



Improving Access and Coordinating Delivery for Vulnerable Populations

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Outline

- Implications of Affordable Care Act, 2010
- Example of challenges faced by local/regional healthcare systems
- Framework for a coordinated system of care
- Role of analytics in transforming delivery systems
 - Successful examples
 - Predictive analytics
- Concluding remarks



Affordable Care Act, 2010

- Healthcare reform is approved at the Federal level but its challenge will be how it is implemented at the community or grass roots level
- Improvements in health outcomes are hard to achieve without changes in the delivery system
- Delivery system changes require local support and collaboration



Predictive Analytics in Communities

- Rising healthcare needs with scarce resources
- Expanded data availability because of health information technology and health information exchange initiatives
- Need to adjust for risk at population level to increase efficiency & effectiveness of delivery system
- Need to improve system of care coordination and disease management



ICC - a regional collaborative

Integrated Care Collaboration (ICC)

- Consortium of safety net providers in Central Texas Region (pop: ~2 million; uninsured: ~450,000)
- To improve access to healthcare for uninsured and underinsured
- 26 members: hospitals, clinics, academic institutions, mental health authority, public health departments, EMS, jail health, call centers
- Hybrid model of a health information exchange (HIE) with a database

ICC Functions

- Collaboration among members for community-coordinated efforts
- Point-of-care sharing of patient data using HIE network
- Quality improvement and evaluation through reporting and analytics
- Strategic planning and research using the HIE database

I-Care Database

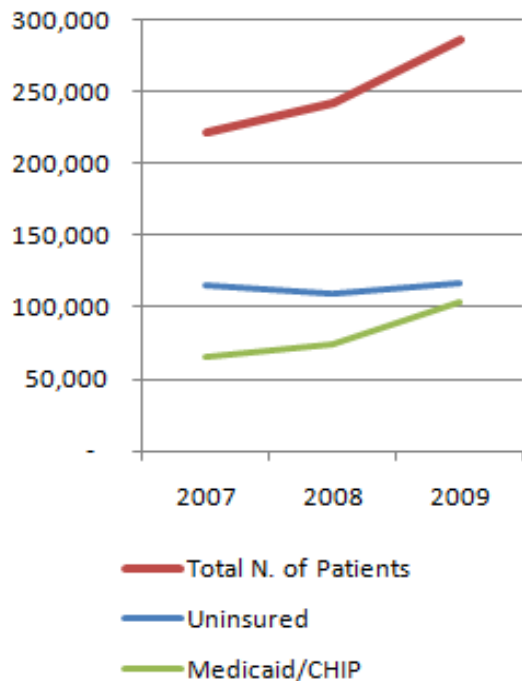
- MPI/CDR (Master Patient Index/Clinical Data Repository)
 - Data collected via electronic interfaces
 - Includes Medicaid, CHIP, local medical assistance programs, charity, self-pay, etc.
 - Demographics, encounters, PHI disclosure authorizations, medications, diagnoses, procedures
 - Treatment locations, type of service, attending physician, funding programs

I-Care Snapshot

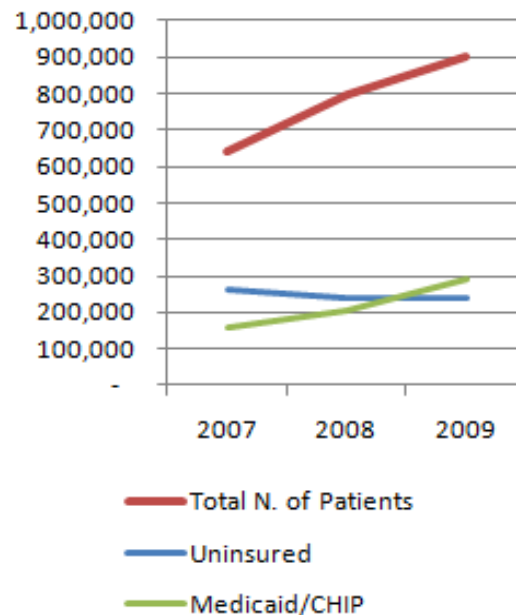
- Over 70 locations: 16 hospitals, 50 clinics, 1 Mental Health Authority, 2 Physician Networks
- About 1 million unique patients
- About 7 million encounters (2002- present)
- More than 900,000 filled prescriptions

