

# DMAA FORUM 2008

## “Random Fluctuations and Validity”

“Random Fluctuations and Validity  
In Measuring Disease Management Effectiveness  
For Small Populations”  
November 23, 2008

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# Learning Objectives

## “Random Fluctuations and Validity”

- Understand the credibility of results of evaluations of different sized groups
- Recognize the empirical analysis of randomness in DM measurements in a large population
- Understand how to mitigate the problem of randomness with different measurement techniques and alternative methodologies

# Agenda

## “Random Fluctuations and Validity”

1. DM Process
2. What happens in practice?
3. For what size of population can results be considered credible?
4. Our study
5. Results
6. Q&A

# Background

## “Random Fluctuations and Validity”

Concerns over variable DM results.

How much is due to random fluctuations?

DMAA Guidelines refer to minimum group sizes for credibility.

# Authors

## “Random Fluctuations and Validity”

Explored in the paper published in *Disease Management:*

“Random Fluctuations and Validity in Measuring Disease Management Effectiveness for Small Populations.”

Authors:

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- Kyahn Kamali, MHS
- Jeffrey Harner, MS
- Ian Duncan, FSA MAAA
- Tom Messer, PhD ASA MAAA

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All statements are the speakers opinion

# Synopsis of “Disease Management” Process

## “Random Fluctuations and Validity”

- Attempt to manage chronic diseases through active engagement of (members) patients;
- Patients are identified through claims searches, health risk assessments & various referrals;
- Risks are stratified and interventions are customized;
- Nurses contact and monitor members’ diet, weight, prescriptions etc.& provide tailored health education;
- Interventions are typically conducted by telephone, web assisted and supported by mailings & Physician notification

# DM Evaluation

## “Random Fluctuations and Validity”

DMAA has led the way with its efforts to codify standard evaluation practice.

Definitions of populations, including target conditions, included and excluded members, etc.

Standard methodology, as practiced in the industry and codified by DMAA is an adjusted-historical population comparison.

# DM Evaluation

“Random Fluctuations and Validity”

## Treated Conditions

Diabetes

Coronary Artery Disease (CAD)

Congestive Heart Failure (CHF)

Chronic Obstructive Pulmonary Disease (COPD)

Asthma

Members with more than one condition are assigned to the higher hierarchical condition.

# DM Evaluation

“Random Fluctuations and Validity”

## EXCLUDED MEMBERS

Members with:

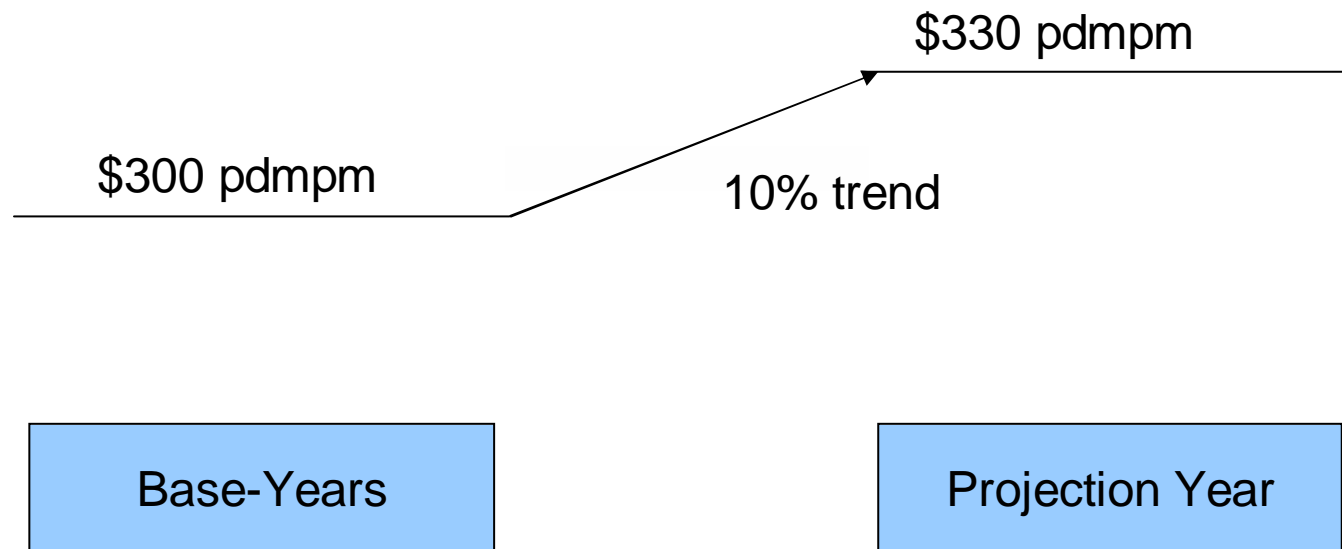
- Aids/HIV
- Dialysis
- Cancer
- Transplants
- Infertility
- Hemophilia
- Maternity

