JOHNS HOPKINS BLOOMBERG SCHOOL of PUBLIC HEALTH

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Applying Pharmacy Data to Design Innovative Care Management Interventions in Medicaid Populations

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°90% salary support from the ACG System

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Goals for this Presentation

- **To describe the conceptual basis of an Rx-based predictive model**
- **To present details of the construction and technical features of the this model**
- **To apply this tool for care management of diabetics in an adult SSI population, showing how to apply the Rx model and related tools to better understand risk in population subgroups**
- **To consider the implications the findings for forming new care management intervention around a population subgroup**

ACG System Is A Family Of Tools that Focus on Risk of Health Resource Utilization in Different Populations

- Case-Mix Adjustment
- Morbidity Classification
- Predictive Modeling

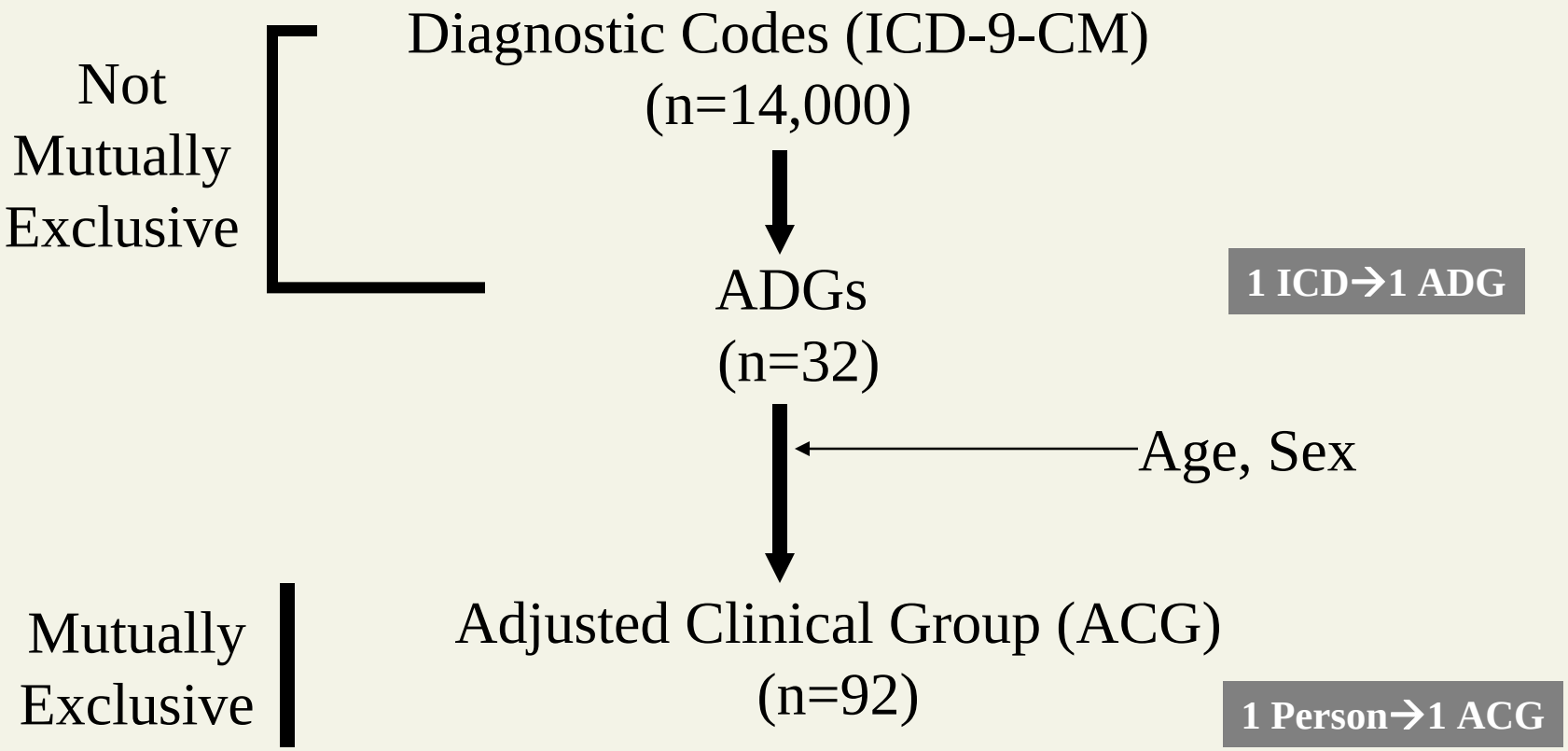
Overview of Johns Hopkins ACG System

- ACGs measure illness burden of patient populations
- ACGs assign persons to unique, mutually exclusive categories
- The “grouper” requires readily available diagnosis information

