

Predictive Modeling: a Key Tool for Decision-Making in Care Management at Johns Hopkins HealthCare

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JHHC Care Management

End Stage Renal Disease

Behavioral Health

HIV/AIDS

Substance Use

Guided Care

End of Life Care

Partners with Mom

Rehabilitation

Cardiovascular/Diabetes

Complex Medical Needs

TeleWatch

Children with Special Needs



Historical Population Case Finding

- Target diagnoses with financial prioritization
 - Total dollars
 - Medical Loss Ratio
- Referrals
 - Utilization management
 - Providers
 - Health department
 - Outreach department
- Focused committees

Motivation for Change

- Increasing Evidence that threshold-based models are inadequate for case finding and can lead to misallocation of resources, inefficiencies, and missed opportunities (Cousins MS, Shickle LM, Bander JA (2002), An introduction to predictive modeling for disease management risk stratification, Disease Management, 5(3), 157-67.)
- Evidence that Adjusted Clinical Groups Predictive Model (ACG-PM) and similar predictive models perform better than threshold-based models (ACG Virtual Library: Version 5.0 (December 2001) ACG Software Documentation/Users Manual. www.acg.jhsph.edu.)

Stakeholders in the Decision to Implement ACG-PM

- Care Management Administration
- JHHC Administration
- Medical Directors
- Disease and Case Management Staff
- Finance
- Information Systems
- Decision Support

Assessing Our Medicaid Population

	Sensitivity or Capture Rate	Positive Predictive Value or Detection Rate
Financial Method	30.2%	24.5%
ACG-PM Method	42.9%	44.3%

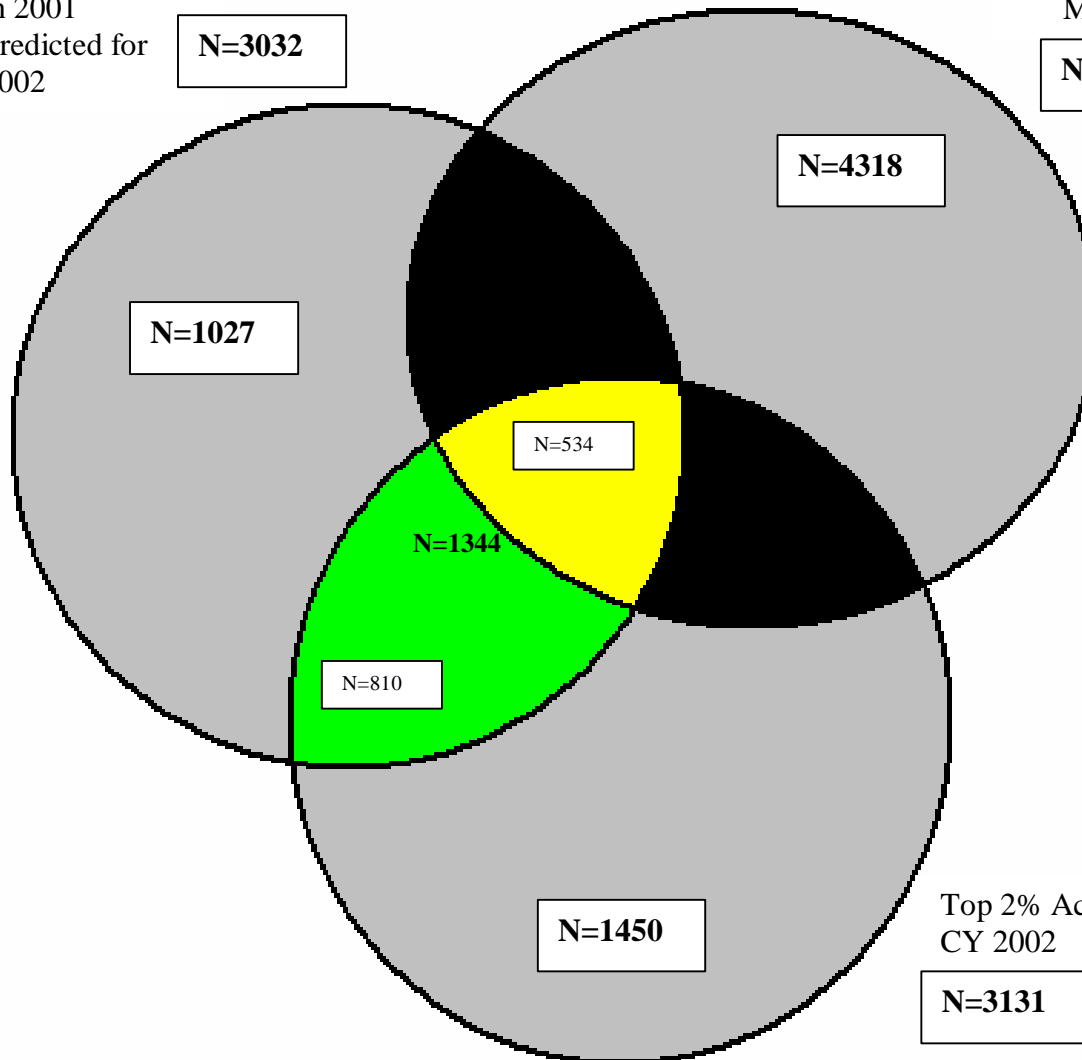
Analysis was performed using ACG beta-testing version 6. CY2001 predicted enrollees were compared to CY2002 actual high cost enrollees.

