

# Rx-PM Overview

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# Topics of Discussion

- Introduce Rx-MGs
- Convey the benefits of pharmacy-based risk predictions for the applications of underwriting and care management
- Share information about the amount of data required for credible predictions
- Introduce the Rx-PM models



# The ACG PM System: Nomenclature

- **ACG PM**: The suite of ACG Predictive Models
- **Dx-PM** (formerly ACG-PM) represents a diagnosis based model intended to identify potentially high cost patients for care management initiatives or forecasting future resource needs.
- **Rx-MGs** (Rx Morbidity Groups) are groupings of NDC codes based on generic drug and route of administration combinations that are similar in terms of morbidity, duration, stability and therapeutic goal.
- **Rx-PM** represents a NDC based model intended to identify potentially high cost patients for care management initiatives or forecasting future resource needs.
- **DxRx-PM** represents predictive modeling based on both diagnosis and pharmacy information.



# Initial Motivation for Developing Rx Morbidity Groups for Predictive Model

*“I have loads of patients with NDC codes, but no ICD information. How can I use the ACG system to identify the high risk patients?”*



# Opportunities

- Rx data capture a unique constellation of clinical information
- Retail pharmacy-based PM can be done before the full set of ICD codes are obtained
- Potential Applications
  - Risk measurement when NDC codes are the only data source
  - Rx + Dx predictive models
  - Non-Concordance



# Challenges

- Drug use is NOT synonymous with presence of specific diseases
  - Multiple indications for same drug
    - Approved uses
    - Off-label uses
- Patterns of practice can directly influence risk scores
- Did not want to develop a me-too system
- Complexities of working with 100,000+ NDC codes



# The National Drug Code (NDC) System

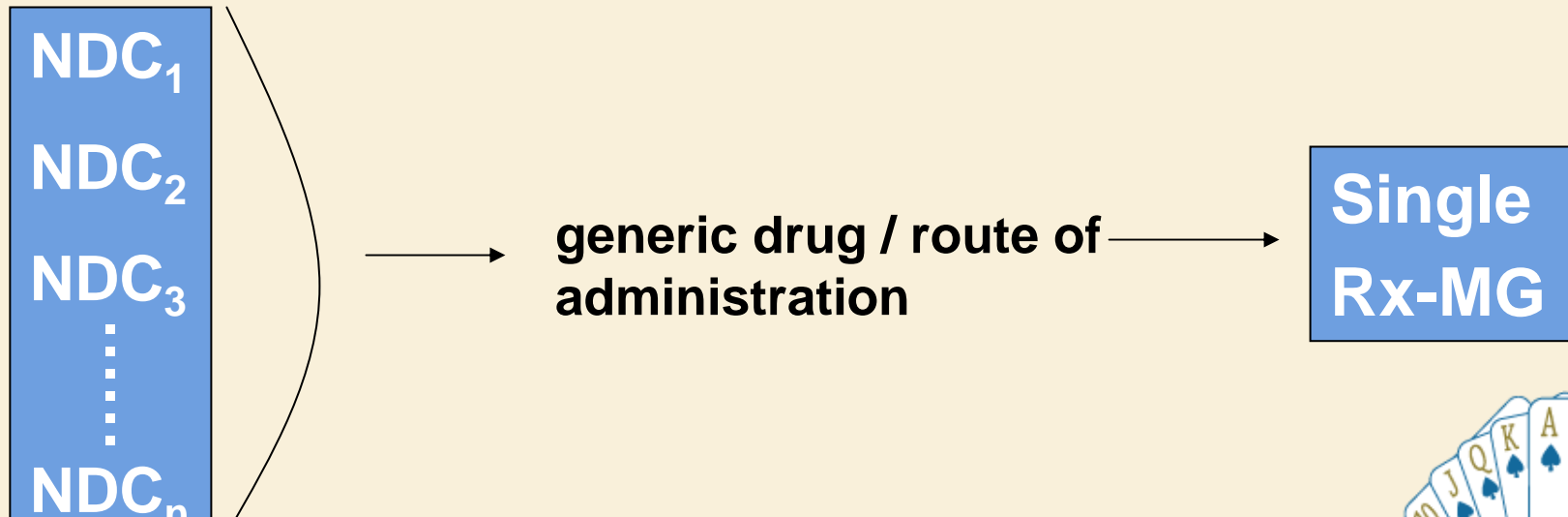
- The NDC system serves as a universal product identifier for human drugs. It is maintained by the FDA.
- The NDC identifies the:
  - Generic name/active ingredient
  - Manufacturer
  - Strength
  - Route of administration
  - Package size
  - Trade name
- Same generic has many NDC codes