Also excluded were trauma Claims.

# ...Adjusted historical control methodology

“Random Fluctuations and Validity”

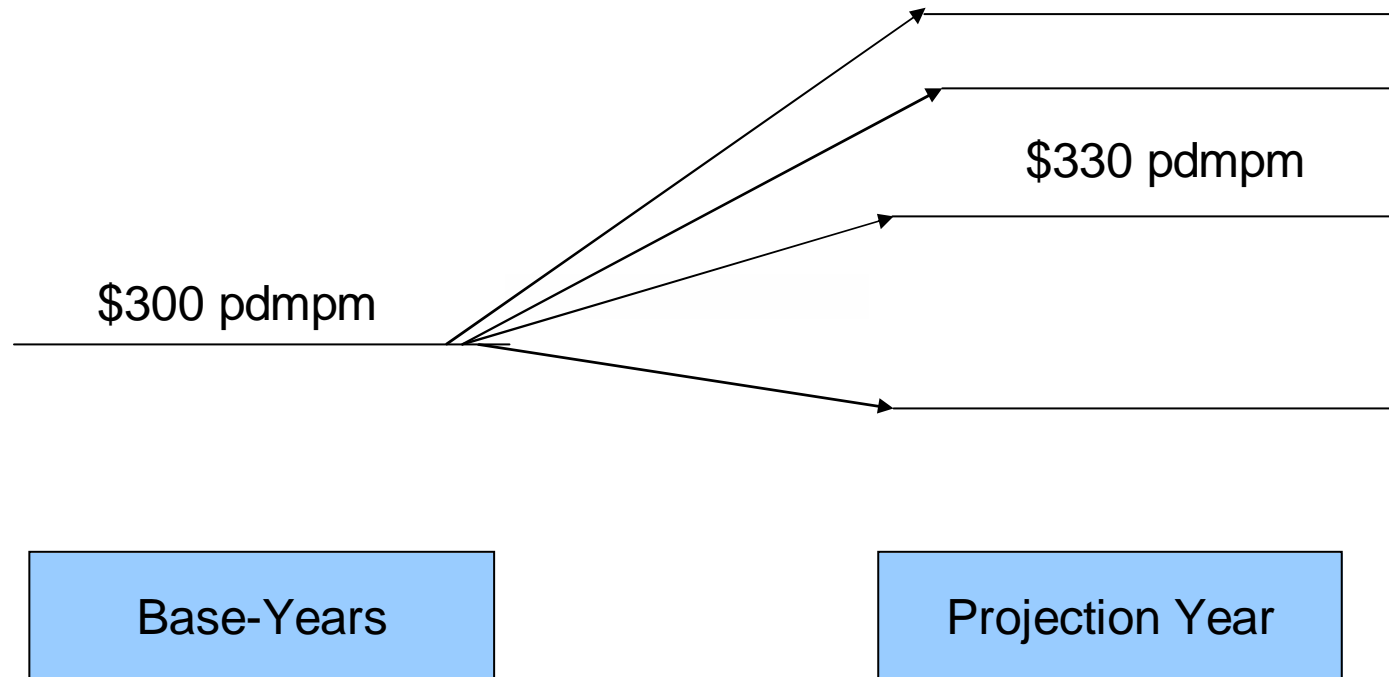
We expect:



