	0.443
group:level	184.32	-247.49	616.12	0.406
group:trend	-12.48	-40.78	15.82	0.390

Inclusion criteria supplied by site

- Health status: Clients with medical or functional complexity and/or clients in transition, and/or clients with social complexity issue
- Location of residence: Vancouver, Richmond, Coastal

Inclusion criteria used for case selection and matching

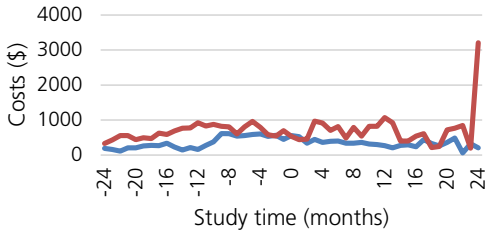
- Time dimension: match on intervention time (year)
- Age: 5-year age ranges
- Sex
- Health status: Major ADGs
- Geography: Similar health system environment (LHA --> health system environment) within VCHA
- Anchor point: n/a
- Criteria not being used: clients in transition, clients with functional complexity, clients with social complexity issue

Case/control match

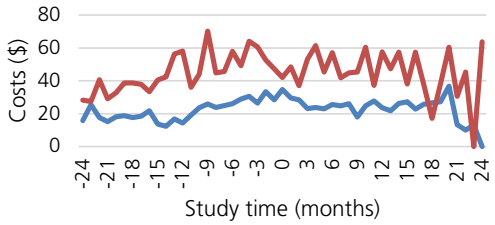
- We matched the 1572 eligible cases (out of 1632) to 6230 controls, which the final case-control ratio is 1:3.96.

Community intervention: Care Management Strategy (telephonic care management only) (VCHA)