Johns Hopkins ACG Philosophy 5

- Comprehensive measure of a population's risk and disease burden. They do not just categorize organ system-based diseases.
- They can be applied to a wide range of population oriented case-mix / risk adjustment applications. They do more than identify outliers.
- ACGs are designed by clinicians with clinical "sense" paramount. Excellent statistical performance is a happy by-product.
- Unlike any other widely used case-mix tools, ACG's academic home provides for an emphasis on research & development and openness.

A Case – Mix Classification System



Predictive Modeling (PM) in Healthcare: A Definition

- **The process by which clinical data are used to estimate the risk of future medical service utilization.**
- **Primary Purposes of PM**
  - Case identification
  - Disease management tiering
  - Actuarial forecasting
- **PM is a risk adjustment application**

Risk Factors in the Johns Hopkins ACG Predictive Model

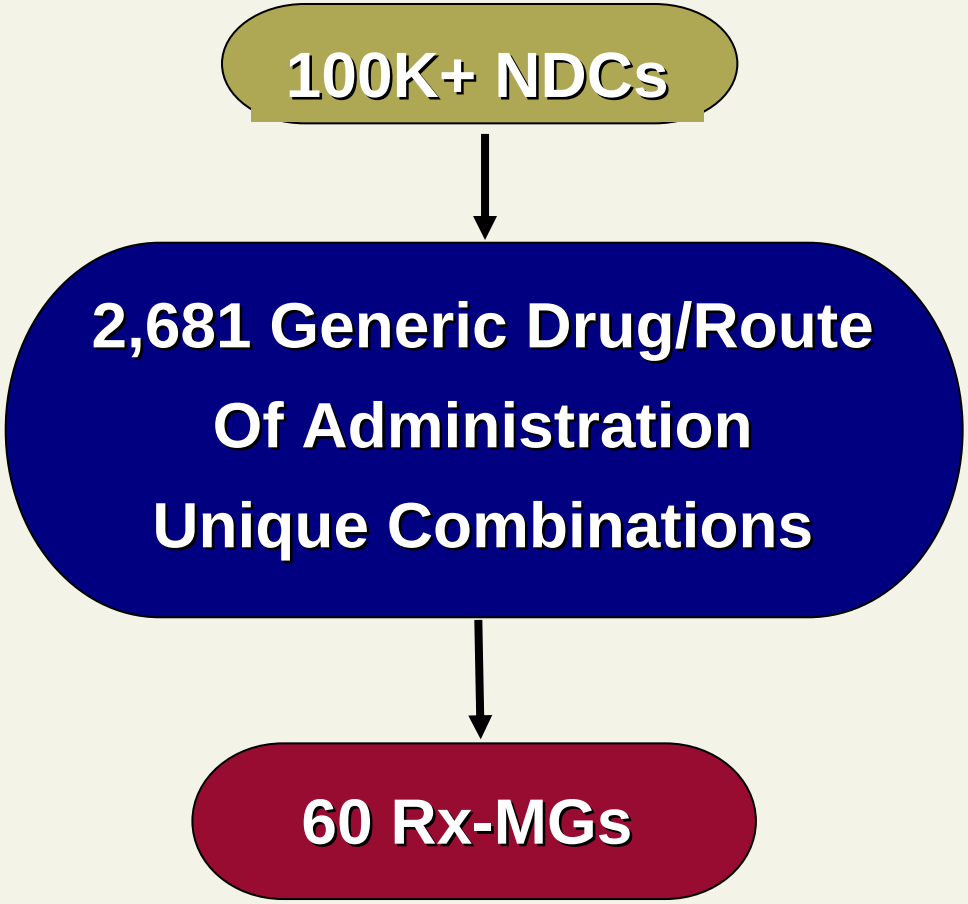
Rx-PM Conceptual Design

Risk = f (age, gender, Rx-MG)