# What Really Happens – Random Fluctuations

“Random Fluctuations and Validity”

We get...additional factors beyond random



*The actual experience can vary significantly.*

# “Random” vs. Other Factors Affecting Fluctuations

## “Random Fluctuations and Validity”

Catastrophic Claims;  
Changes in Practice Patterns;  
Changes in Provider Contracts;  
Changes in Member Benefits;  
Changes in Underlying Demographics;  
And the general unpredictability of life.

# Adjusted Historical Control Methodology 101

## “Random Fluctuations and Validity”

Calculate the base years PMPM for members with disease;

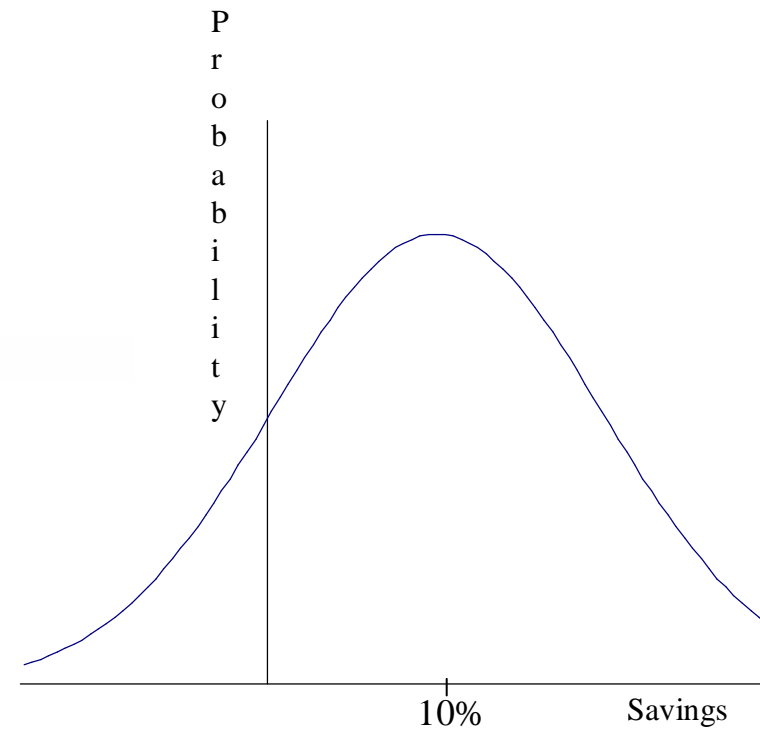
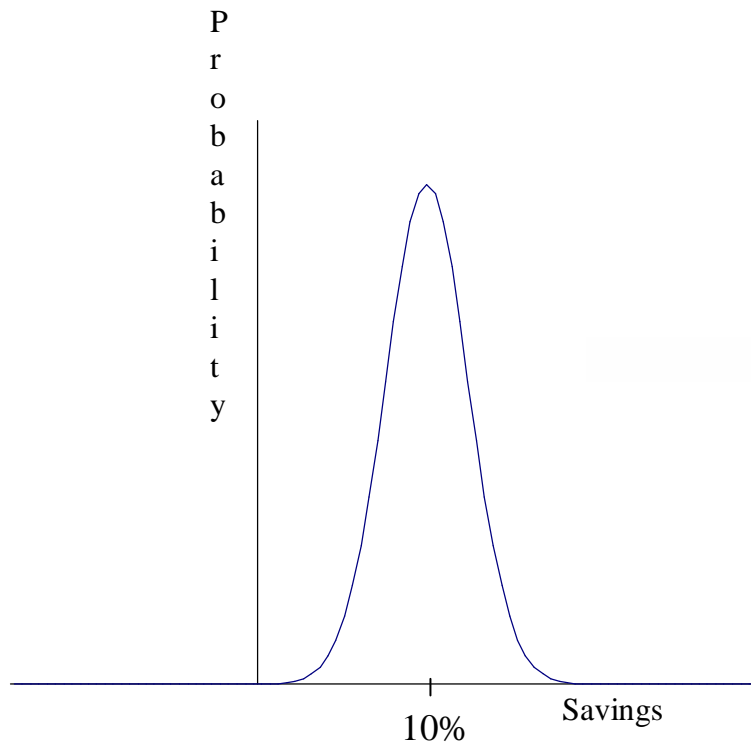
Multiply baseline PMPM by trend to predict intervention year costs for these members;