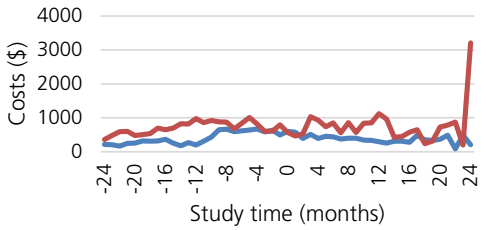
Acute Care Costs



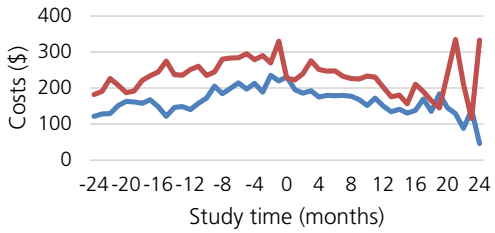
Emergency Deparment Costs



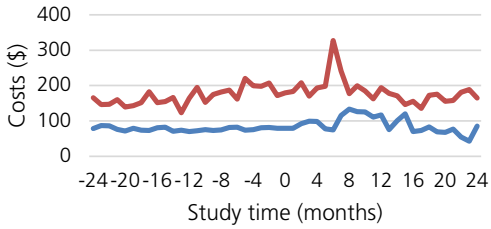
Hospital Costs



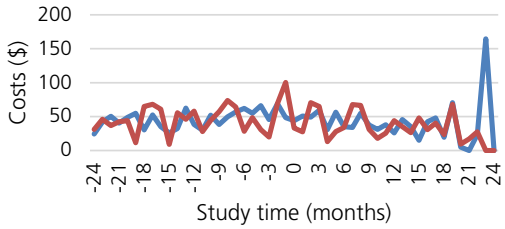
Total Physician Costs



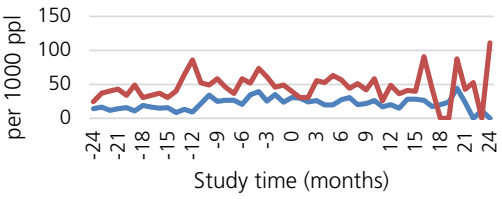
Pharmaceutical Costs



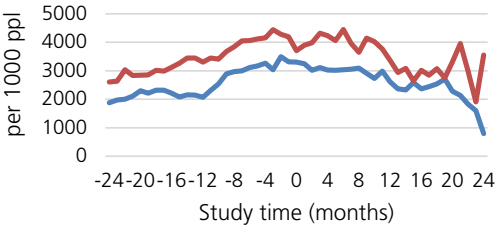
Day Surgery Costs



Number of Emergency Department to Acute Admissions



Total Number of Physician Visits



ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
(Intercept)	457.47	350.52	564.43	<0.001
time	62.78	44.81	80.74	<0.001
group	869.44	718.18	1020.6	<0.001
level	-483.93	-733.5	-234.37	0.001
trend	-73.89	-102.02	-45.77	<0.001
time:group	-57.69	-83.09	-32.28	<0.001
group:level	324.84	-28.1	677.78	0.081
group:trend	73.51	33.74	113.29	0.001

Inclusion criteria supplied by site

Health status:

- Clients with chronic disease and some functional impairment, but with the capacity for self management with support AND Clients requiring professional clinical intervention and expertise for treatment and support during short term management of a chronic condition

Location of residence:

- Vancouver, Richmond, Coastal

Other

- Have intact cognitive function.
- Can manage their chronic disease.
- Are not expected to deteriorate from their current health status.
- Have access to a telephone and are able to use it.
- Have no barrier to communicate over the telephone (e.g. hearing, language, mobility)

Inclusion criteria used for case selection and matching

- Time dimension: match on intervention time (year)
- Age: 5-year age ranges
- Sex
- Health status: ACG
- Geography: Similar health system environment (LHA --> health system environment) within VCHA
- Anchor point: n/a
- Criteria not being used: have professional clinical intervention and expertise for treatment and support.
- Have intact cognitive function, can manage their chronic disease, are not expected to deteriorate from their current health status, have access to a telephone and are able to use it, have no barrier to communicate over the telephone (e.g. hearing, language, mobility), and functional impairment