Distribution by Payer, '07-'09

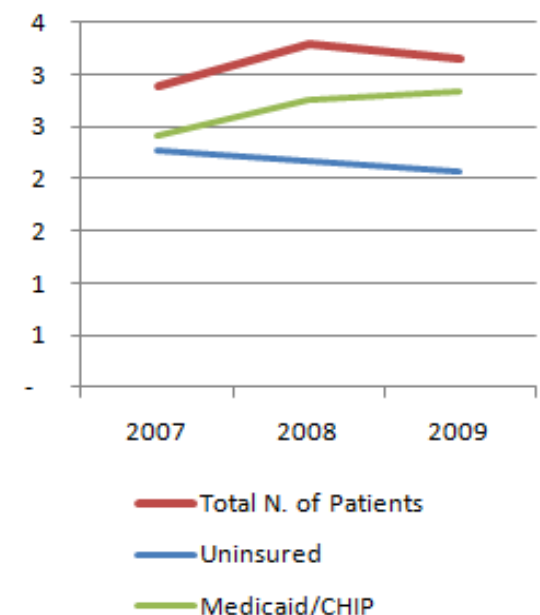
Number of Patients



Number of Encounters



Encounters per Patient



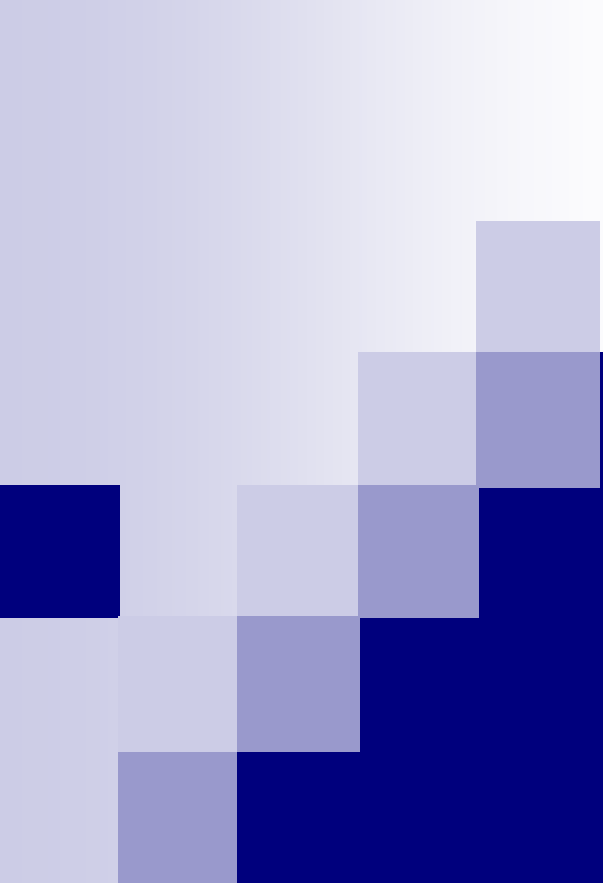
2007	2008	2009	2007-2009
221,568	241,956	285,701	511,441
114,935	109,879	117,055	233,739
64,908	74,599	103,823	147,164

2007	2008	2009	2007-2009
640,648	797,025	900,736	2,338,409
260,409	238,988	241,490	594,327
156,717	205,003	294,048	491,191

2007	2008	2009	2007-2009
3	3	3	5
2.3	2.2	2.1	2.5
2.4	2.7	2.8	3.3

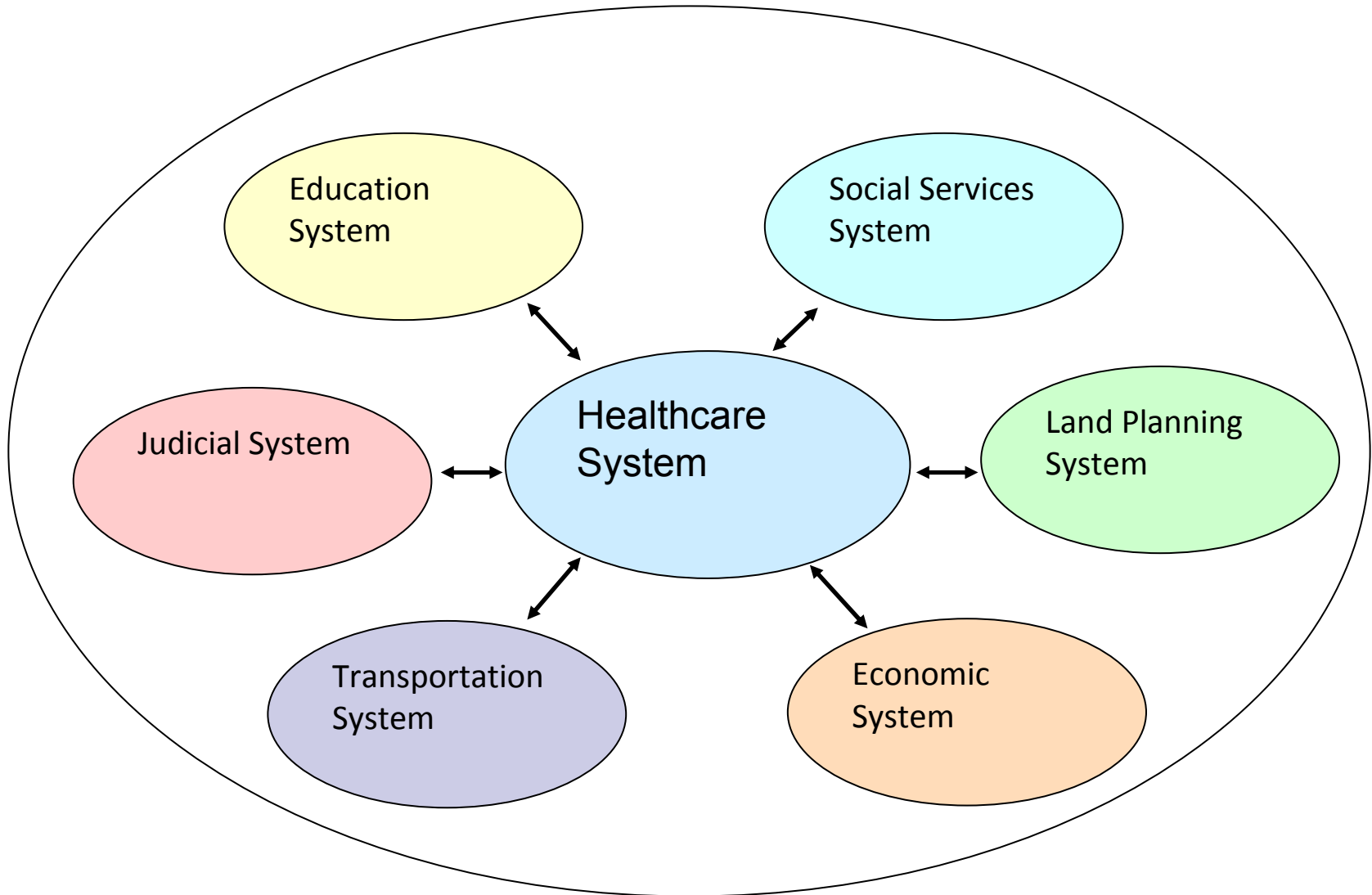
Challenges for ICC

- Increased demand for services
 - Increase in vulnerable population (economy, immigration)
 - Increase in covered population
- Relatively small changes in supply side
 - Workforce issues
 - Capacity of primary care
 - Charity contributions