Compare predicted PMPM with actual PMPM;

If actual PMPM is lower, the difference is assigned to savings due to the intervention.

# How Wide are Fluctuations?

“Random Fluctuations and Validity”



# How did we study?

**“Random Fluctuations and Validity”**

Adjusted Historical Control

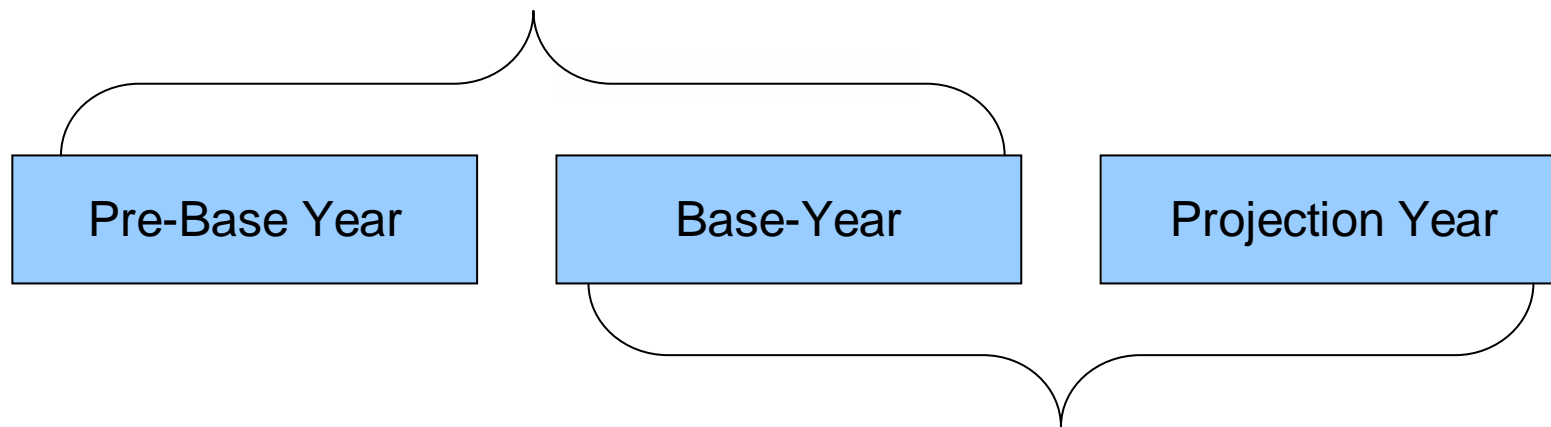
Large Commercial Database

Simulated large number of “employer groups”

# Adjusted Historical Control Methodology 101

“Random Fluctuations and Validity”

So AHC insists on parallel structure:



# Simulation

## “Random Fluctuations and Validity”

- A DM program managing employer groups is expected to save  $x\%$  of costs;
- Choose (randomly) the specified number of members;
- Follow those members through the measurement year;
- Add members to simulate drop-outs;
- Total number of members is constant although member-months will vary;
- Some churn of diseased members;
- Use “well” trend

# Simulation

## “Random Fluctuations and Validity”

For each run, calculate deviation from expected pmpm.