*Some of this information is unnecessary for medication classification purposes.*



# Pharmacy Morbidity Groups (Rx-MGs)

- The Building Blocks of the Rx-PM Model
- Based entirely on NDC codes
- All NDC codes are assigned to a unique Rx-MG
- Assignments made at the generic drug/route of administration level



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# Clinical Criteria for Rx-MG Assignment

- Morbidity-type
  - symptom v disease
- Duration of morbidity
  - chronic v time-limited
- Stability of morbidity
  - stable v unstable
- Route of administration
  - oral, inhaled, topical, intramuscular, intravenous
- Therapeutic goal
  - curative, palliative, preventive

This is the clinical information derived from NDC codes and the criteria that underpin Rx-PM.



# 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

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## Rx-MG Example: Corticosteroids

Active Ingredient	Route of Administration	Rx-MG	Description
methylprednisolone-neomycin	topical	SKNx020	Skin / Acute and Recurrent
Prednisolone	compounding	ALLx030	Allergy/Immunology / Immune Disorders
Prednisolone	injectable	MUSx020	Musculoskeletal / Inflammatory Conditions
Prednisolone	oral	ALLx030	Allergy/Immunology / Chronic Inflammatory
prednisolone	ophthalmic	EYEx020	Eye / Acute Minor: Palliative
prednisolone-sodium sulfacetamide	ophthalmic	EYEx010	Eye / Acute Minor: Curative
Beclomethasone	Compounding	RESx030	Respiratory / Cystic Fibrosis
Dexamethasone	Nasal	ALLx010	Allergy/Immunology / Acute Minor
Betamethasone	Injectable	ENDx020	Endocrine / Chronic medical
Dexamethasone	Compounding	ALLx030	Allergy/Immunology / Chronic Inflammatory
ciprofloxacin-dexamethasone otic	Otic	EARx010	Ears, Nose, Throat / Acute Minor
Dexamethasone	Intravenous	MUSx020	Musculoskeletal / Inflammatory Conditions
beclomethasone	inhalation	RESx040	Respiratory / Airway Hyperactivity
betamethasone-calcipotriene topical	topical	SKNx030	Skin / Chronic Medical

# Common Cardiovascular Drugs

- ACE Inhibitor; Congestive heart failure, hypertension
  - Oral – CARx030 hypertension
  - Compounded or Intravenous – CARx010 Chronic Medical
- Beta Blockers; Hypertension, Angina, Mitral valve prolapse, Cardiac arrhythmia, Congestive heart failure, Myocardial infarction
  - Oral – CARx030 hypertension
  - Injectable or Intravenous – CARx010 Chronic Medical
  - Ophthalmic – EYEx030 Glaucoma



# Common Cardiovascular Drugs

- Calcium Channel Blockers; hypertension, angina
  - Dihydropyridine
    - Oral – CARx030 Hypertension
    - Intravenous or Compounded – CARx010 Chronic Medical
    - Exception nifedipine and isradipine – CARx010 Chronic Medical
    - Exception Amlodipine- atorvastatin are grouped with – CARx040 Hyperlipidemia
  - Phenylalkylamine – CARx010 Chronic Medical
  - Benzothiazepine - CARx010 Chronic Medical
- Diuretics - edema associated with heart failure, hepatic cirrhosis, renal impairment, nephrotic syndrome, hypertension
  - Injectable or Oral - CARx010 Chronic Medical