Attributes of Rx-PM

- **Clinically meaningful and actionable**
- **Avoid issues of assigning specific diagnoses**
- **Exhaustive, covers all drugs and spans clinical practice**
- **Parsimonious, limited to 60 groups**
- **Excellent statistical performance**
- **Continuously updated**

From NDCs to Rx-Morbidity Groups

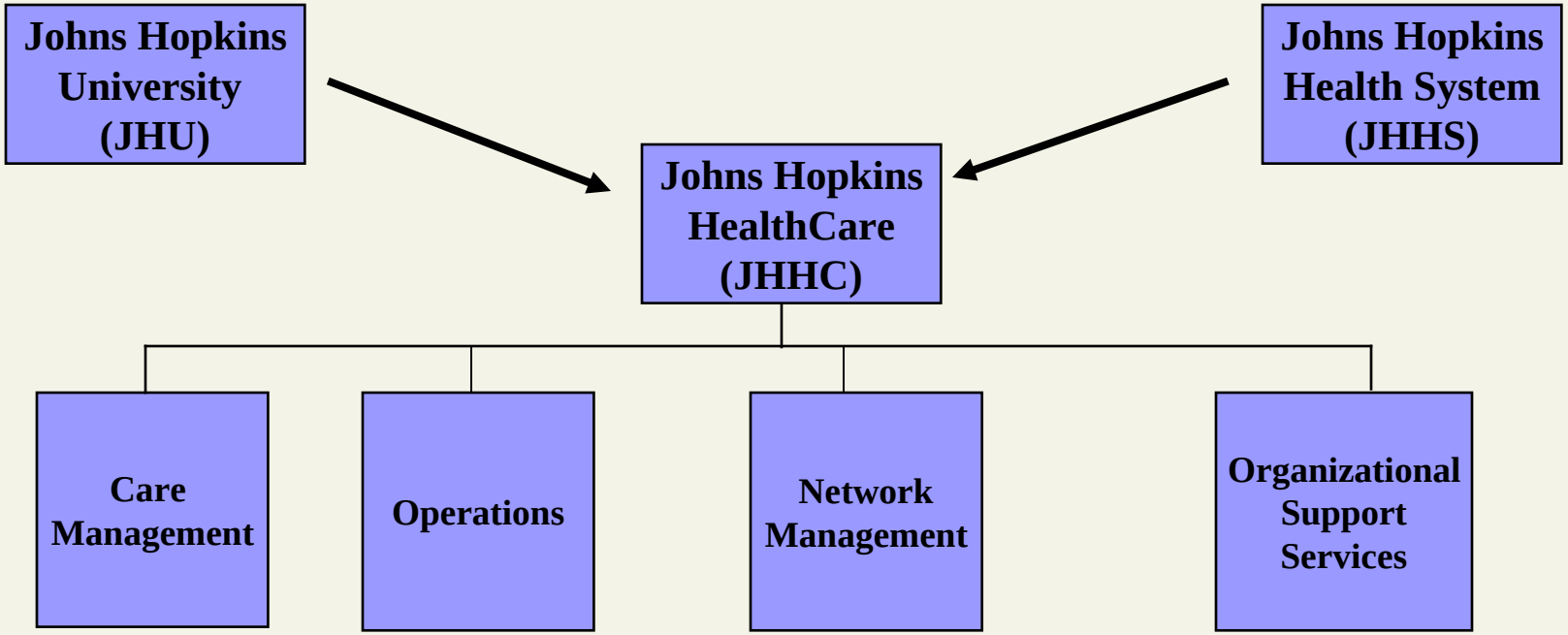


The Major Rx-MG Categories

- Allergy/Immunology
- Cardiovascular
- Ears, Nose, Throat
- Endocrine
- Eye
- Female Reproductive
- Gastrointestinal/Hepatic
- General Signs & Symptoms
- Genito-urinary
- Hematologic
- Infections
- Malignancies
- Musculoskeletal
- Neurologic
- Psychosocial
- Respiratory
- Skin
- Toxic Effects/ Adverse Reactions
- Others / non-specific medications

The GI/Hepatic Rx-MG Categories

Gastrointestinal / Hepatic	
Rx-MG	**Exemplary Therapeutic Classes**
Acute minor-palliative	Antidiarrheals, laxatives, antacids
Chronic liver disease	Interferons, penicillamine
Chronic stable	Gallstone solubilizing agents
Inflammatory bowel disease	5-aminosalicylates, infliximab
Pancreatic disorders	Digestive enzymes
Peptic disease	Proton pump inhibitors, H2 antagonists, GI stimulants



