Whatcom Alliance for Health Advancement Intensive Case Management System:

Evaluation of health care outcomes

Public Health
Seattle & King County

Background

WAHA Intensive Case Management System (ICM)

- ICM is a case management program coordinated by WAHA that aims to foster collaboration between health organizations, public agencies and funders to identify complex patients in our community and enroll them into a community-based case management system

- ICM case managers work in a multi-disciplinary team across organizational boundaries to provide the appropriate level of support to complex patients

- ICM case manager teams are comprised of mixed disciplines, such as housing case managers, nurses, social workers or mental health professionals, clients

- Each team is oriented around the needs of a specific patient or client population based on a set of characteristics such as homeless, medically complex, frequently incarcerated, frequent users of EMS

- For the purpose of this evaluation, each client received, on average, between 1-3 visits per month and 2-3 telephone calls

Intensive Case Management Enrollment Flow Chart

Referred

WAHA Director of Care Management screens based on inclusion criteria (any one)

EMS Pod
(4) 911 calls in 1 month
OR (6) 911 calls in 6 months
OR (10) 911 calls in 1 year
OR   other high risk clients per EMS

Frequently Incarcerated Pod
Frequent jail bookings (≥3 in last 3 years)
Address within City of Bellingham
5 or more ER visits in 1 yr.
OR 3 or more admissions in 1 yr.

Exclusion Criteria (any one)
Unwilling to sign ROI
As determined by program director
Unavailability of ICM case management staff

Homeless Pod
5 or more ER visits in 1 yr.
OR 3 or more admissions in 1 yr.
OR at the discretion of program director.

Health Homes
Medicaid beneficiary
AND PRISM score > 1.5
As identified by HCA Health Homes program

Eligible

Director of Care Management assigns client to Case Manager

Unable to Contact

Enrollment

No Enrollment

Begin Service

Attrition
Violent behavior or threatens team
Lost to follow-up/unable to contact
Withdraw
Death

August 2015

Source: WAHA

Completed Program

Methods overview

- Study design: retrospective cohort design with no comparison group

- Intervention is defined as ICM enrollment (yes/no)
  - Secondary exposure of interest is duration of program enrollment (days enrolled)

- Outcomes, comparing pre to post-enrollment period:
  - Change in ED visit rate
  - Change in hospitalization rate
  - Change in charges due to ED visits
  - Change in charges due to hospitalizations

- Study subjects: 130 individuals enrolled in ICM between January 13, 2014 and March 31, 2016, residing in Whatcom County, Washington
  - Per guidance of ICM program staff, inclusion criteria will be total enrollment in ICM for 90 or more days

- Data source: Individual-level, de-identified data on enrollee characteristics, program enrollment dates, and dates and charges of outcomes (ED visits, hospitalizations) was provided to the study team by WAHA

Addressing the lack of a comparison group

- Problem:
  - ICM enrollees are enrolled for varying amounts of time
  - Concern that certain individual factors might be associated with both dropping out of the program AND our outcomes of interest

- Solution:
  - Include in our model each enrollee's likelihood (i.e. propensity score) of dropping out of program in less than 180 days, given their age, sex, race, and ethnicity
  - 180 days selected based on descriptive analysis of enrollment data

Results

# Effect of ICM enrollment on ED visits and hospitalizations

Outcome	% change comparing post to pre-intervention period	P-value
ED visit rate	-39%	<0.001
Hospitalization rate	-64%	<0.001
Charges billed for ED visits	-36%	<0.001
Charges billed for hospitalizations	-62%	<0.001

Sample interpretation

Adjusting for multiple enrollment periods & likelihood of having short program enrollment (<180 days), program enrollment was statistically significantly associated on average with a 38.8% reduction in the ED visit rate during the post-enrollment period (95% CI 21.2, 52.5, p-value <0.001).