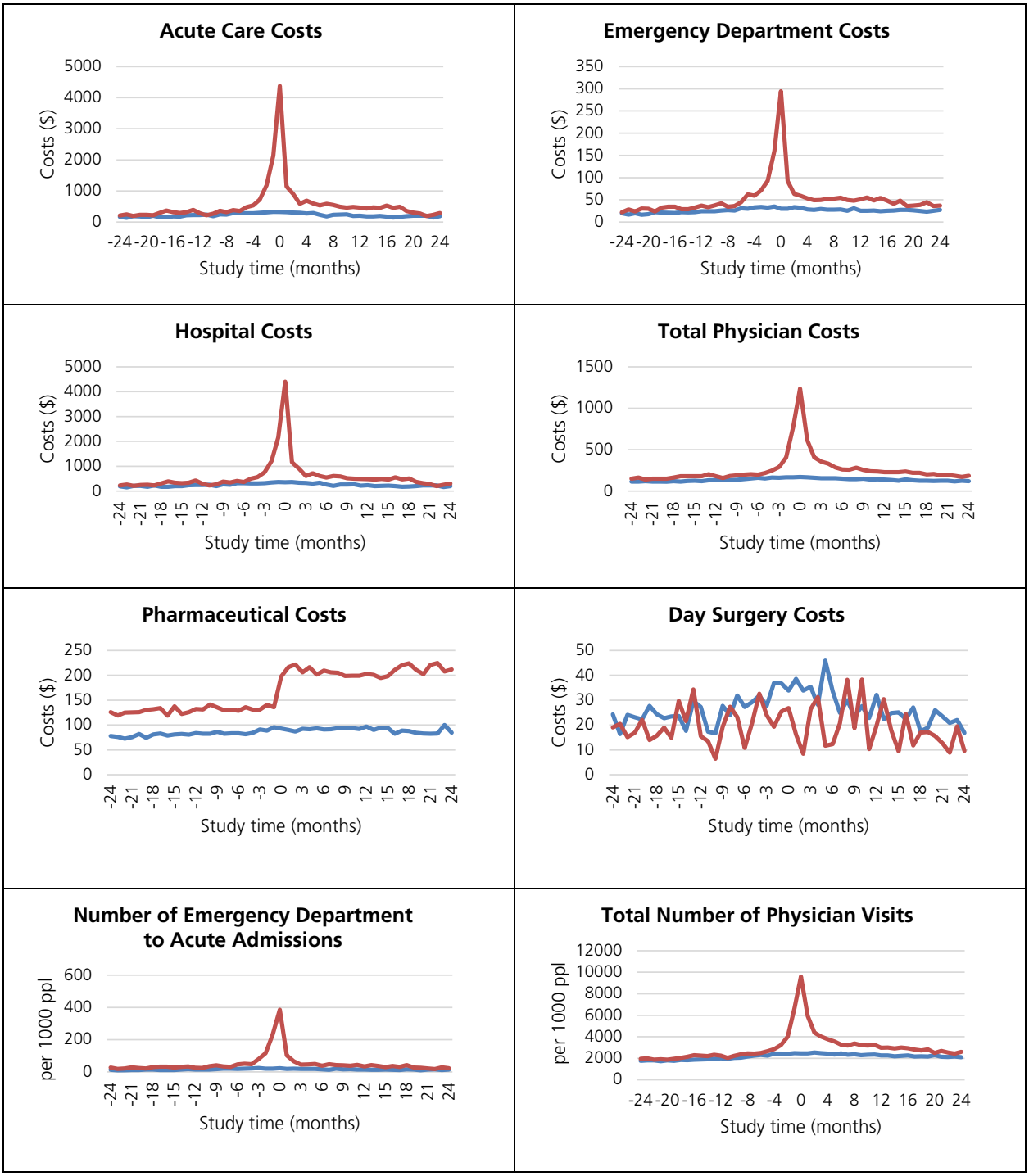
Case/control match

- We matched the 328 eligible cases (out of 334) to 1304 controls, which the final case-control ratio is 1:3.98.

Methodology differences

- As most of the clients (over 90%) were enrolled in year 2014/15, which resulted in a lack of data in the later the 24 months follow-up period for many of them, as we only requested data till 2015/16. There were 94% of patients in the month 13 after enrolment, but only 75% in the next month. Also, we had only 32% of clients in the 17 months after enrolment which led to unstable monthly average costs. Therefore, we only included 13 months before and 13 months after in the ITS analysis.

Mental health: Acute Home Based Treatment (VCHA)



ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
(Intercept)	357.35	281.95	432.75	<0.001
time	10.41	4.51	16.32	<0.001
group	126.22	19.59	232.86	0.023
level	-10.00	-141.48	121.49	0.882
trend	-18.14	-26.79	-9.49	<0.001
time:group	7.50	-0.85	15.85	0.082
group:level	457.48	271.54	643.42	<0.001
group:trend	-27.17	-39.40	-14.93	<0.001

Inclusion criteria supplied by site

- Health status: Depression, Schizophrenia, Bipolar Disorder, Schizoaffective Disorder, Psychosis, Anxiety Disorder, Stress Reaction/ Adjustment Disorder, Mood [Affective] Disorder, ETOH Dependence, Substance Use, Dementia/Delirium, , Dysthymia, , PTSD,, Psychoactive Substance Use. Simplified: anxiety disorder, bipolar disorder, dementia, mood disorder, psychosis, substance use, other.
- Location of residence: Vancouver, Richmond, North Shore
- Source of referral: ER, Acute inpatient units and community, GPs

Inclusion criteria used for case selection and matching

Case/control selection

- Health status: Any of the following conditions: Depression, Schizophrenia, Bipolar Disorder, Schizoaffective Disorder, Psychosis, Anxiety Disorder, Stress Reaction/Adjustment Disorder, Mood [Affective] Disorder, ETOH Dependence, Substance Use, Dementia/ Delirium, Dysthymia, , PTSD, Psychoactive Substance Use