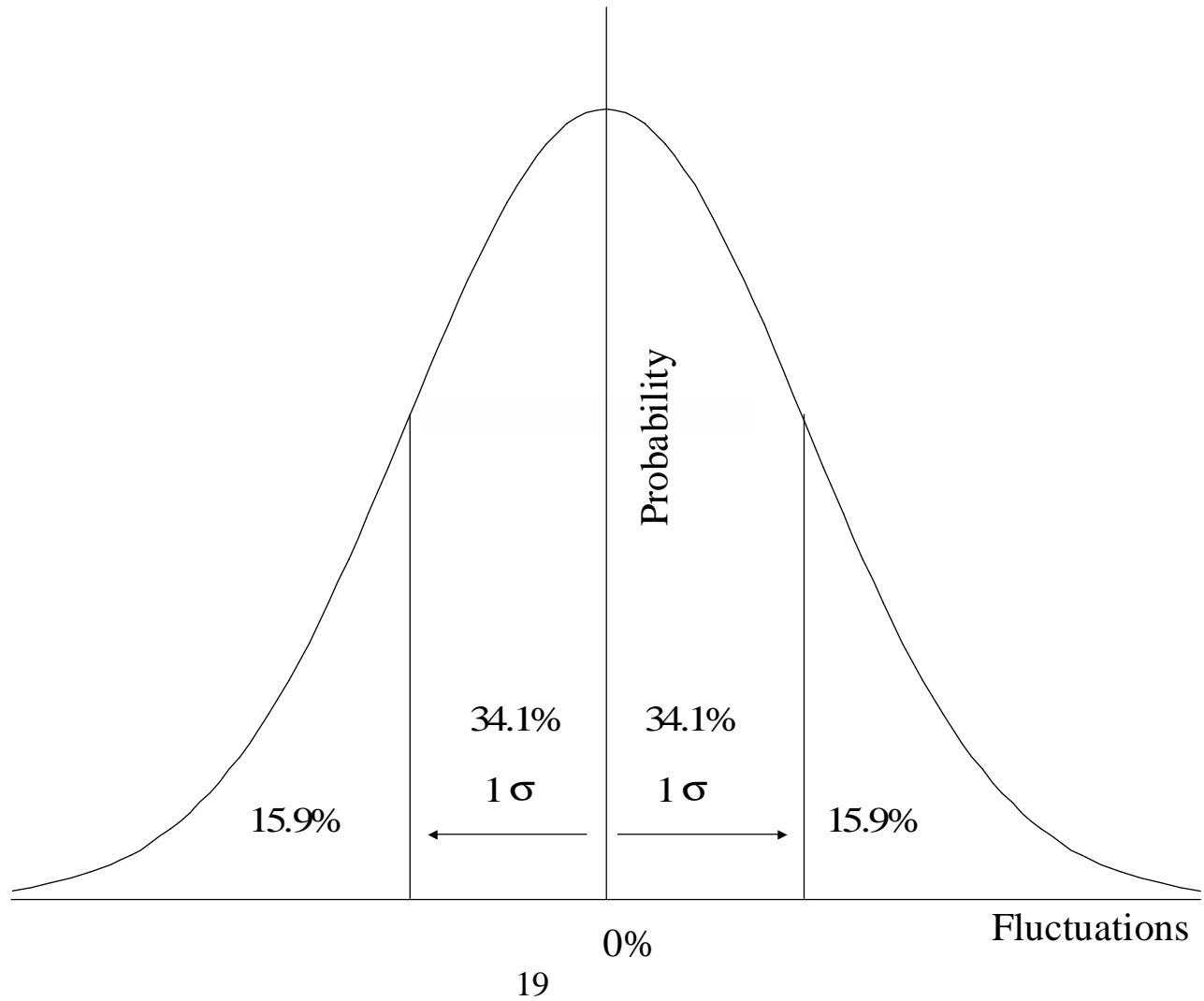
$$\text{Fluctuation} = \frac{\text{Actual PMPM} - \text{Expected PMPM}}{\text{Expected PMPM}}$$

$$= \frac{\text{Projection Year PMPM} - \text{Base Year PMPM} * \text{Trend}}{\text{Base Year PMPM} * \text{Trend}}$$

We expect the 1000 results for each employer group to (more or less) follow a normal (bell) curve.