Note: Program enrollment was not a significant predictor of having 0 visits/hospitalizations/charges for all 4 outcomes.
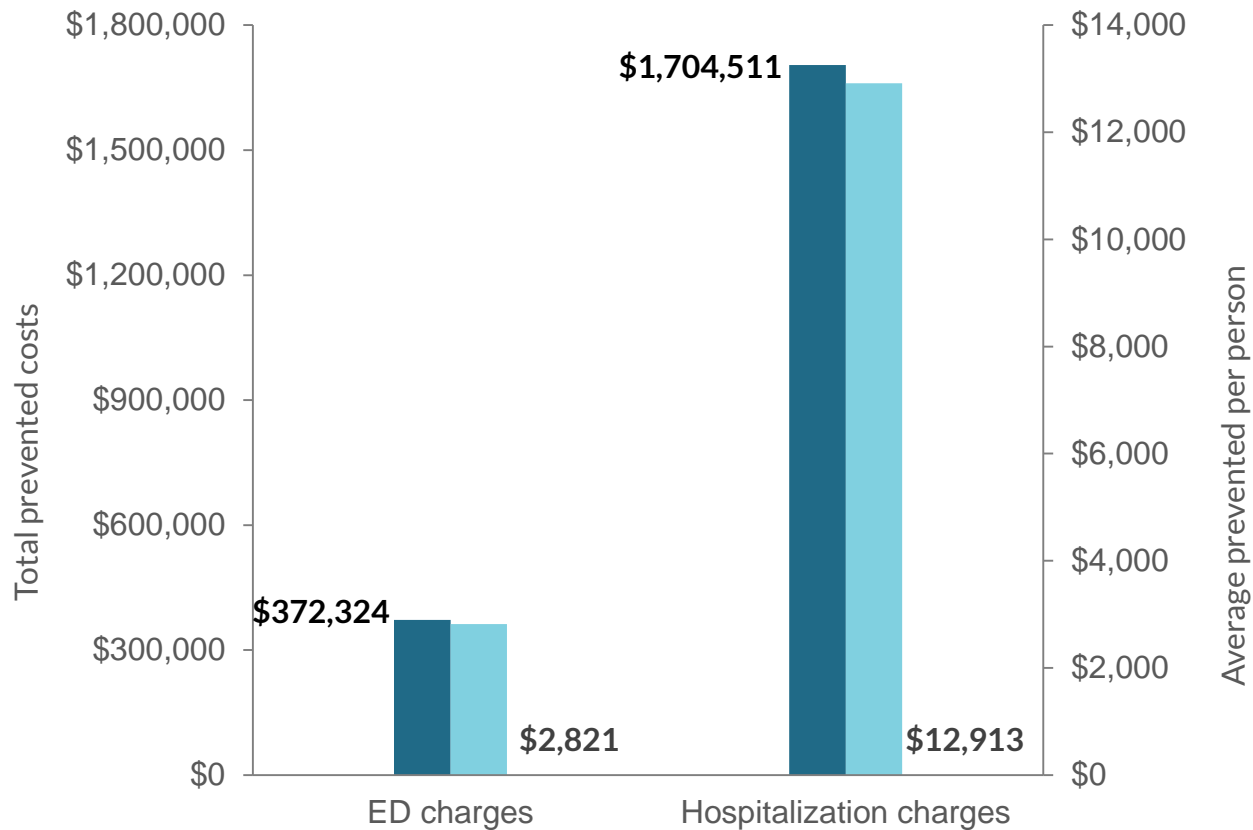
Prevented healthcare utilization due to ICM enrollment
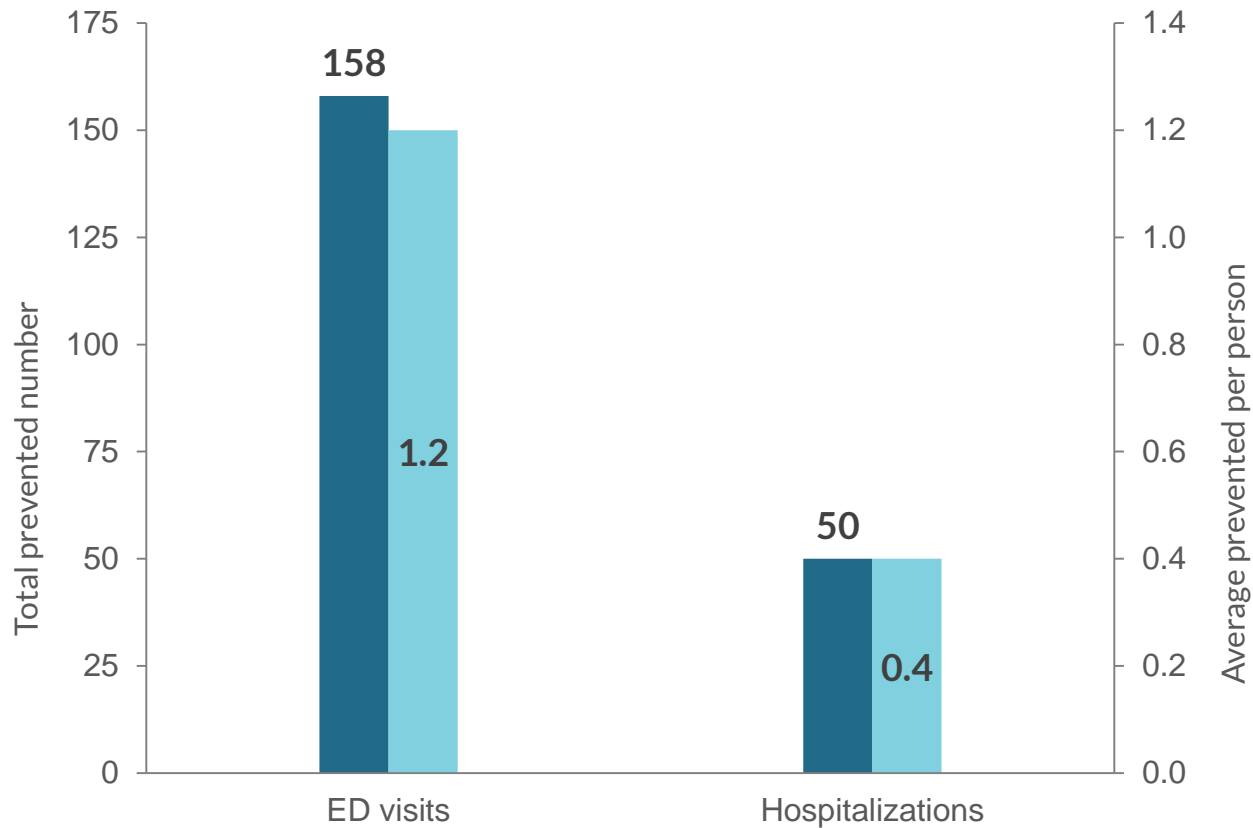
Sample interpretation