Top 2% acgPM
in 2001
Predicted for
2002

N=3032

Financial Selection
Method 2001

N=5850



Top 2% Actual Costs
CY 2002

N=3131

ACG-PM to Select Medicaid Enrollees with Substance Use Problems(SUP)

- All Claims for the determined time period inputted into the ACG grouper software
- ACG grouper software assigned a probability score to every enrollee that represented their probability of being in the top 5% of high utilizers in the next year(s)
- Algorithm using diagnoses and ACG-PM score used to select enrollees for intervention

Selection Algorithm

Medicaid currently enrolled,
Age ≥ 21 , geographic criteria
n=14,624



Positive for substance use using ICD-9
and CPT criteria, exclusions removed
n=3123



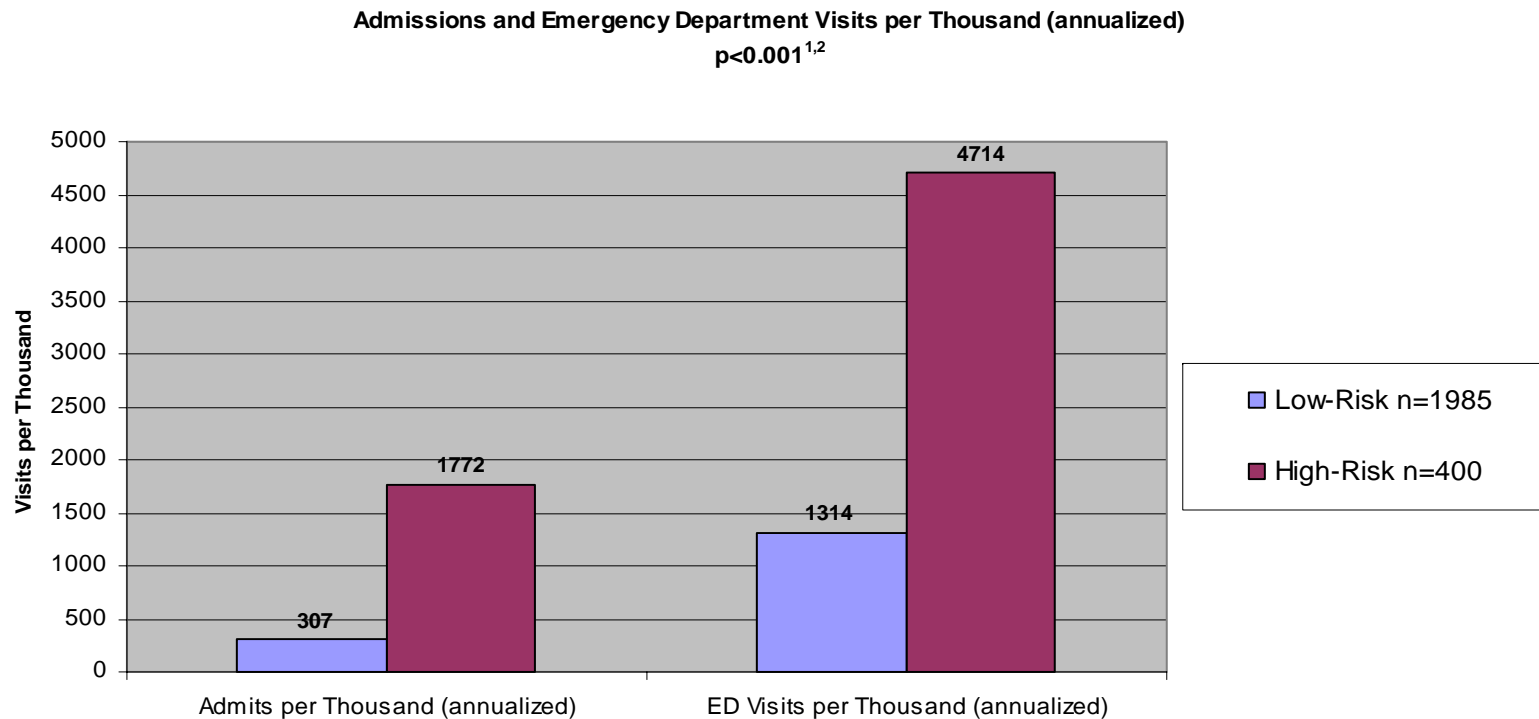
Ranking on ACG-PM Score
Top 400 chosen for intervention