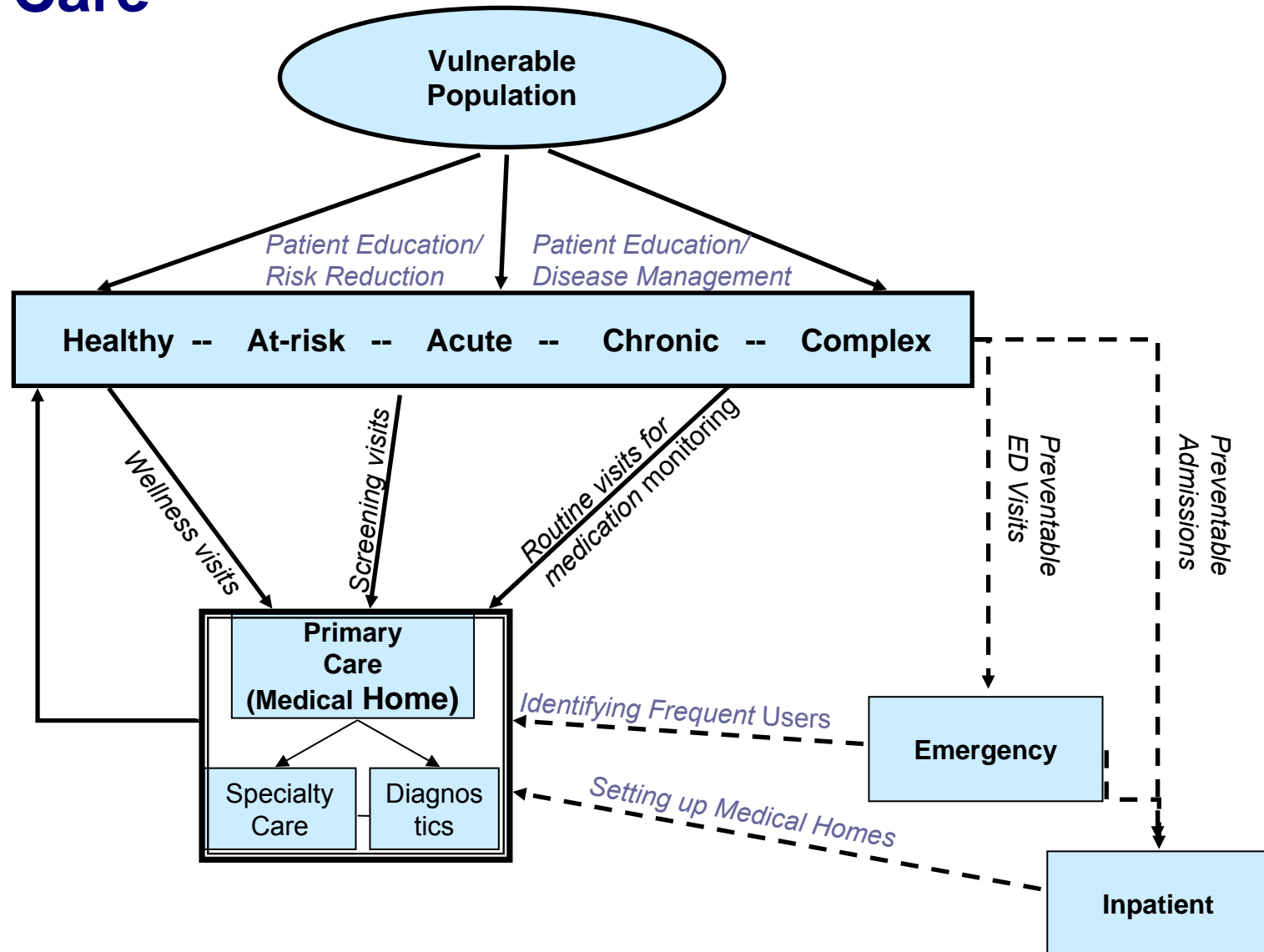


Approaches to the Challenges of Transformation

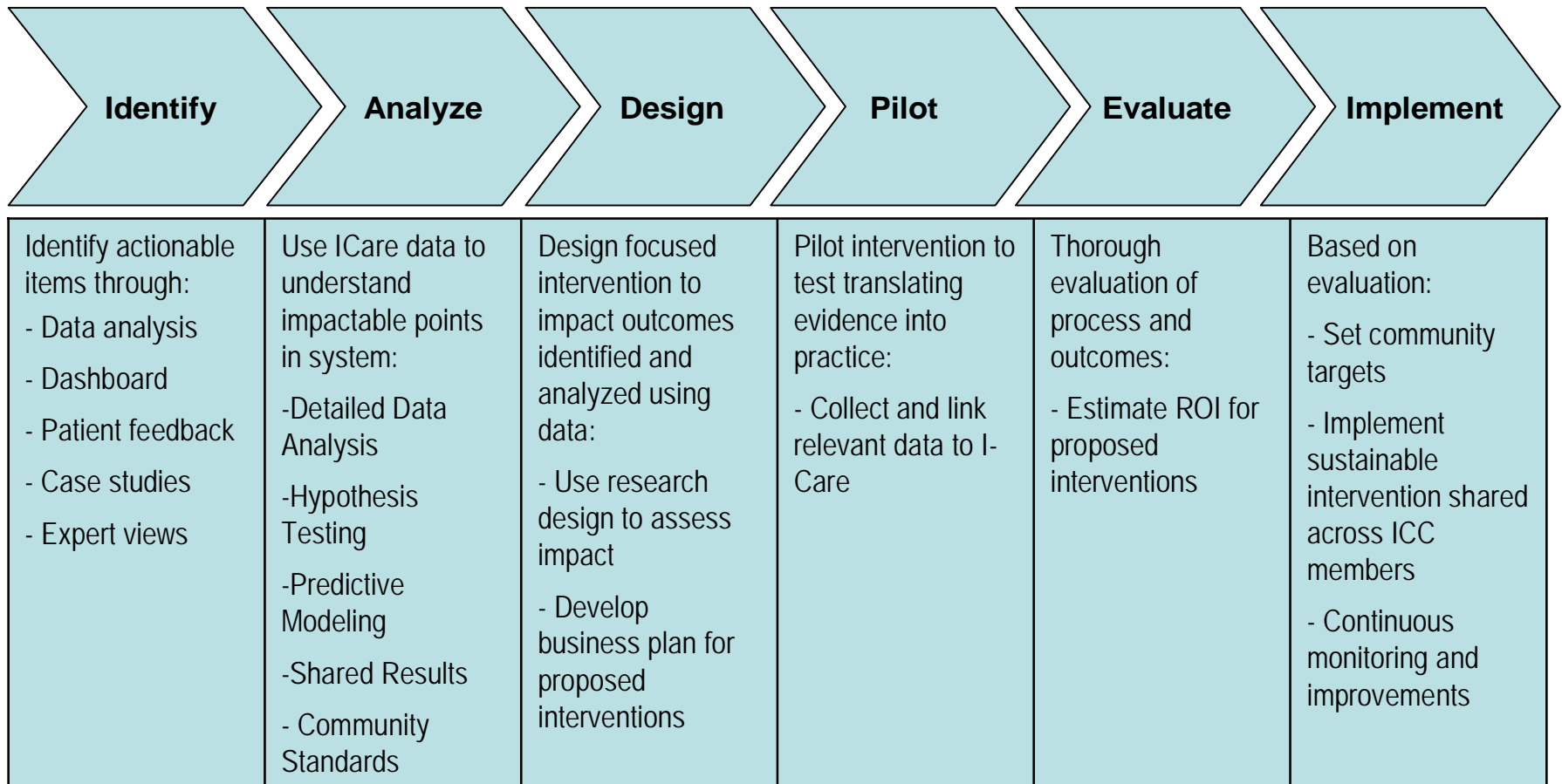
Systems Approach to Community Healthcare



Dynamic Framework for a Coordinated System of Care



Coordinated System of Care





Role of Analytics

Applications

- Program Evaluation
 - Asthma
- Problem identification & intervention design
 - ED Frequent User Analysis
 - Ambulatory Care Sensitive Conditions Management
- Predictive analytics