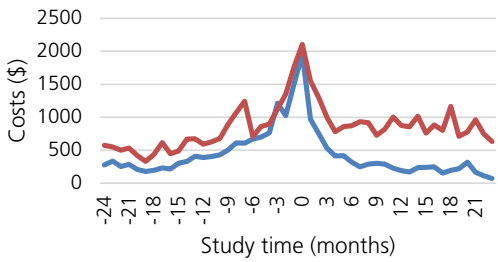
Matching

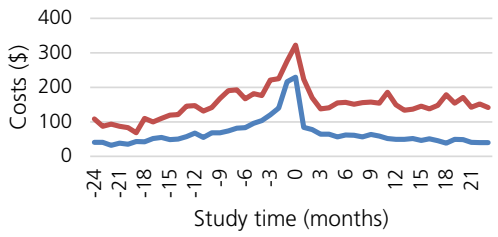
- Geography: Similar health system environment (LHA --> health system environment) within VCHA
- Time dimension: match on intervention time (year)
- Age: 5-year age ranges
- Sex
- ACG
- Anchor point: n/a
- Criteria not being used: Source of referral: ER, Acute inpatient units and community, GPs

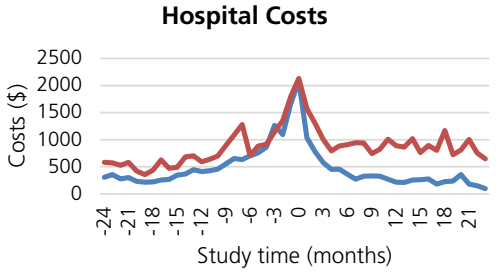
Case/control match

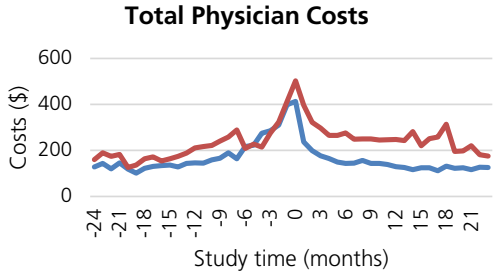
- We matched the 1396 eligible cases (out of 1574 cases) to 5555 controls, which the final case-control ratio is 1:3.98.

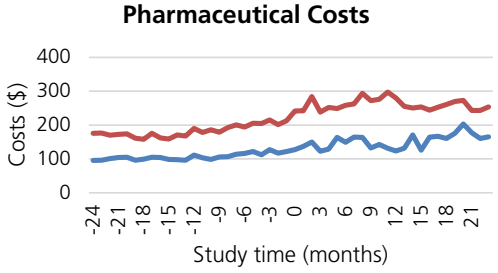
Mental health: Mental Health Integrated Care (IHA)

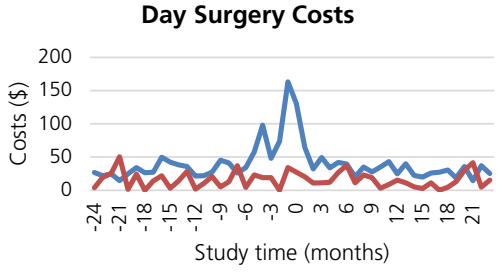


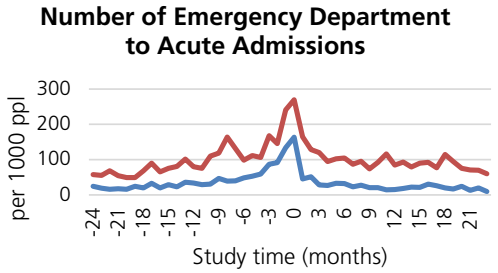


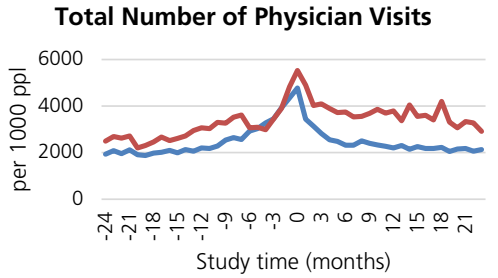












ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
(Intercept)	352.31	183.33	521.28	<0.001
time	36.69	23.36	50.02	<0.001
group	415.82	176.85	654.79	0.001
level	-413.54	-709.31	-117.77	0.008
trend	-51.03	-70.58	-31.48	<0.001
time:group	0.72	-18.14	19.57	0.941
group:level	388.33	-29.95	806.62	0.073
group:trend	5.14	-22.51	32.79	0.717