# Rx-MG Risk Group Clinical Profile

## Risk Groups: Rx-MG Percentile Rank (Year 1)

Characteristic	0-10	11-25	26-50	51-75	76-90	91-95	95-99
Age, mean	9.1	22.5	28.1	37.1	42.9	47.3	49.4
% female	25.5	29.4	56.6	59.8	63.3	64.0	64.0
# chronic conditions	.1	.1	.2	.6	1.1	1.9	3.1
Total # of conditions	1.9	1.8	2.8	3.9	5.6	7.6	10.5
# of therapeutic classes	.2	.4	1.3	2.5	4.8	7.4	10.8

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# Rx-MG Risk Group Utilization and Cost Profile

## Risk Groups: Rx-MG Percentile Rank (Year 1)

Resource Use Measure	0-10	11-25	26-50	51-75	76-90	91-95	95-99
Year 2 Total \$	526	679	1,108	1,717	3,114	5,164	10,912
Year 2 Rx \$	41	57	140	304	800	1,603	3,609
Year 2 MD Visits	2.3	2.1	2.9	3.8	5.0	6.9	10.0
Year 2, % with 1+ Hospital Admits	0.9	1.3	3.5	3.7	8.2	9.5	16.3
Year 2, Hospital Days per 1,000	65	101	165	215	364	600	1,673

Data Source: Pharmedics Validation Data-Set, n=904,007, 2001-02, Commercial Data Only  
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# Understanding Prevalence Rates Based on Pharmacy Use

Rx-MG Description	Patient Count	Observed/ 1000	SMR	95% Conf Interval (low)	95% Conf Interval (high)
Allergy/Immunology / Chronic Inflammatory	160	104.98	1.15	0.97	1.33
Cardiovascular / Congestive Heart Failure	32	20.99	1.34	0.87	1.81
Cardiovascular / Hyperlipidemia	173	113.51	1.06	0.90	1.22
Cardiovascular/High Blood Pressure	166	108.92	1.20	1.02	1.39
Cardiovascular / Chronic Medical	88	57.74	1.33	1.05	1.61
Endocrine/ Diabetes w/o Insulin	51	33.46	1.51	1.10	1.93

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# Identify Members with Specific Conditions

Condition	EDCs	Rx-MGs
Diabetes	END06 - Type 2 diabetes, w/o complication END07 - Type 2 diabetes, w/ complication END08 - Type 1 diabetes, w/o complication END09 - Type 1 diabetes, w/ complication	ENDx030 - Endocrine / Diabetes With Insulin ENDx040 - Endocrine / Diabetes Without Insulin
Hypertension	CAR14 - Hypertension, w/o major complications CAR15 - Hypertension, with major complications	CARx030 - Cardiovascular / High Blood Pressure
Depression	PSY09 - Depression	PSYx040 - Psychosocial / Depression
Asthma	ALL04 - Asthma, w/o status asthmaticus ALL05 - Asthma, with status asthmaticus	RESx040 – Respiratory / Airway Hyperactivity
Peptic disease	GAS06 - Peptic ulcer disease	GASx060 - Gastrointestinal/Hepatic / Peptic Disease

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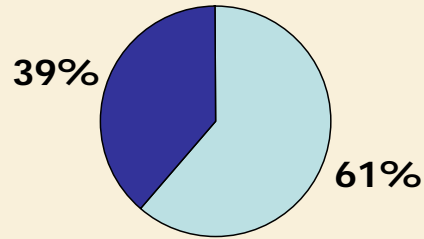
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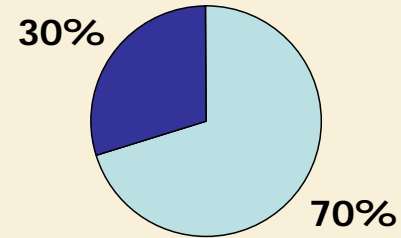