Analytics: Program Evaluation

ICC Asthma Program

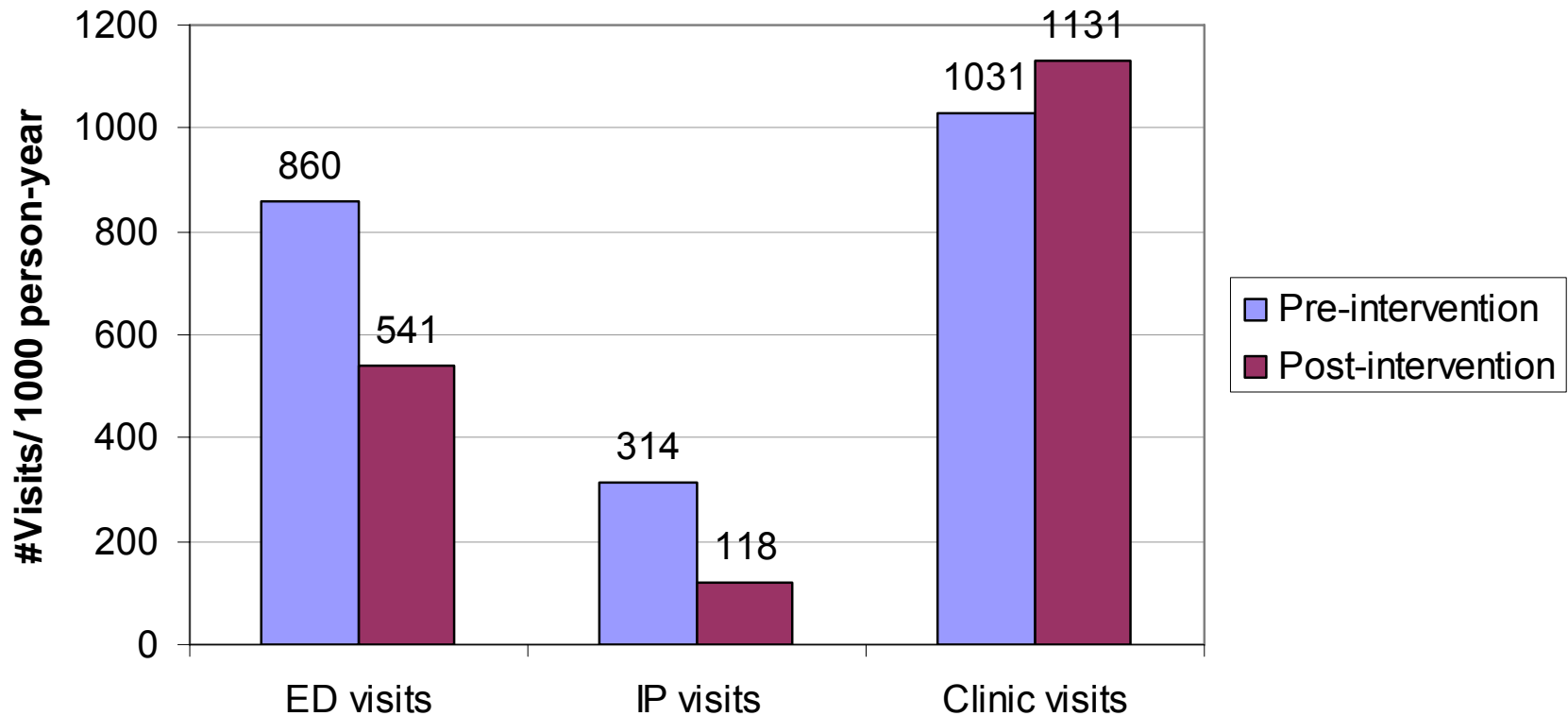
- A nationally recognized community-based, patient-education, disease management program
 - Identifies vulnerable patients through I-Care
 - Asthma education through certified educators
 - Home visits by certified therapists
 - Screening for financial assistance eligibility
 - Developing Asthma Action Plan
 - Training on self-management of asthma
 - Care coordination with primary care physician