Given that total ED visits in pre period were ~408 per 200 days (the median enrollment period) for our cohort of 132 enrollees, a 38.8% reduction translates to a total of 158 prevented visits for a median enrollment period of 200 days. Or averting 1.2 ED visits per person during this time period.

Prevented healthcare costs due to ICM enrollment

Sample interpretation

Given that total ED charges in pre period were $1,048,801 per 200 days (median enrollment period) for our cohort of 132 enrollees, a 35.5% reduction translates to a total savings of $372,324 for a median enrollment period of 200 days. Or savings of $2,821 per person during this time period. Note that this is not net savings as cost of ICM program is not considered.

Strengths and limitations

Strengths

☐ Ability to look at both health care outcomes and associated costs

☐ Propensity scoring used to address lack of a comparison group

☐ Substantial ER and hospitalization reductions demonstrated

Limitations

☐ Outcome data limited to hospital environment (effects likely in other sectors)

☐ If ICM costs included, net costs/savings could be calculated

APPENDIX

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Analytic methods in detail

- Although we originally planned to model this count data (visits, charges) using repeated measures Poisson regression, assessment of the outcome data revealed both overdispersion (greater than expected variability) and excess zeros

- Given that Poisson regression has been shown to be ineffective at modeling data with these distributional characteristics, we instead used zero-inflated negative binomial regression, clustering on client ID to model the pre/post enrollment change in our outcomes:
  - negative binomial regression is designed to address the problem of overdispersion
  - zero-inflated approach essentially treats zero and non-zero counts as 2 separate distributions and models them separately
  - clustering on client ID is essential because we are comparing individuals to themselves (and thus would see less variation than expected if not adjusted)

- As mentioned earlier the regression models also included:
  - Covariate for client-level propensity score for short enrollment (<180 days) conditional on age, sex, and race/ethnicity
  - Covariate indicator of having had multiple enrollment periods

- Model diagnostics:
  - Likelihood ratio test of zero-inflated negative binomial model versus the zero-inflated Poisson model (4/4 models prefer negative binomial)
  - Vuong test compares the zero-inflated model negative binomial with an ordinary negative binomial regression model (3/4 models prefer zero-inflated model)

Enrollment period number and duration

Clients by number of enrollment periods						
			Total enrollment duration (days)			
Number of enrollment periods	**Number of clients**	**% of clients**	**Mean**	**Median**	**Min**	**Max**
1	121	92%	215	195	90	472
2	9	7%	297	292	117	478
3	2	2%	334	334	313	354
Note: Enrollments excluded if total enrollment duration was less than 90 days.						

- Majority of enrollees only enrolled once during program

- Median enrollment duration = 199 days
  - As such, averted health care utilization and costs will be expressed as the amount averted per 200 days of program enrollment

Relationship between demographic/health factors & program enrollment

Missingness of baseline demographic and health factors

Covariate	% missing
age	0%
sex	0%
race	2%
ethnicity	3%
patient activation measure (PAM)	29%
patient health questionnaire (PHQ9)	29%
body mass index (BMI)	42%
behavioral health (BH) concern	16%
chemical dependency (CD) concern	24%
physical disability	71%
homeless	44%
incarceration count for prior 3 years	59%

4 factors included in propensity score model

Association between enrollment duration and baseline demographic & health factors

Covariate	Regression coefficient*	p-value**
age	0.19	0.7
male sex	10.03	0.5
race	-	0.0003***
Hispanic ethnicity	30.28	0.2
PAM	0.76	0.2
PHQ9	-0.34	0.8
BMI	1.86	0.1
BH concern	-15.01	0.5
CD concern	29.62	0.2
disability	-60.68	0.09
homeless	-32.95	0.2

*Regression coefficient represents the change in enrollment duration (days) associated with a 1-unit change in each covariate. For example, men were on average enrolled for 10 days longer than women (not statistically significant).

**P-value <0.05 represents statistical significance.

***This represents a Wald test of equal enrollment duration across all 6 racial groups.