# Expected Distribution

“Random Fluctuations and Validity”



# Trend

## “Random Fluctuations and Validity”

Trends as Calculated from the Well Members of the Population

Sample Size	5,000	20,000	40,000
Mean	9.5%	9.4%	9.4%
Standard Deviation	10.1%	5.1%	3.6%
Minimum	-18.5%	-7.2%	-2.7%
10th Percentile	-3.0%	2.8%	4.9%
Median	9.1%	9.4%	9.4%
90th Percentile	22.5%	16.1%	14.0%
Maximum	50.4%	25.7%	23.5%

The trend for samples of well members can vary widely, even for large samples

# Scenarios Tested

## “Random Fluctuations and Validity”

Base Case – Group Specific Trend

Alternate Case – Population Trend

Alternate Case – Truncation of Large Claims

Alternate Case – Utilization as Measure

Measuring Individual Diseases

# Base Case

“Random Fluctuations and Validity”

Half-Width – Use Group-Specific “Well” Trends without truncation

Confidence Level	Employer Group Size						
	<u>1,000</u>	<u>2,000</u>	<u>4,000</u>	<u>10,000</u>	<u>20,000</u>	<u>40,000</u>	<u>100,000</u>
68%	49.0%	34.7%	24.5%	15.5%	11.0%	7.7%	4.9%
90%	80.6%	57.0%	40.3%	25.5%	18.0%	12.7%	8.1%
95%	98.0%	69.3%	49.0%	31.0%	21.9%	15.5%	9.8%

So, if a DM Program operates on 100,000 members and typically saves 10% of costs, in 68% of the cases, the measurement (but not the actual savings) will lie between  $10\% - 4.9\% = 5.1\%$  and  $10\% + 4.9\% = 14.9\%$

# Base Case

“Random Fluctuations and Validity”

What is the smallest group size that we can be x% confident that the measurement will show savings?

Minimum Group Size when DM Program Saves 5% of Chronic Costs

Standard Deviations	<u>1.000</u>	<u>2.000</u>
One Sided	84.1%	97.7%
Two Sided	68.3%	95.4%
Group Size	96,100	384,300
Expected Chronic Prevalence	6,500	25,900

Minimum Group Size when DM Program Saves 10% of Chronic Costs

Standard Deviations	<u>1.000</u>	<u>2.000</u>
One Sided	84.1%	97.7%
Two Sided	68.3%	95.4%
Group Size	24,000	96,100
Expected Chronic Prevalence	1,600	6,500

# Using Utilization – (Admissions)

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Minimum Group Sizes using Admits