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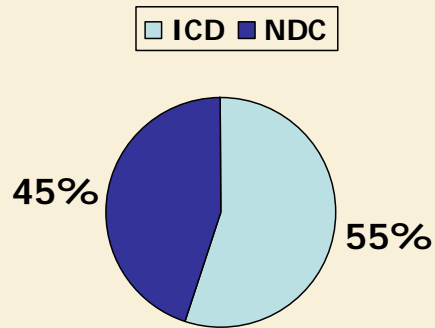
## Diagnosis and Pharmacy Identify Different Populations



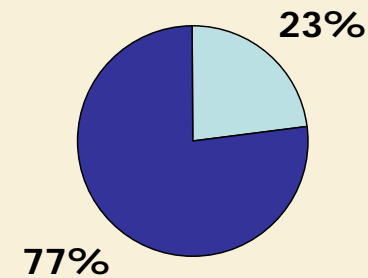
Lipoid Disorders & CHF



Hypertension



Diabetes



Depression

Source: Pharmetrics Validation Data-set, n=90,000 M+C plans in 2000  
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# Areas for investigation

- Discordant Dx-PM and Rx-PM scores
- Trend in risk score
- Rx-MGs as a polypharmacy measure
- Continuity in chronic Rx-MGs as a medication adherence measure



# Risk Factors in the Johns Hopkins Predictive Model



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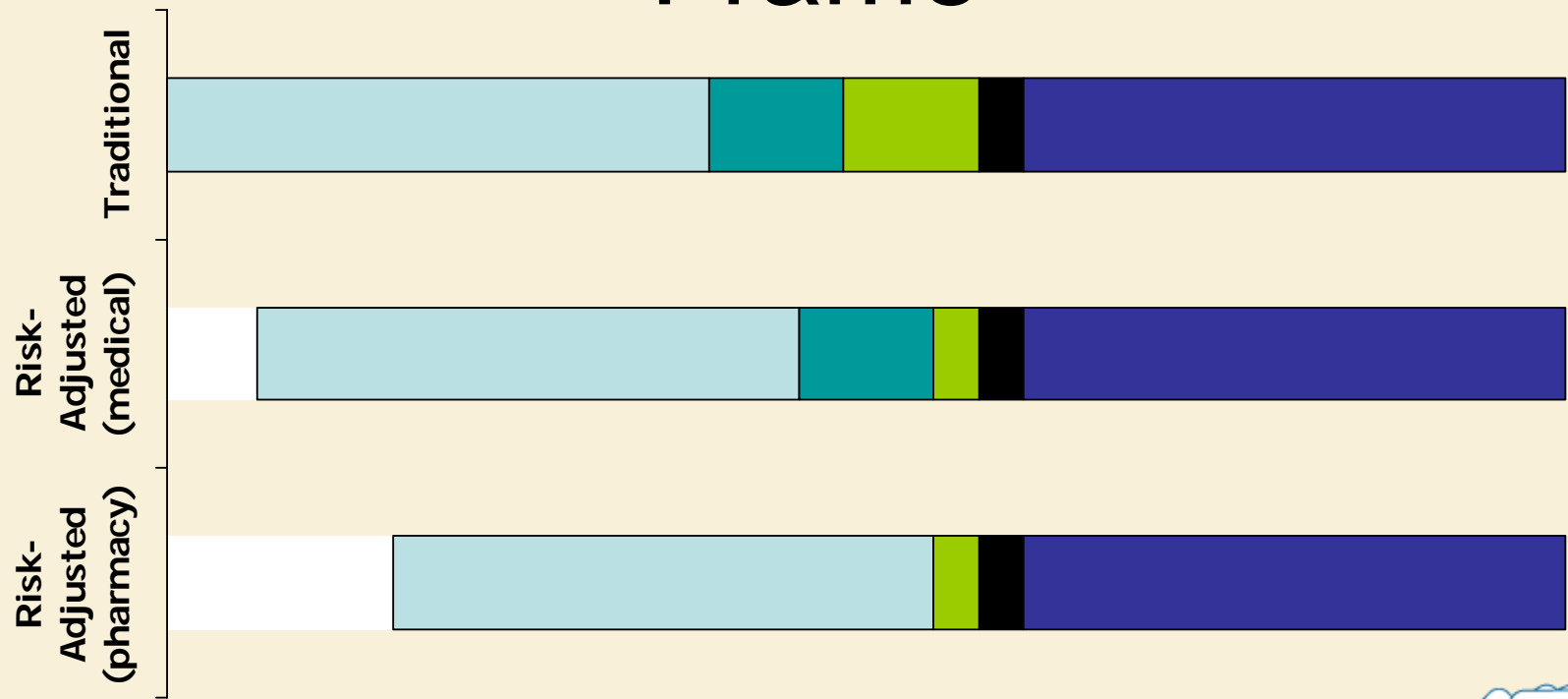