Inclusion criteria supplied by site

- Health status: Moderate or severe substance use clients; • Complex medical conditions including being at risk of metabolic syndrome
- Health care utilization: High acute care utilization (2 ED visits and/or 1 hospital admission) in the previous year
- Location of residence: Williams Lake/100 Mile House, Salmon Arm, Kamloops, Kelowna, Penticton, Trail, Nelson, Cranbrook.
- Other: Complex and severe mental health clients who have limited or no access to primary care and who are at risk for or have concurrent chronic disease.

Inclusion criteria used for case selection and matching

Case/control selection

- Health status: Moderate to severe substance use AND/OR Severe Mental Health Issue AND Complex Medical conditions (including at risk of metabolic syndrome)
- Health care utilization: ≥ 2 emergency room visits (All visits/admissions had to have occurred within one year (same year as client) OR ≥ 1 hospital admission (All visits/admissions had to have occurred within one year (same year as client))

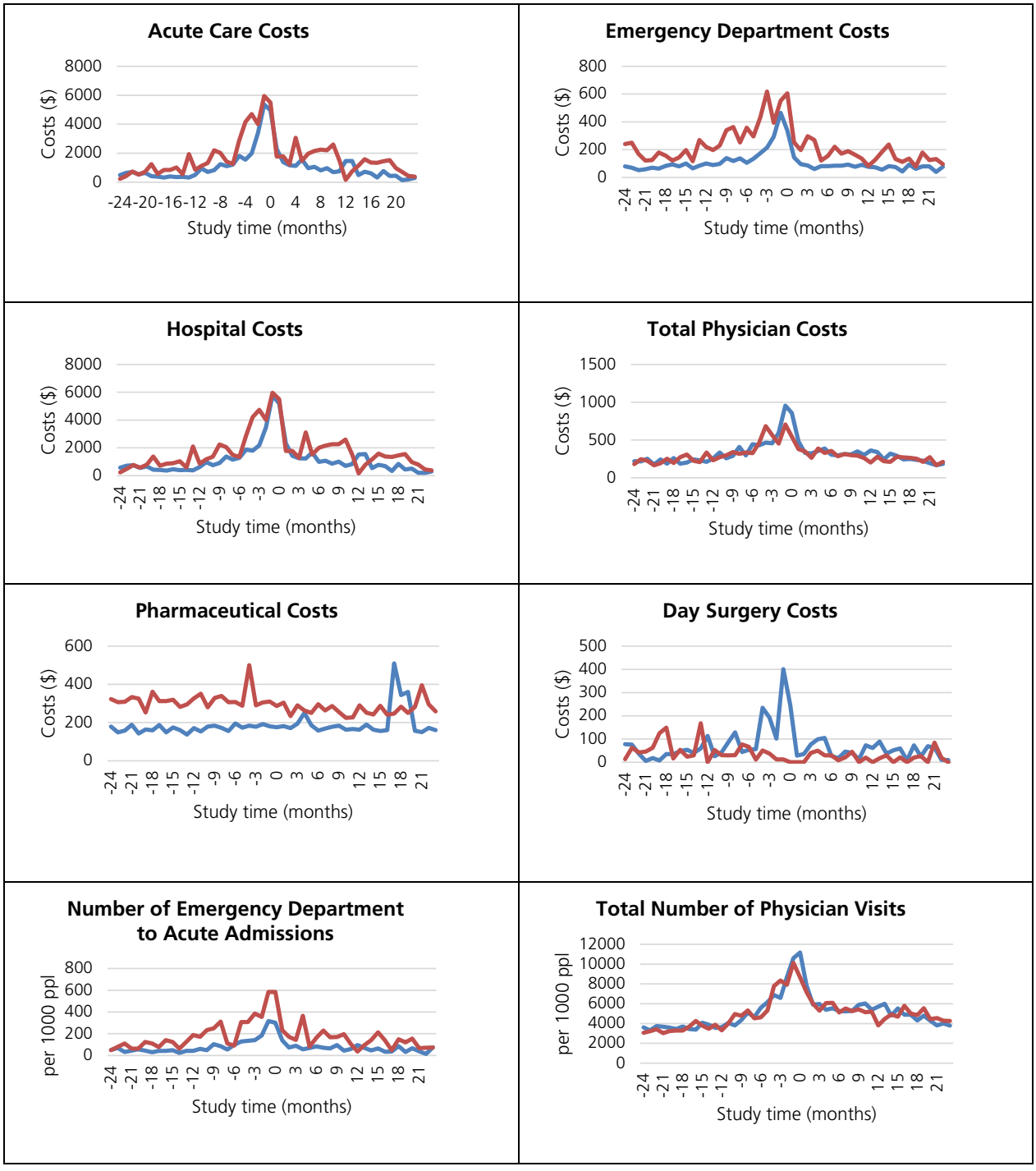
Matching

- Time dimension: Match on intervention time (year)
- Age: 5-year age ranges
- Sex
- major ADGs
- Geography: Similar health system environment (LHA --> health system environment) within IHA
- Anchor point: utilization
- Criteria not being used: Limited access to primary care

Case/control match

- We matched the 384 eligible cases (out of 638) to 1098 controls, which the final case-control ratio is 1:2.86.

Frequent users: Intensive Integrated Care Management (IH)



Inclusion criteria supplied by site

Health status

- Complex chronic disease, with self-care impaired by mild to moderate mental health, substance use and/or lifestyle factors.

Health care utilization

Frequent ED and Acute Users in Nanaimo/Qualicum (NRGH):

- 5 + visits to the Emergency Department in the past 12 months; and/or

ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