ACG-PM range = 0.39 to 1.00

Characteristics of the SUP/High ACG- PM Enrollees

- Compared to low-risk SUP enrollees, high-risk SUP enrollees identified by ACG-PM
 - Had higher prevalence of 52 chronic medical conditions
 - Had a higher average number of medical conditions
 - More hospital admissions
 - More hospital days
 - More ER visits
 - Higher pharmacy costs
 - Higher total Costs

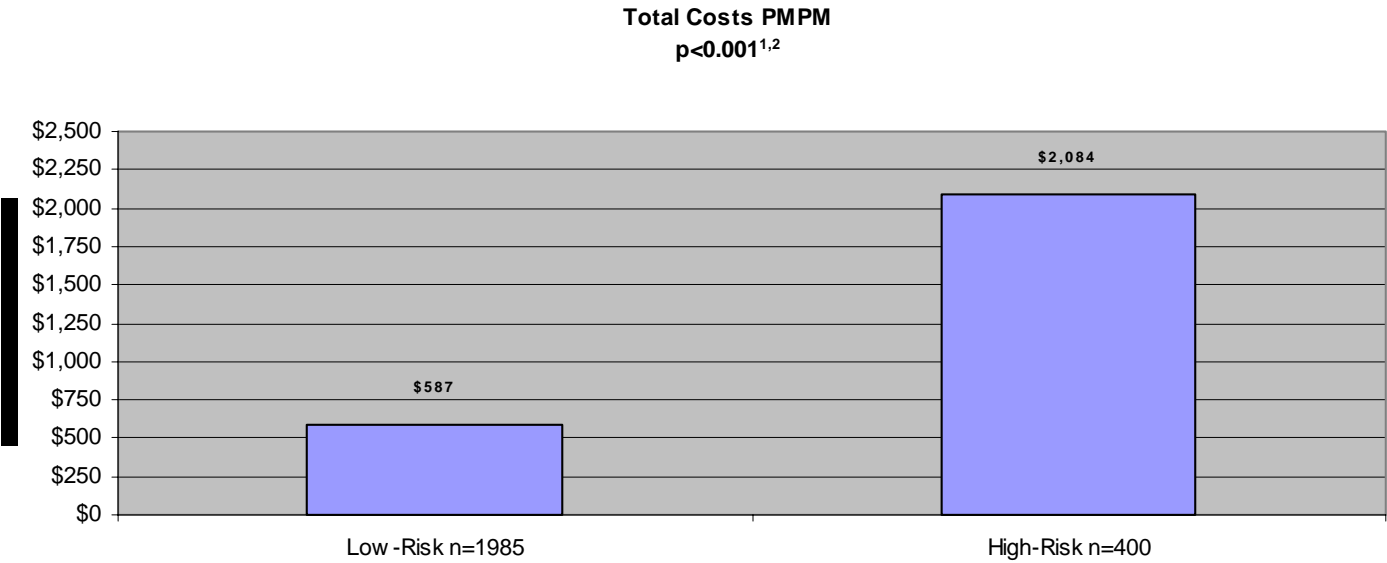
High-risk SUP Enrollees had More Admissions and ED Visits than Low-risk SUP Enrollees



¹ p calculated using Mann-Whitney-U (non-parametric). Did not meet assumption of equal variances necessary for t-test.

² n=1985 represents number of members claims data available for out of the total n=2085.