- Care Management
- Quality Improvement
- Utilization Management
- Referral Management
- Outreach
- Disease Management
- Pharmacy Management
- Health Education

- Claims Mgmt.
- Customer Service
- Enrollment Mgmt.
- Systems Mgmt.
- Reporting
- Decision Support

- Contracting
- Credentialing
- Provider Relations
- Provider Education
- Fee Schedules

- Training/Performance Improvement
- Client Relations
- Human Resources
- Business Development
- Finance

Maryland Medicaid

- Medicaid
  - Provides health insurance to low-income families (TANF), children, elderly, and people with disabilities (SSI)
- HealthChoice
  - Mandatory managed care program providing healthcare to Medicaid recipients
  - 7 participating managed care companies
- Priority Partners
  - Johns Hopkins HealthCare and 5 federally qualified health centers

Source: Maryland Department of Health & Mental Hygeine

Maryland Supplemental Security Income

- SSI
  - Federal cash assistance program providing monthly payments to low-income aged, blind, and disabled persons based on nationally uniform eligibility standards
- During 2004: 53,781 SSI beneficiaries between ages of 18-64 were eligible for Medicaid
- Maryland SSI beneficiaries represent approximately 1.5 % of the US total

Source: US Social Security Administration and Maryland Department of Health & Mental Hygeine

Study Population

- All Adult SSI Enrollees Covered by JHHC
- Most Recent Data Year
- Includes Run-out Period
- Excludes Mental Health Carve-out Claims

Risk Modeling Methods Applied to Five Distinct SSI Populations

- Overall Adult SSI (aged 18 and older)
- Adult SSI with a Least One Chronic Condition
- Adult SSI with Diabetes
- Adult SSI “Pathway” Patients
- Adult SSI Patients Who Are Diabetics but Not “Pathway”

SSI Population Is Relatively Young With a Peak at Age 45 to 54 Years

Age Category	SSI		Chronic	
	n	Percent	n	Percent
Age between 18 and 24	2,311	14.89	913	8.74
Age between 25 and 34	2,150	13.85	1,126	10.77
Age between 35 and 44	3,081	19.85	2,173	20.79
Age between 45 and 54	4,577	29.49	3,509	33.57
Age between 55 and 59	1,818	11.71	1,458	13.95
Age between 65 and 69	231	1.49	169	1.62

Cardiovascular, Psychosocial, and Musculoskeletal Problems Are Prominent in SSI

SSI			Chronic		
EDC	**Number**	**Percent**	**EDC**	**Number**	**Percent**
Hypertension w/o Major Complications (CAR14)	5,389	3.64	Hypertension w/o Major Complications (CAR14)	7,355	13.00
Preventive care (ADM06)	5,266	3.56	Type 2 diabetes, w/o complication (END06)	5,294	9.36
Administrative concerns and non-specific laboratory abnormalities (ADM05)	5,027	3.40	Disorders of lipoid metabolism (CAR11)	4,221	7.46
Musculoskeletal signs and symptoms (MUS01)	4,037	2.73	HIV, AIDS (INF04)	2,499	4.42
Disorders of lipoid metabolism (CAR11)	3,237	2.19	Asthma, w/o status asthmaticus (ALL04)	2,489	4.40
Low back pain (MUS14)	2,813	1.90	Ischemic heart disease (excluding acute myocardial infarction) (CAR03)	2,208	3.90
Substance use (PSY02)	2,757	1.86	Degenerative joint disease (MUS03)	1,943	3.43
Depression (PSY09)	2,649	1.79	Emphysema, chronic bronchitis, COPD (RES04)	1,921	3.40
Chest pain (GSI02)	2,449	1.66	Depression (PSY09)	1,720	3.04
Tobacco use (PSY03)	2,324	1.57	Obesity (NUT03)	1,691	2.99
Cardiovascular signs and symptoms (CAR01)	2,271	1.53	Chronic liver disease (GAS05)	1,663	2.94