(Intercept)	584.27	-71.02	1239.57	0.085
time	71.06	19.47	122.64	0.009
group	-48.56	-975.29	878.16	0.918
level	-3.97	-1149.80	1141.87	0.995
trend	-133.69	-209.33	-58.05	<0.001
time:group	83.37	10.41	156.32	0.028
group:level	-451.84	-2072.29	1168.62	0.586
group:trend	-131.47	-238.45	-24.50	0.018

- 3+ admissions to hospital in the past 12 months; and/or
- 2 or more readmissions to hospital within 30 days of discharge;

Location of residence

- Vancouver Island Health Authority

Source of referral

- The team has started receiving referrals from physician offices, in addition to referrals from hospital, ED and HCC teams.

Other

Challenges to discharge planning, as previous experience indicates clients have significant issues in successful self-management of their health conditions in the community, due to:

- A mix of mental health, chronic disease and/or substance use issues. Typically clients may present with significant anxiety or symptoms of depression, which do not meet MHSU intake criteria, and affect their ability to manage medical co-morbidities;
- Unique challenges in self-management arising from lifestyle, social isolation, risk of neglect or self-neglect or other social determinants;
- Unknown factors which require exploration with the physician, clients and family to identify and address.

Inclusion criteria used for case selection and matching

Case/control selection

- Health status: Complex chronic disease, AND POSSIBLY Moderate mental health, substance use and/or lifestyle factors, anxiety or depression
- Health care utilization: ≥ 5 visits to the emergency department in the past 12 months AND/OR ≥ 3 admissions to the hospital in the past 12 months AND/OR ≥ 2 readmissions to hospital within 30 days of discharge

Matching

- Time dimension: Match on intervention time (year)
- Age: 5-year age ranges
- Sex
- Geography: Similar health system environment (LHA --> health system environment) within IH
- ACG
- Anchor point: utilization