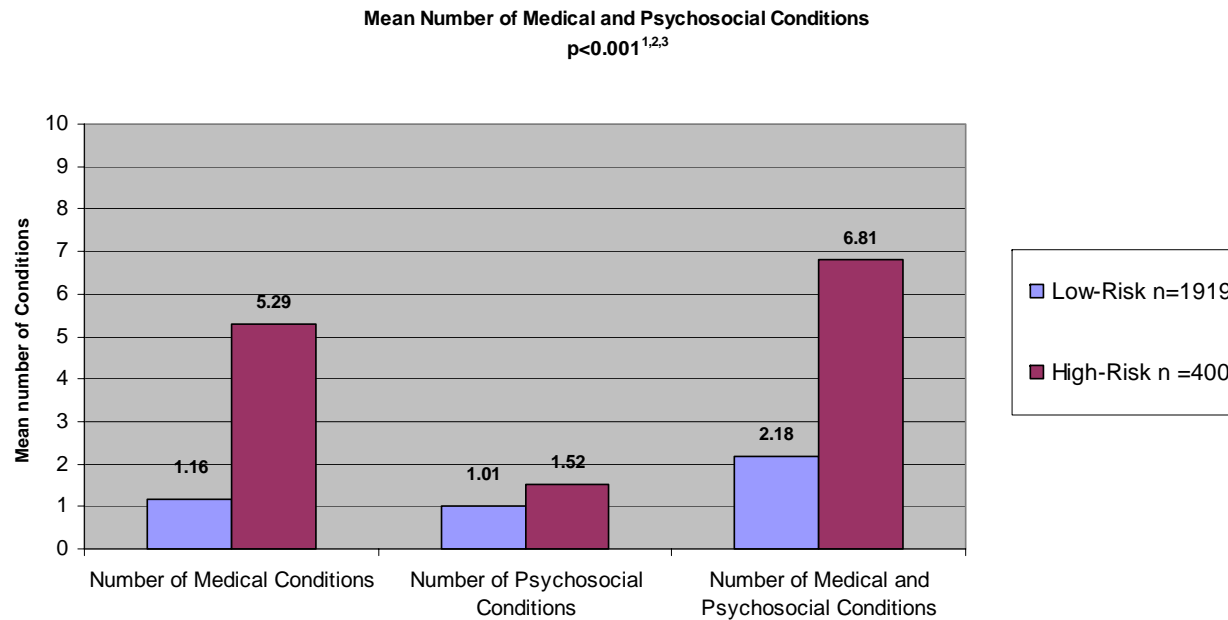
High-risk SUP Enrollees had Higher Total Costs than Low-risk SUP Enrollees



¹ p calculated using Mann-Whitney-U (non-parametric). Did not meet assumption of equal variances necessary for t-test.

² n=1985 represents number of members claims data available for out of the total n=2085.

High-risk SUP Enrollees had More Medical and Psychosocial Conditions than Low-risk SUP Enrollees