The Majority of SSI Patients Have 3 or More Co-Morbidities

Chronic Count	SSI		Diabetes					
			All		Pathway		Other	
	n	Percent	n	Percent	n	Percent	n	Percent
0	2,079	16.59	32	1.16				
1-2	3,339	26.65	238	8.64				
3-4	2,518	20.09	467	16.95	214	13.39	253	28.52
5-7	2,201	17.56	726	26.35	438	27.41	288	32.47
8 Plus	2,394	19.10	1,292	46.90	946	59.20	346	39.01

The SSI Population Bears a High Disease Burden

Resource Utilization Band	SSI		Chronic	
	n	Percent	n	Percent
RUB 0 (Low)	2,254	14.52		
RUB 1	2,058	13.26	288	2.76
RUB 2	5,011	32.29	4,113	39.35
RUB 3	3,089	19.90	2,967	28.39
RUB 4 (High)	3,109	20.03	3,084	29.51

SSI Represents a Fairly Costly Service Population

			Diabetes		
Cost Category	**SSI**	**Chronic**	**All**	**Pathway**	**Other**
Total	$9,912	$14,310	$18,086	$18,607	$21,967
Pharmacy	$2,240	$3,195	$3,953	$4,527	$3,762

There is Considerable Skewing of Costs to Highest Cost Decile

Cost Category	SSI	Chronic	Diabetes		
			All	Pathway	Other
Lowest	$0	$290	$672	$988	$868
1	$54	$923	$1,829	$2,278	$2,142
2	$286	$1,755	$3,105	$3,445	$3,438
3	$805	$2,852	$4,708	$4,882	$5,205
4	$1,686	$4,294	$6,633	$6,602	$7,351
5	$3,056	$6,370	$9,039	$8,710	$10,583
6	$5,238	$9,426	$12,598	$12,021	$14,651
7	$9,019	$14,666	$19,138	$18,024	$23,048
8	$17,242	$24,899	$31,003	$28,950	$37,138
Highest	$61,762	$77,636	$94,119	$79,154	$115,901

Most Chronically Ill Are in Two Highest RUB Categories

Resource Utilization Band	SSI		Chronic	
	n	Percent	n	Percent
RUB 0 (Low)	2,254	14.52		
RUB 1	2,058	13.26	288	2.76
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RUB 3	3,089	19.90	2,967	28.39
RUB 4 (High)	3,109	20.03	3,084	29.51

The Chronically Ill Are a Much More Costly Population to Treat

Cost Category	SSI	Chronic	Diabetes		
			All	Pathway	Other
Total	$9,912	$14,310	$18,086	$18,607	$21,967
Pharmacy	$2,240	$3,195	$3,953	$4,527	$3,762

Hypertension, Diabetes, and Hyperlipidemia are Prominent in Chronically Ill Population

SSI			Chronic		
EDC	**Number**	**Percent**	**EDC**	**Number**	**Percent**
Hypertension w/o Major Complications (CAR14)	5,389	3.64	Hypertension w/o Major Complications (CAR14)	7,355	13.00
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Cardiovascular signs and symptoms (CAR01)	2,271	1.53	Chronic liver disease (GAS05)	1,663	2.94