Evaluation Methodology

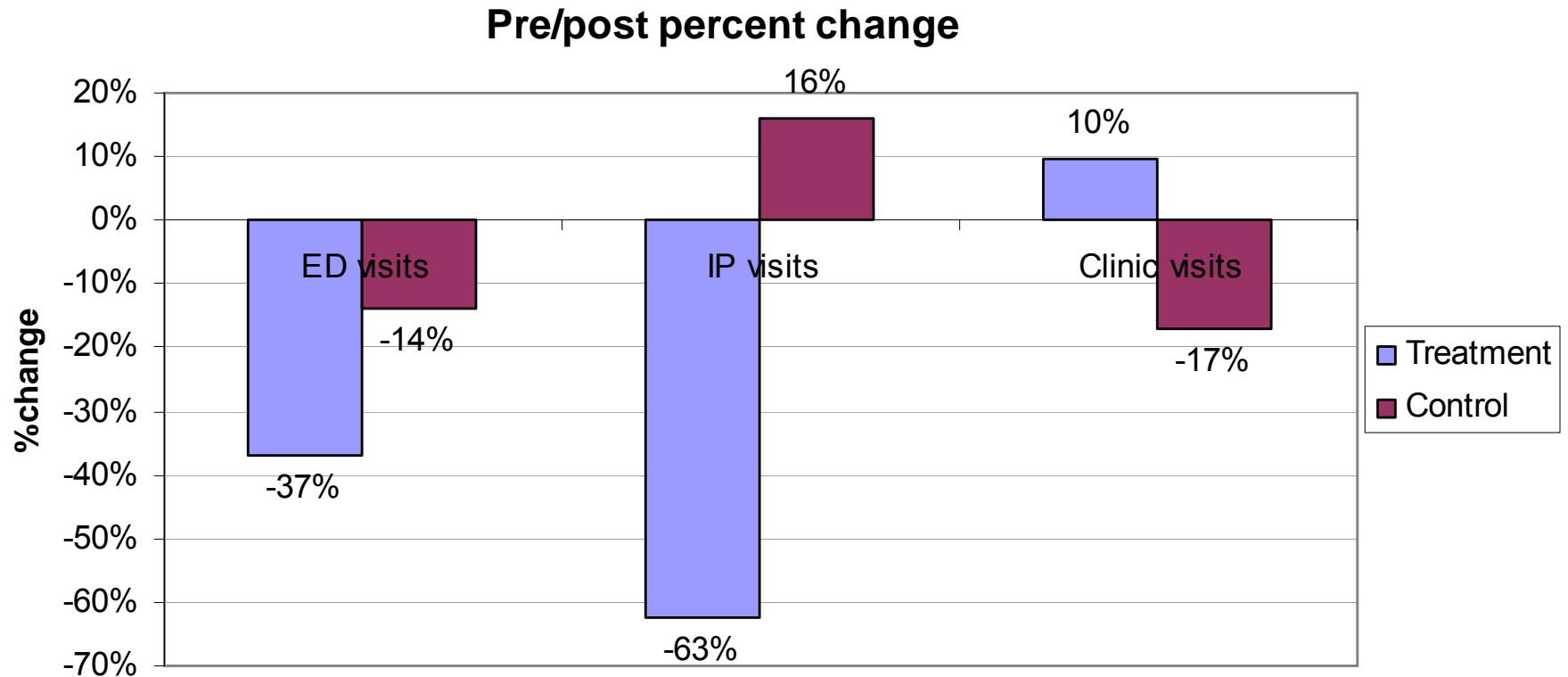
- Use I-Care database to identify patients and track outcomes
- Criteria:
 - ≥ 1 ED visit for asthma in last 12 months
 - ≥ 1 hospitalization for asthma in last 12 months
 - ≥ 4 outpatient visits for asthma in last 12 months
- Enrolled group: eligible for the program with enrollment between 4/1/2007 to 3/31/2009
- Use pre-test/post-test design with comparison to a control group