# Benefits of PM for Underwriting

- Greater Efficiency
  - Reduce medical underwriting effort
  - Reduce lag between analysis period and rating period
- Reduce Underwriting Discretion
  - Greater consistency among underwriters
  - Objective, reproducible method
  - More defensible to customers
- Greater Accuracy
  - Better matches premiums to future cost – improved profit margin
  - Improvements in R-Squared of 3-5%
- Competitive Renewal Rates/Improved Customer Retention



# Typical Underwriting Time Frame



Claims Period Claims lag Manual review Presentation of Rate Rating period



# How Much Data Do You Need?

- If time is not an issue, waiting for a full year of claims is best
- For new business, Rx-PM is a viable alternative with less than a full year

	1 Month Rx	3 Months Rx	6 Months Rx	12 Months Rx	12 Months Rx+Dx+ Prior Cost	12 Months Prior Cost
No truncation	6.91	8.57	8.86	8.86	15.81	14.83
\$50,000 truncation	14.55	16.87	17.26	17.38	23.79	19.04

R-squared calculations for a commercial health plan with 400,000 members  
Comparing Rx-PM to predict total medical expenditures with a total prior cost model

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# How Does it Compare to Prior Cost Really?

- To underwrite the second year with a group, there will only be 5 months of experience available (assuming 90 days claims lag)
- If manual review can be reduced, up to 7 months may be available
- Using Rx data to reduce lag, up to 10 months may be available

	5 months prior cost	5 months Rx	7 months Rx	10 months Rx
No truncation	6.59	6.85	7.44	8.25
\$50,000 truncation	10.65	14.22	15.05	16.32