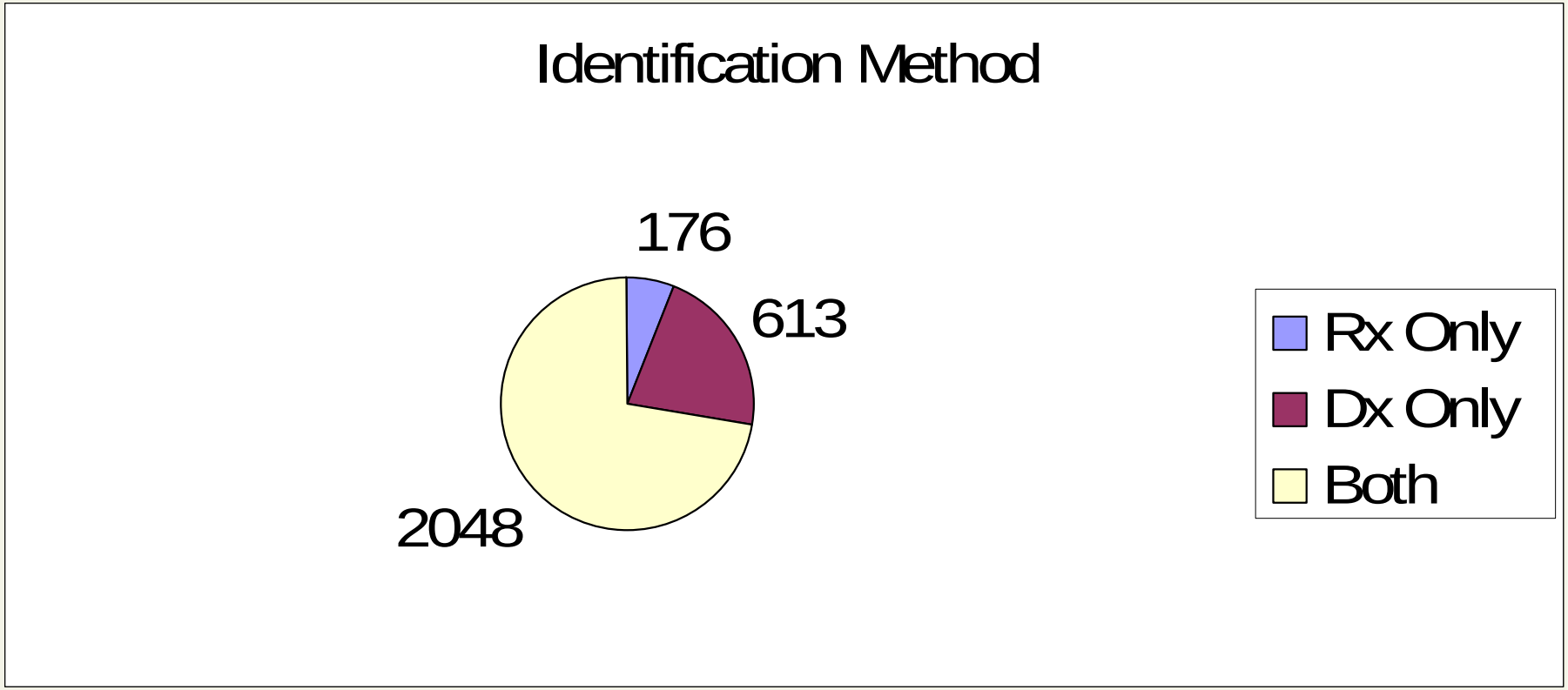
Diabetics Show An Age Profile Similar to Overall SSI Population

Age Category	Diabetes					
	All		Pathway		Other	
	n	Percent	n	Percent	n	Percent
Age between 18 and 24	444	15.65	257	16.08	184	20.74
Age between 25 and 34	413	14.56	219	13.70	128	14.43
Age between 35 and 44	557	19.63	327	20.46	143	16.12
Age between 45 and 54	833	29.36	459	28.72	157	17.70
Age between 55 and 59	324	11.42	172	10.76	118	13.30
Age between 60 and 64	220	7.75	141	8.82	134	15.11
Age between 65 and 69	46	1.62	23	1.44	23	2.59

Diabetics Are Substantially More Co-Morbid Than the SSI Population

Chronic Count	SSI		Diabetes					
			All		Pathway		Other	
	n	Percent	n	Percent	n	Percent	n	Percent
0	2,079	16.59	32	1.16				
1-2	3,339	26.65	238	8.64				
3-4	2,518	20.09	467	16.95	214	13.39	253	28.52
5-7	2,201	17.56	726	26.35	438	27.41	288	32.47
8 Plus	2,394	19.10	1,292	46.90	946	59.20	346	39.01

The Pharmacy Only System Captures Most Diabetic Patients



Diabetics Are Dedicated Users of Services

- Only 3% of Diabetic Patients Failed to Use Any Health Care Services
- Non-Users a Logical Focus of Care Management Intervention, Missing Basic Mandated Care
- This is a Stable Population, With Only 10 New Enrollees Out of 2,837 Patients

Diabetics Show Greater Disease Burden Than the Chronically Ill

Resource Utilization Band	Diabetes					
	All		Pathway		Other	
	n	Percent	n	Percent	n	Percent
RUB 0 (Low)						
RUB 1	178	3.63	37	2.32	7	0.79
RUB 2	869	30.63	461	28.85	223	25.14
RUB 3	771	27.18	475	29.72	267	30.10
RUB 4 (High)	1,019	35.92	625	39.11	390	43.97