Utilization Rate of Enrolled Patients

Treatment Group (n=229)



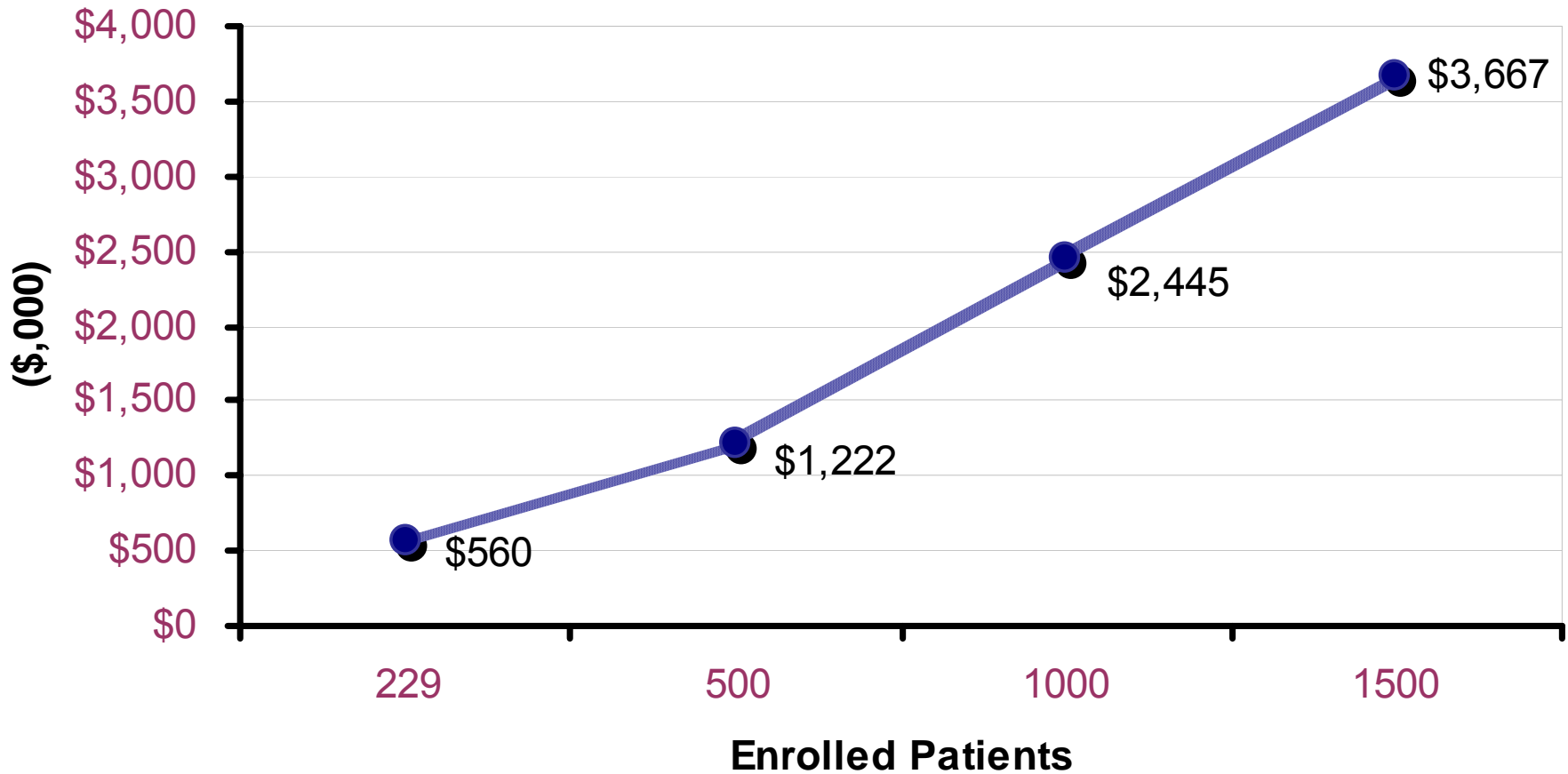
Age-adjusted Change in Utilization



Treatment, n = 229

Control, n = 1010

Projected Savings from Asthma Program





Analytics:

Problem identification
Intervention design

Emergency Department (ED) Frequent Users (FU)

■ Problem:

- ED services are overburdened*
- Some patients use the ED services more frequently than others**