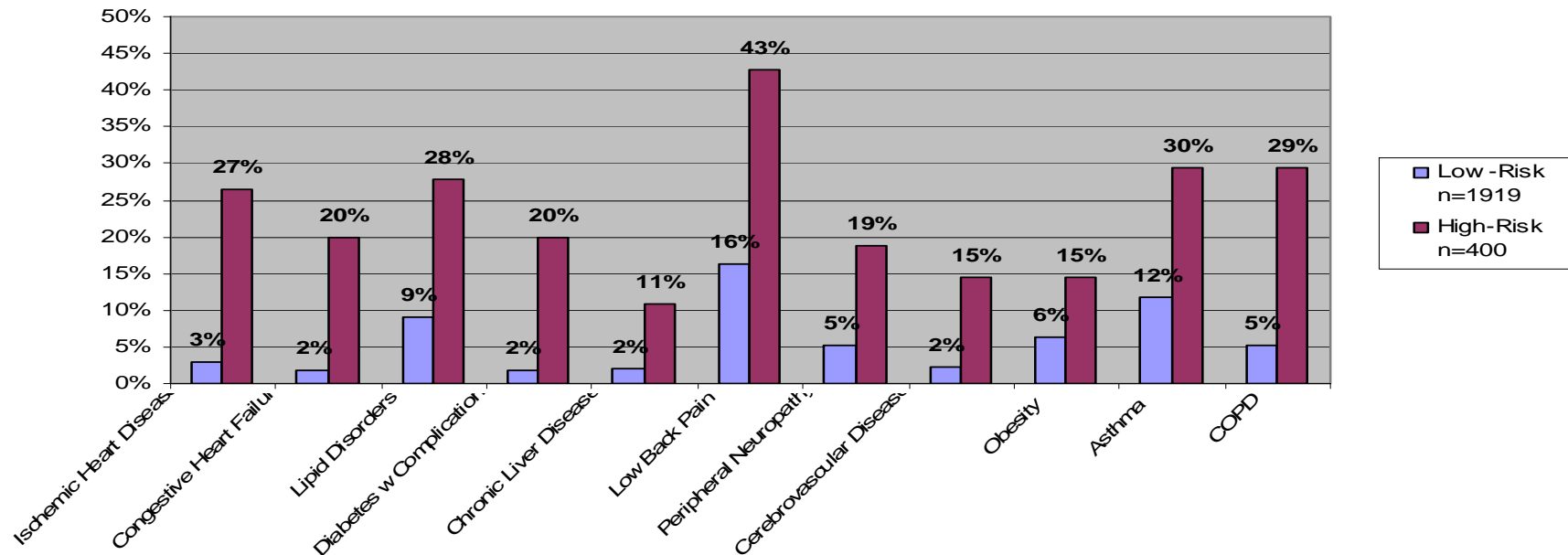
¹ 52 chronic medical conditions and 7 psychological conditions were analyzed using Expanded Diagnostic Clusters (EDCs, which are part of the ACG toolkit). These conditions were chosen because of their high cost and amenability to intensive clinical intervention

² p calculated using Mann-Whitney-U (non-parametric). Did not meet assumption of equal variances necessary for t-test.

³ n=1919 represents number of members disease categories were assigned for out of the total n=2085.

High-risk SUP Enrollees had a Higher Prevalence of Selected High Cost Medical Conditions than Low-risk SUP Enrollees

Disease Prevalence of Selected Medical Conditions
 $p < 0.001^{1,2,3}$



¹52 chronic medical conditions and 7 psychological conditions using Expanded Diagnostic Clusters (EDCs, which are part of the ACG toolkit). These conditions were chosen because of their high cost and amenability to intensive clinical intervention

² p calculated using chi-square

³ n=1919 represents number of members disease categories were assigned for out of the total n=2085.

Integrating ACG-PM into Daily Operations

- Intensive staff education
- Disseminating information
- Disease management database enhancements
- Clinical screener role
- Clinical screener toolkit

Database Enhancements

General Info | Enrollment Info | Screening | HRA | Screening Status | Contacts | Referrals | Print

Case Manager:

High Utilizer:

Begin Date	End Date	ID Source
9/9/2004		acgPM Score >= .3

Inclusion Criteria (ID'd from claims):

Criteria	Date Added
Cardiovascular Disease	4/21/2003 7:09:00 AM
HBP	11/7/2003 8:51:00 AM

Diagnosis Criteria Met (ID'd from claims):

Date Stamp	DX Code	Diagnosis
4/15/2003 10:31:00 AM	401.1	BENIGN HYPERTENSION
4/15/2003 10:31:00 AM	401.9	HYPERTENSION NOS
4/15/2003 10:31:00 AM	I13.9	ANGINA PECTORIS NEC/MOS

DM Program Enrollment:

Program	CaseMgr	Status	StatusDate
DM SCREENING	Not Assigned	Inactive	

Claims Data

Claims | acgPM | EDC

Adjusted Clinical Groups - Predictive Score

BeginPdDate	EndPdDate	ACGPMscore
1/1/2003	12/31/2003	0.42
1/1/2002	12/31/2002	0.62
1/1/2001	12/31/2001	0.42

Close

Save Member Info | Find Existing Member | Lookup New Member | Open QBF | Add To Current Group

Form View

Database Enhancements

General Info | Enrollment Info | Screening | HRA | Screening Status | Contacts | Referrals | Print

Case Manager:

High Utilizer:

Begin Date	End Date	ID Source
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4/15/2003 10:31:00 AM	413.9	ANGINA PECTORIS, NCD, NOS

DM Program Enrollment:

Program	CaseMgr	Status	StatusDat
DM SCREENING	Not Assigned	Inactive	

Claims Data

Claims | acgPM | EDC

Expanded Diagnostic Clusters

Major

BeginPdDt	EndPdDt	MajorEDC
1/1/2003	12/31/2003	MUSCULOSKELETAL
1/1/2003	12/31/2003	NEUROLOGIC
1/1/2003	12/31/2003	UNASSIGNED
1/1/2002	12/31/2002	ADMINISTRATIVE
1/1/2002	12/31/2002	CARDIOVASCULAR
1/1/2002	12/31/2002	FEMALE REPRODUCTIVE
1/1/2002	12/31/2002	GASTROINTESTINAL/HEPATIC
1/1/2002	12/31/2002	GENERAL SURGERY

(Note: Click on a major category to view the associated minor categories)

Minor

- Cardiac Arrhythmia
- Cardiomyopathy
- Cardiovascular Signs and Symptoms
- Congestive Heart Failure
- Heart Murmur

Close

Save Member Info | Find Existing Member | Lookup New Member | Open QBF | Current Group

Form View

NUM

Clinical Screener: A New Nursing Role

- Registered Nurse
- Managed care and clinical experience
- Proactive screening of enrollees identified by ACG-PM as potential high utilizers
- Continued referral screening
- Assessment and program referral

Clinical Screener Toolkit

- ACG-PM: Predictive Modeling
- Diagnoses
- Utilization
- Clinical indicators: lab and radiology results
- Clinical assessment: telephone contact
- Disease/case management amenability assessment

ACG Lookup Database

The image shows a software dialog box titled "Search Historical ACG". It features three search criteria tabs: "Search by Last Name", "Search by Mem ID", and "Search by acgPM". The "Search by acgPM" tab is currently selected. Below the tabs, there are three input fields, each with a dropdown arrow on the right. The first field contains the value "0.8" and is labeled "Choose acgPM Lower". The second field contains the value "1" and is labeled "Choose acgPM Upper". The third field contains the date "1/1/2004" and is labeled "Choose ACG Period".

Search Method	Lower Bound	Upper Bound	ACG Period
Search by Last Name			
Search by Mem ID			
Search by acgPM	0.8	1	1/1/2004

ACG Lookup Database

Historical Demos							Historical ACG	Historical Admits/Visits	Historical Flags	Current EDC	Current Address
Pd Begin	Pd End	PCP	Aid Code	Aid Code Desc	County	Zip					
1/1/2002	12/31/2002	CHASE BREXTON HEALTH SERVICE:	BC316	SSI	BALTIMORE CITY,MD	21229					
4/1/2002	3/31/2003	CHASE BREXTON HEALTH SERVICE:	EC011	SSI	BALTIMORE CITY,MD	21229					
7/1/2002	6/30/2003	CHASE BREXTON FULL RISK (H)	BC497	SSI	BALTIMORE CITY,MD	21229					
10/1/2002	9/30/2003	CHASE BREXTON FULL RISK (H)	BC497	SSI	BALTIMORE CITY,MD	21229					
1/1/2003	12/31/2003	CHASE BREXTON FULL RISK (H)	BC497	SSI	BALTIMORE CITY,MD	21229					
4/1/2003	3/31/2004	CHASE BREXTON FULL RISK (H)	BC497	SSI	BALTIMORE CITY,MD	21229					
7/1/2003	6/30/2004	CHASE BREXTON FULL RISK (H)	BC497	SSI	BALTIMORE CITY,MD	21229					
10/1/2003	9/30/2004	CHASE BREXTON FULL RISK (H)	BC497	SSI	BALTIMORE CITY,MD	21229					
1/1/2004	12/31/2004	CHASE BREXTON	BC497	SSI	BALTIMORE CITY,MD	21229					

Record: 1 of 1

ACG Lookup Database

Priority Partners ACG Lookup

emos | **Historical ACG** | Historical Admits/Visits | Historical Flags | Current EDC | Current Address

Pd Begin	Pd End	Major EDC	MEDC Desc
1/1/2004	12/31/2004	END	Endocrine
1/1/2004	12/31/2004	GSU	General Surgery
1/1/2004	12/31/2004	INF	Infections
1/1/2004	12/31/2004	MUS	Musculoskeletal
1/1/2004	12/31/2004	NUR	Neurologic
1/1/2004	12/31/2004	PSY	Psychological
1/1/2004	12/31/2004	RES	Respiratory
1/1/2004	12/31/2004	SKN	Skin
1/1/2004	12/31/2004	UDC	Unassigned

[EDC Detail](#)

EDC Code	EDC Desc
PSY01	Anxiety, Neuroses
PSY02	Substance Use
PSY06	Family and Social Problems

Record: 1 of 1

Form View

NUM

Referral from Screener to Disease/Case Manager

Member Contacted: Yes

Date Member Contacted: 1/11/2005

Member Consent to CM: Yes

IP Utilization:

AcgPM Score: 0.94

multiple admits and OP surgical procedures for wound debridement. See IDX for clinical details.