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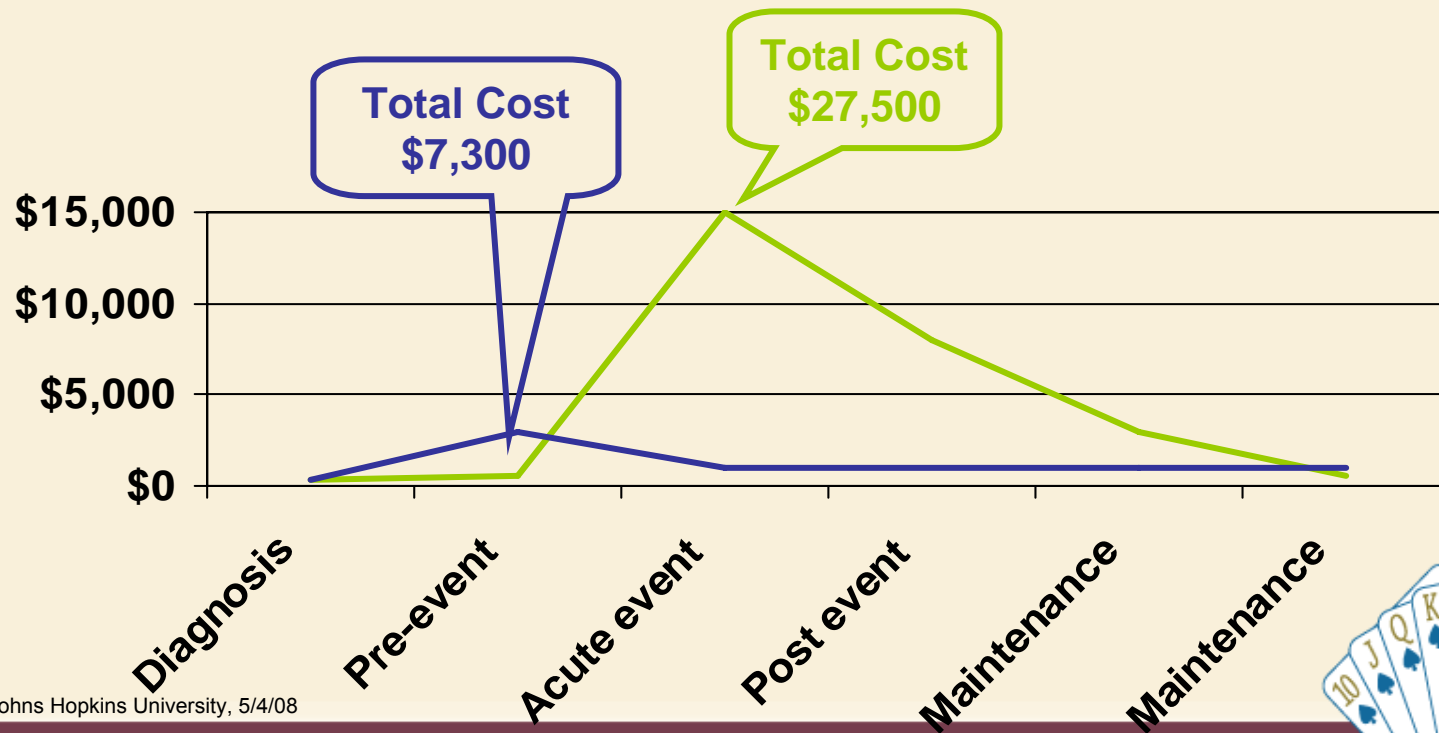
# Quick Summary

- Risk adjustment useful for
  - More timely and efficient underwriting
  - Differentiating high, average and low-risk small groups
  - Identifying the underlying morbidity profile of group and thus what programs might benefit their population
  - Useful for explaining increasing/decreasing costs over time and how these are linked to underlying changes in the morbidity of the population



# High-Risk Case Identification

- Prior cost is an excellent predictor of future cost, why use a predictive model?



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# Sensitivity and PPV Calculations

Predictive Model Result	Year 2 Cost Category		Total	
	High Cost	Low Cost		
Predict High	True Positive	False Positive	TP + FP	PPV = TP/(TP + FP)
Predict Low	False Negative	True Negative	FN + TN	
Total	TP + FN	FP + TN	TP+FP+FN+TN	

Sens. =  $TP / (TP + FN)$

Spec. =  $TN / (TN + FP)$



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## With as Little as One Month of Data

Amount of Data	Score threshold	Cost threshold	Sensitivity	PPV
1 month	Top 1%	Top 1%	14.9%	14.9%
1 month	Top 1%	Top 5%	10.23%	51.16%
1 month	Top 5%	Top 5%	28.05%	28.05%
3 months	Top 1%	Top 1%	16.93%	16.93%
3 months	Top 1%	Top 5%	11.21%	56.05%
3 months	Top 5%	Top 5%	30.23%	30.23%

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