HIV and Depression Drop Out Of Prominent EDCs for Diabetes

DIABETES		
All		
EDC	**Number**	**Percent**
Type 2 diabetes, w/o complication (END06)	2,619	16.21
Hypertension, w/o major complications (CAR14)	2,112	13.07
Disorders of lipoid metabolism (CAR11)	1,468	9.09
Obesity (NUT03)	619	3.83
Ischemic heart disease (excluding acute myocardial infarction) (CAR03)	578	3.58
Type 1 diabetes, w/o complication (END08)	572	3.54
Asthma, w/o status asthmaticus (ALL04)	549	3.40
Degenerative joint disease (MUS03)	461	2.85
Emphysema, chronic bronchitis, COPD (RES04)	454	2.81
Congestive heart failure (CAR05)	401	2.48
Cardiac arrhythmia (CAR09)	370	2.29
Thyroid disease (END04)	320	1.98

Diabetics Represent a Substantially More Costly Service Population

			Diabetes		
Cost Category	**SSI**	**Chronic**	**All**	**Pathway**	**Other**
Total	$9,912	$14,310	$18,086	$18,607	$21,967
Pharmacy	$2,240	$3,195	$3,953	$4,527	$3,762

Diabetics Are Predicted to Be Higher Users of Services Than Those Who Are "Merely" Chronically Ill

Predictive Score	SSI	Chronic	Diabetes		
			All	Pathway	Other
Total	1.00	1.41	1.75	1.85	2.10
Pharmacy	1.00	1.32	1.78	2.00	1.71

Pathway Patients Have Been Regarded as a Distinct Population With Respect to their Needs

- Diabetes
- Hypertension
- Disorders of Lipoid Metabolism

Comparison Group Balanced in Terms of Level of Co-Morbidity

- Persons With Diabetes Who Did Not Have The Two Marker Conditions
- Persons Who Did Have 3 or More Chronic Conditions

"Other" Patients Fail to Show Distinctive Bump in 45 to 54 Age Group

Age Category	Diabetes					
	All		Pathway		Other	
	n	Percent	n	Percent	n	Percent
Age between 18 and 24	444	15.65	257	16.08	184	20.74
Age between 25 and 34	413	14.56	219	13.70	128	14.43
Age between 35 and 44	557	19.63	327	20.46	143	16.12
Age between 45 and 54	833	29.36	459	28.72	157	17.70
Age between 55 and 59	324	11.42	172	10.76	118	13.30
Age between 60 and 64	220	7.75	141	8.82	134	15.11
Age between 65 and 69	46	1.62	23	1.44	23	2.59

"Other" Patients Show Slightly Higher Morbidity Burden

Resource Utilization Band	Diabetes					
	All		Pathway		Other	
	n	Percent	n	Percent	n	Percent
RUB 0 (Low)						
RUB 1	178	3.63	37	2.32	7	0.79
RUB 2	869	30.63	461	28.85	223	25.14
RUB 3	771	27.18	475	29.72	267	30.10
RUB 4 (High)	1,019	35.92	625	39.11	390	43.97

HIV and Depression Are Key Distinguishing EDCs for "Other"

DIABETES					
Pathway			Other		
EDC	Number	Percent	EDC	Number	Percent
Type 2 diabetes, w/o complication (END06)	1,571	14.32	Type 2 diabetes, w/o complication (END06)	847	17.61
Hypertension, w/o major complications (CAR14)	1,493	13.61	Hypertension, w/o major complications (CAR14)	553	11.49
Disorders of lipoid metabolism (CAR11)	1,342	12.23	Asthma, w/o status asthmaticus (ALL04)	208	4.32
Ischemic heart disease (excluding acute myocardial infarction) (CAR03)	452	4.12	Obesity (NUT03)	202	4.20
Obesity (NUT03)	413	3.76	Type 1 diabetes, w/o complication (END08)	180	3.74
Type 1 diabetes, w/o complication (END08)	380	3.46	Emphysema, chronic bronchitis, COPD (RES04)	148	3.08
Asthma, w/o status asthmaticus (ALL04)	333	3.03	Chronic liver disease (GAS05)	142	2.95
Degenerative joint disease (MUS03)	322	2.93	HIV, AIDS (INF04)	136	2.83
Emphysema, chronic bronchitis, COPD (RES04)	304	2.77	Degenerative joint disease (MUS03)	135	2.81
Congestive heart failure (CAR05)	291	2.65	Cardiac arrhythmia (CAR09)	126	2.62
Hypertension, with major complications (CAR15)	253	2.31	Ischemic heart disease (excluding acute myocardial infarction) (CAR03)	124	2.58
Cardiac arrhythmia (CAR09)	240	2.19	Depression (PSY09)	123	2.56