EDC Descriptors:

car03 - Ischemic Heart Disease (excl AMI)
car05 - Congestive Heart Failure
car06 - Cardiac Valve Disorders
car07 - Cardiomyopathy
car09 - Cardiac Arrhythmia
car10 - Generalized Atherosclerosis
car11 - Disorders of Lipoid Metabolism
car12 - AMI
gsu11 - Peripheral Vascular Disease
nur05 - Cerebrovascular Disease
res04 - Emphysema, Chronic Bronchitis, COPD

ED Utilization:

1 ER visit for swollen legs in 7-04.

Member Referred to: Complex Medical Team

Date Referred: 1/11/2005

General Comments:

Referral Source Notified: Yes

Referral from Screener to Disease/Case Manager

Yale Social Isolation Responses:

1. Are you married? Divorced, Widowed, Never married
2. Who were you living with before you came/went to the hospital? Lives alone
3. Is there someone you can count on for help and support when you need it? Yes, 1 or more local adults
4. Emergency contact status: Yes, emergency contact name/number given or listed in medical record WITHIN 410 area code

YSI Comments:

Member lives alone but has a daughter who visits daily.

Instrumental Activities of Daily Living Responses:

Q1. Because of a health or physical problem, how much difficulty do you have doing these activities without the assistance of another person or a special device:

A. Bathing	<u>Some difficulty</u>	H. Doing housework	<u>A lot of difficulty</u>
B. Dressing	<u>Some difficulty</u>	I. Taking medications	<u>Some difficulty</u>
C. Eating	<u>Some difficulty</u>	J. Getting to places beyond walking distance	<u>A lot of difficulty</u>
D. Getting in or out of chairs	<u>Some difficulty</u>	K. Preparing your own meals	<u>Some difficulty</u>
E. Walking across a small room	<u>A lot of difficulty</u>	L. Shopping	<u>A lot of difficulty</u>
F. Using the toilet	<u>Some difficulty</u>	M. Managing money like keeping track of expenses or paying bills	<u>Some difficulty</u>
G. Using the telephone	<u>Some difficulty</u>		

Referral from Screener to Disease/Case Manager

Q2. In the past 6 months, how many days did you stay in bed for more than one-half day because of illness or injury? 10

Q3. In the past 6 months, not counting the days you spent in bed, how many days did you cut down on things you usually do because of illness or injury? 50

Q4. On a Scale of 0 (No Burden at all) to 5 (Very High Burden),
How great a BURDEN is:

A. Taking Medications as Recommended	<u>2</u>	C. Following Dietary Recommendations	<u>3</u>
B. Visiting Health Care Providers	<u>4</u>	D. Following Exercise Recommendations	<u>N/A</u>

Q5. On a Scale of 0 (Not Confusing at all) to 5 (Very Confusing),
How CONFUSING is:

A. Taking Medications as Recommended	<u>1</u>	C. Following Dietary Recommendations	<u>2</u>
B. Visiting Health Care Providers	<u>1</u>	D. Following Exercise Recommendations	<u>N/A</u>

Q6. Many people cannot do everything their health care providers recommend.
How often do you:

A. Take your medications as recommended	<u>4 - Most of the time</u>	C. Follow exercise recommendations	<u>N/A</u>
B. Keep your health care appointments	<u>4 - Most of the time</u>	D. Follow dietary recommendations	<u>2 - Sometimes</u>

In Summary...

- Predictive Modeling
 - An important part of an overall strategy
 - One of many screening tools
 - Improves CM and DM targeting
 - Our research shows that predictive model does identify high-risk cases amenable to Care Management interventions
 - Must be employed with appropriately educated staff
 - Clinical Screener Role
 - Disease and Case Managers must understand output of predictive models

Future Directions....

- Children with Special Health Care Needs
 - Performance of model with children
 - Part of a screening strategy that would include instruments that are sensitive to children and families
- HIV/AIDS population
 - Performance of model
 - Part of a screening strategy