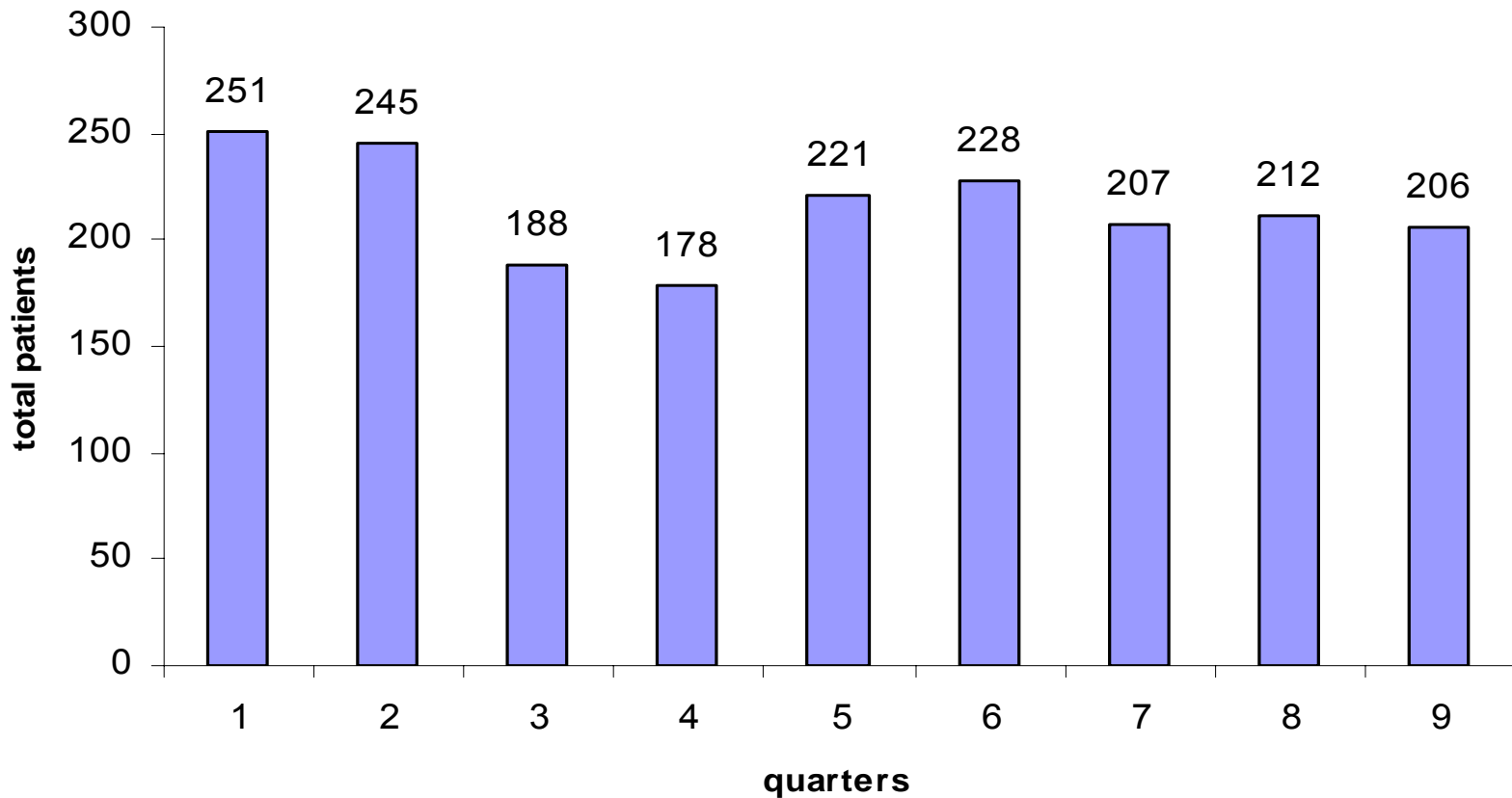
■ Project Scope:

- Methodology to identify and stratify frequent users and design interventions to improve care

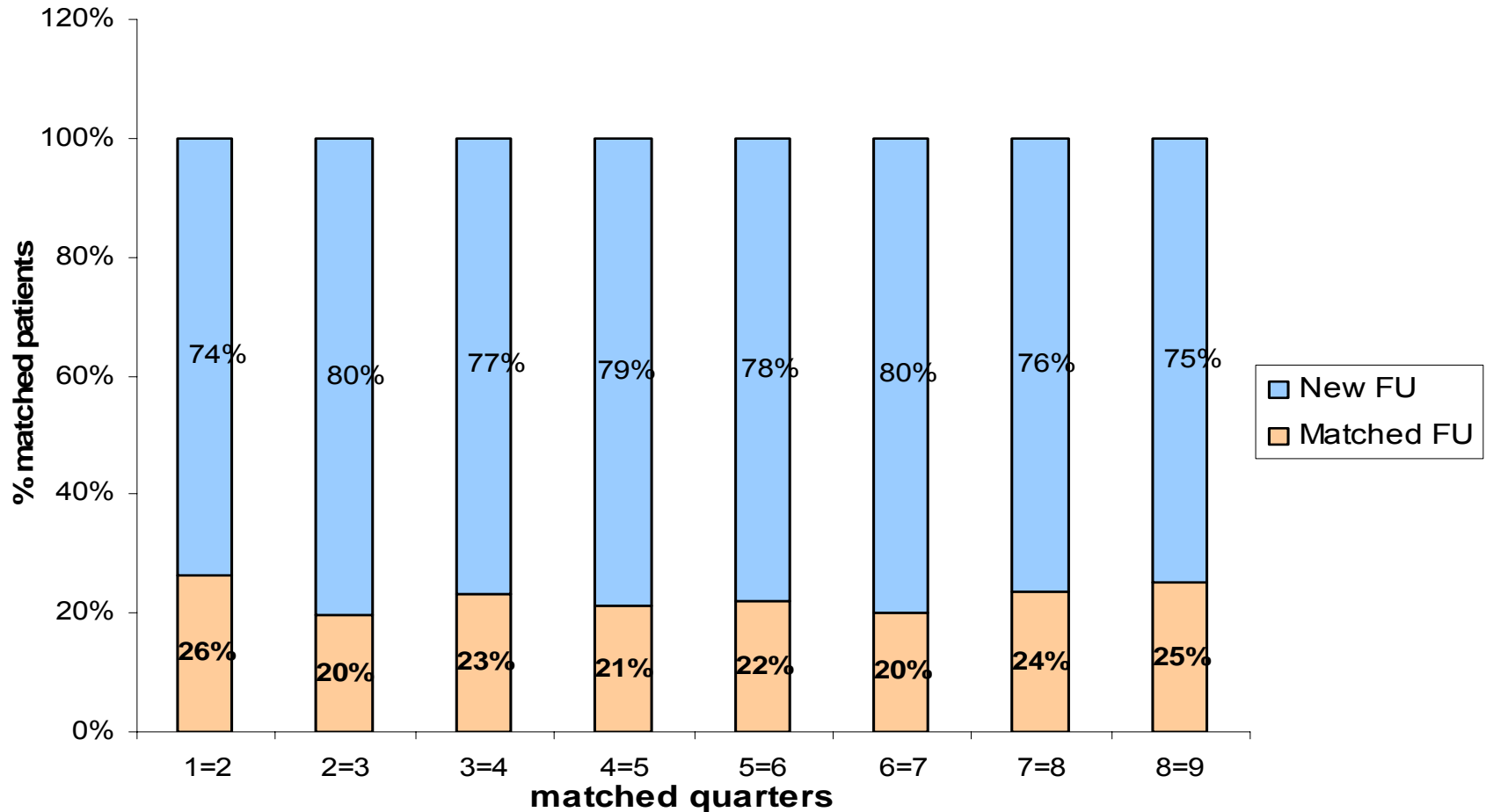
* *American College of Emergency Physicians, 2009*