Cardiovascular Prescribing Is More Common in Pathway Cohort

DIABETES					
Pathway			Other		
Rx-MG	Number	Percent	Rx-MG	Number	Percent
Cardiovascular / High Blood Pressure (CARx030)	1,477	10.32	Infections / Acute Minor (INFx020)	610	9.73
Cardiovascular / Hyperlipidemia (CARx040)	1,319	9.21	General Signs and Symptoms / Pain (GSIx020)	558	8.90
Endocrine / Diabetes Without Insulin (ENDx040)	1,148	8.02	Cardiovascular / High Blood Pressure (CARx030)	526	8.39
Infections / Acute Minor (INFx020)	1,021	7.13	Endocrine / Diabetes Without Insulin (ENDx040)	473	7.54
General Signs and Symptoms / Pain (GSIx020)	1,009	7.05	General Signs and Symptoms / Pain and Inflammation (GSIx030)	356	5.68
Cardiovascular / Chronic Medical (CARx010)	826	5.77	Other and Non-Specific Medications (ZZZx000)	314	5.01
Gastrointestinal/Hepatic / Peptic Disease (GASx060)	697	4.87	Gastrointestinal/Hepatic / Peptic Disease (GASx060)	303	4.83
Other and Non-Specific Medications (ZZZx000)	647	4.52	Respiratory / Airway Hyperactivity (RESx040)	287	4.58
General Signs and Symptoms / Pain and Inflammation (GSIx030)	628	4.39	Cardiovascular / Chronic Medical (CARx010)	271	4.32
Endocrine / Diabetes With Insulin (ENDx030)	597	4.17	Endocrine / Diabetes With Insulin (ENDx030)	264	4.21
Respiratory / Airway Hyperactivity (RESx040)	534	3.73	Skin / Acute and Recurrent (SKNx020)	252	4.02
Skin / Acute and Recurrent (SKNx020)	476	3.33	Allergy/Immunology / Acute Minor (ALLx010)	214	3.41

Given the Differences in Morbidity Burden, No Surprise That "Other" Patients Tend to Be Costlier

Cost Category	SSI	Chronic	Diabetes		
			All	Pathway	Other
Total	$9,912	$14,310	$18,086	$18,607	$21,967
Pharmacy	$2,240	$3,195	$3,953	$4,527	$3,762

Pathway Patients May Still Deserve Special Attention for Higher Risk of Increased Pharmaceutical Costs

Predictive Score	SSI	Chronic	Diabetes		
			All	Pathway	Other
Total	1.00	1.41	1.75	1.85	2.10
Pharmacy	1.00	1.32	1.78	2.00	1.71

Implications for Designing a Care Management Program

- Diabetics Represent a Distinct and Important Cohort with Significant Implications for the Cost of Care
- Data Suggest that Case Identification Solely Based on Pharmacy Codes Performs Almost As Well As Diagnostic Codes
- While Pathway Patients Have a Lower Co-Morbidity Burden Than “Other” Patients, They Are Predicted to Be Higher Users of Pharmacy
- Given Pharmacy Use is Among More Controllable Dimensions of Healthcare, a Distinct Care Management Intervention May Be Warranted

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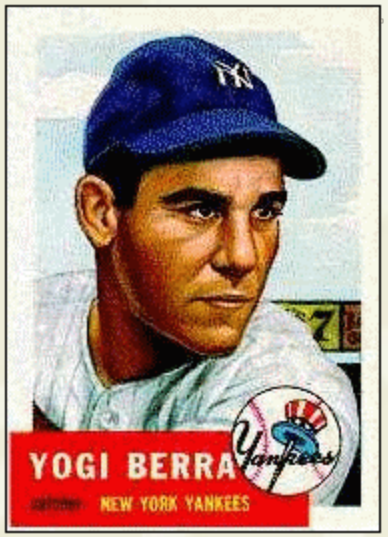
Questions??



"If you ask me anything I don't know, I'm not going to answer."

Yogi Berra

For More Information See Our Web Site

www.acg.jhsph.edu