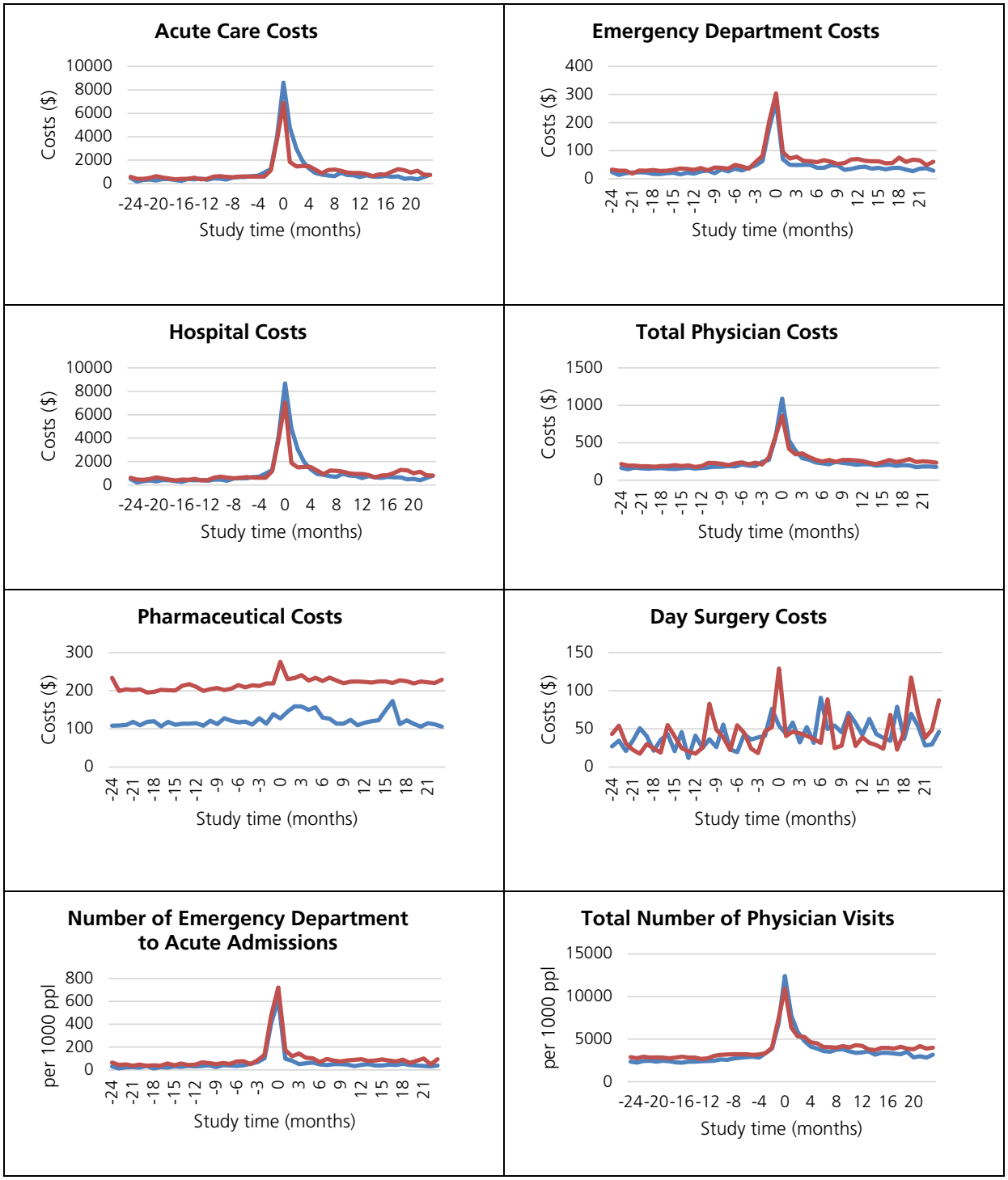
Criteria not being used for matching

- Typically, clients may present with significant anxiety or symptoms of depression, which do not meet MHSU intake criteria, and affect their ability to manage medical co-morbidities;
- Unique challenges in self-management arising from lifestyle, social isolation, risk of neglect or self-neglect or other social determinants;
- Unknown factors which require exploration with the physician, clients and family to identify and address.

Case/control match

- We matched the 65 eligible cases (out of 94 cases) to 163 controls, which the final case-control ratio is 1:2.51.