** *Shumway 2008, Huang 2008, Byrne 2003*

ED Frequent Users*, 2006-08



ED Frequent Users Matched in Consecutive Quarters, 2006-08



ED Use of Most Frequent Users

Patient	2003	2004	2005	2006	2007	2008	Individual Pt. total
#1	23	110	111	103	62	145	554
#2	22	73	94	116	68	55	428
#3	43	83	87	78	42	51	384
#4	39	34	55	108	97	50	383
#5	6	48	49	94	84	75	356
#6	27	15	27	80	36	31	216
#7	10	9	17	39	38	27	140
#8	4	12	29	43	37	7	132
#9	0	7	14	17	31	16	85
Total ED visits per year	174	391	483	678	495	457	2,678

Successful Coordination Results

- Complex patient who had >100 ED encounters each year for 4 years
- A detailed citywide care plan that involved several providers
- Various strategies attempted: tokens, everyday cash, door to door 20 minutes
- Admitted to a group home in December 2008
- Only three emergency department visits in 2009



Analytics: Predictive Modeling

Study Objectives

- To identify the main factors associated with the event of an emergency department (ED) visit
- Include measures for
 - the total number of visits per year to ED
 - the factors associated to the first visit ED
- The prediction would be done from the data of the first two years and would be tested using the third year

Model Description

- Hierarchical data set
 - Patient₁, Patient₂, . . . Patient_i
 - Encounter₁, Encounter₂, . . . Encounter_j
 - Payer₁, Payer₂, . . . Payer_k
 - DX₁, DX₂, . . . DX_l
- Demographic: sex, race/ethnicity, neighborhood
- Date of birth, date of encounter
- Data aggregated at the level of patient and patient/year

Model Selection

- The event of the first visit to ED follows a binomial distribution
- For the count variable we observe an over-dispersed Poisson distribution but we cannot identify any variable particularly correlated to the zeros. Therefore, we use a negative binomial regression

Model (for count variables)

$$\begin{aligned} N \text{ of Events}^* &= \alpha \\ &+ \beta_1 \text{ female} \\ &+ \beta_2 \text{ age} \\ &+ \beta_3 \text{ n of other encounters} \\ &+ \beta_{4j} \text{ neighborhood}_j \\ &+ \beta_{4j} \text{ payor}_j \\ &+ \beta_{4j} \text{ ethnicity}_j \\ &+ \gamma_i \text{ cdi group}_i \\ &+ \epsilon \end{aligned}$$

* Number of ED visits

Model (for dummy variables)

$$\begin{aligned} 1st\ Event^* &= \alpha \\ &+ \beta_1\ female \\ &+ \beta_2\ age \\ &+ \beta_{3j}\ neighborhood_j \\ &+ \beta_{4j}\ payor_j \\ &+ \beta_{5j}\ ethnicity_j \\ &+ \gamma_i\ cdi\ group_i \\ &+ \epsilon \end{aligned}$$

* ED, 1=event is observed, 0 otherwise.

Results

- The following table shows the results for predicting the number of visits to ED:

	Observed Number of Events (in average)	Predicted Number of Events (in average)	Difference (in average)	Percentage of coincidence b/w observed & predicted values	Percentage of coincidence when observed values > 0
Including 8 cdi groups	0.88	0.88	0.7	59.61%	52.81%
Including 12 cdi groups	0.88	0.89	0.69	60.14%	53.23%
Including 19 cdi groups	0.88	0.89	0.67	61.35%	55.27%

- We can observe that the prediction just improves slightly when adding more ICD9 groups. The most powerful set of variables gives us an accurate prediction of over 55% of the values over zero

Results


- The following table shows the results for predicting the event of having a ED visit during the third year:

	Observed Percentage of the Event	Predicted Percentage of the Event	Difference (in average)	Percentage of coincidence b/w observed & predicted values	Percentage of coincidence when observed values = 1
Including 19 cdi groups	0.52	0.52	0	99.81%	99.63%

- We can observe that the prediction of having a visit corresponds almost exactly with the observed data
- We should consider that there is some randomness in the results, since the coefficients actually come from a different dataset



To Summarize . . .

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- Analytics will play an increasingly important role in transformation of healthcare delivery system in communities & regions
 - New and more serious challenges await beyond the implementation of the Affordable Care Act, to provide access and quality care to vulnerable populations
 - ICC is a good example of a collaboration of providers that is using analytics to serve vulnerable populations by establishing a coordinated and efficient delivery system
 - Data analytics, including predictive modeling, will be key in development of focused strategies to improve care for vulnerable patients through coordinated care plans in the community



Thank you

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