Community reintegration: Early Supported Discharge (VCHA)



ITS Results

α=0.05	Value	Lower CI	Upper CI	p-value
(Intercept)	573.91	363.62	784.20	<0.001
time	16.92	0.50	33.34	0.047
group	331.64	34.24	629.04	0.032
level	620.64	254.51	986.76	0.001
trend	-49.27	-73.32	-25.21	<0.001
time:group	-8.55	-31.76	14.67	0.473
group:level	186.76	-331.02	704.54	0.482
group:trend	18.56	-15.45	52.58	0.288

Inclusion criteria supplied by site

Health status

- A primary diagnosis of congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD) or a new stroke

Health care utilization

- Patients admitted to acute care or emergency
- Location of residence: Vancouver, Richmond, Coastal and Providence Health Care

Other

- Require further short-term (3 months of less) rehabilitation therapy, adaptive equipment and linkages to community program services to achieve their optimal functioning
- Patient has been asked to be followed again by the family physician
- No active family physician and limited community support
- Significant decline in disease status requiring new/increased referrals to community supports
- Patient has exceeded the 6-month window since last intervention/discharge
- Patient exhibits recurrent emergency admissions and would benefit from being followed again

Inclusion criteria used for case selection and matching

Case/control selection

- Health status: congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD) or a new stroke AND major ADGs
- Healthcare utilization: Patients admitted to acute care or emergency at least once

Matching

- Time dimension: match on intervention time (year)
- Age: 5-year age ranges
- Sex
- Geography: Similar health system environment (LHA --> health system environment) within VCHA
- ACG
- Anchor point: utilization

Criteria not being used for matching

- Require further short-term (3 months of less) rehabilitation therapy, adaptive equipment and linkages to community program services to achieve their optimal functioning.
- Patient has been asked to be followed again by the family physician
- No active family physician and limited community support
- Significant decline in disease status requiring new/increased referrals to community supports
- Patient has exceeded the 6-month window since last intervention/discharge
- Patient exhibits recurrent emergency admissions and would benefit from being followed again
- Have poorly controlled COPD or HF symptoms, compliance or education concerns around inhalers, medications and/or chronic disease self-management; OR;
- Are a previous patient of ESD team and would benefit from reconnecting with the team

Case/control match

- We matched the 711 eligible cases (out of 2069 cases) to 916 controls, which the final case-control ratio is 1:1.29.

Methodology difference

- The inclusion criteria we received for this program didn't specify the time and frequency of the ED visit/acute care admission. We assumed the frequency is at least once admission to ED/acute care, and applied a 60 day cut-off which over 90% of ESD clients were included when excluding controls.

Appendix D: Advisory Committee Members

Health Authority Representatives

- Pam Mulroy, Northern Health Authority
- Shelley Tice, Vancouver Island Health Authority
- Oluseyi (Seyi) Oyedele, Interior Health Authority
- Susan Lim, Vancouver Coastal Health Authority
- Carol Park, Vancouver Coastal Health Authority
- Rizwan Damji, Vancouver Coastal Health Authority
- Petra Pardy, Fraser Health Authority
- Catherine Butler, Fraser Health Authority

Ministry of Health Representatives

- Aureleo Reyes, Finance and Corporate Services
- Sandra Feltham, Primary and Community Care Analytics
- Shana Ooms, Primary Health Care Services
- Meiying Liu, Performance Measurement Analysis and Reporting
- Harriet Graham, Research, Library Services and Knowledge Translation

Research Team Representatives

- Kim McGrail (Chair), Professor, UBC Centre for Health Services and Policy Research
- Sabrina Wong, Professor, UBC Centre for Health Services and Policy Research
- Mike Law, Associate Professor, UBC Centre for Health Services and Policy Research
- Shannon Berg, Associate, Centre for Clinical Epidemiology and Evaluation
- Mark Harrison, Assistant Professor, Pharmaceutical Sciences, UBC
- Margaret McGregor, MD, Research Associate, Centre for Clinical Epidemiology and Evaluation
- Craig Mitton, Professor, Centre for Clinical Epidemiology and Evaluation
- Stirling Bryan, Professor, Centre for Clinical Epidemiology and Evaluation
- Megan Ahuja (Engelhardt), Research Coordinator, UBC Centre for Health Services and Policy Research

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