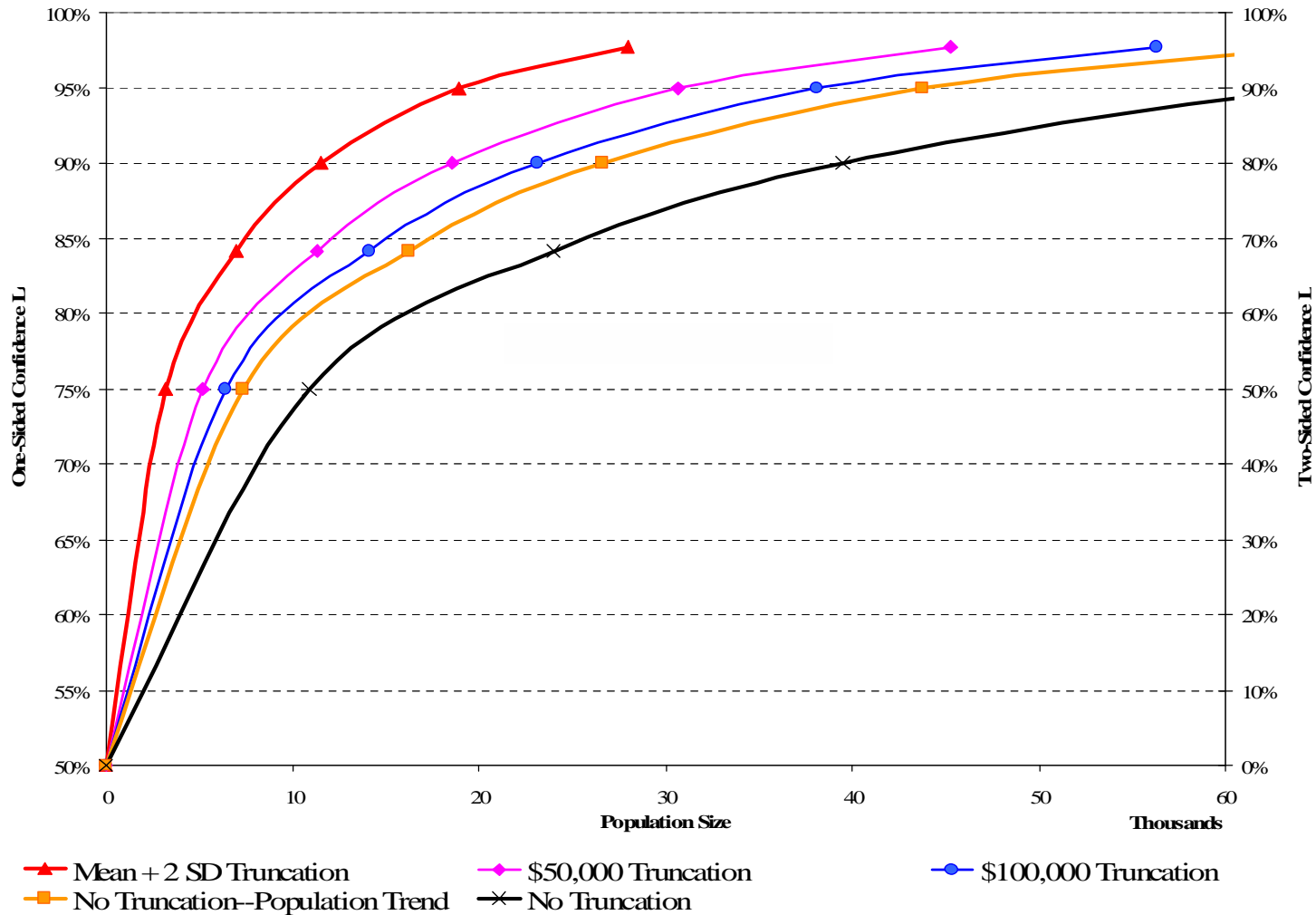
– When DM Program Saves 10% of Costs of Diseased Members

Standard Deviations	Type of Trend	<u>1,000</u>	<u>2,000</u>
One Sided		84.1%	97.7%
Two Sided		68.3%	95.4%
Standard Scenario – Use Group–Specific “Well” Trends	Employer Group	24,000	96,100
Alternate Scenario – Use Population “Well” Trends	Population	16,200	64,700
Alternate Scenario – Use Truncation at Mean + 2 sd	Employer Group	7,000	28,000
Alternate Scenario – Use Truncation at \$50,000	Employer Group	11,300	45,300
Alternate Scenario – Use Truncation at \$100,000	Employer Group	14,100	56,300
<b>Alternate Scenario – (20% of Chronic Admissions)</b>	<b>Employer Group</b>	<b>4,340</b>	<b>17,400</b>

# Population Size Vs. Confidence Intervals

“Random Fluctuations and Validity”

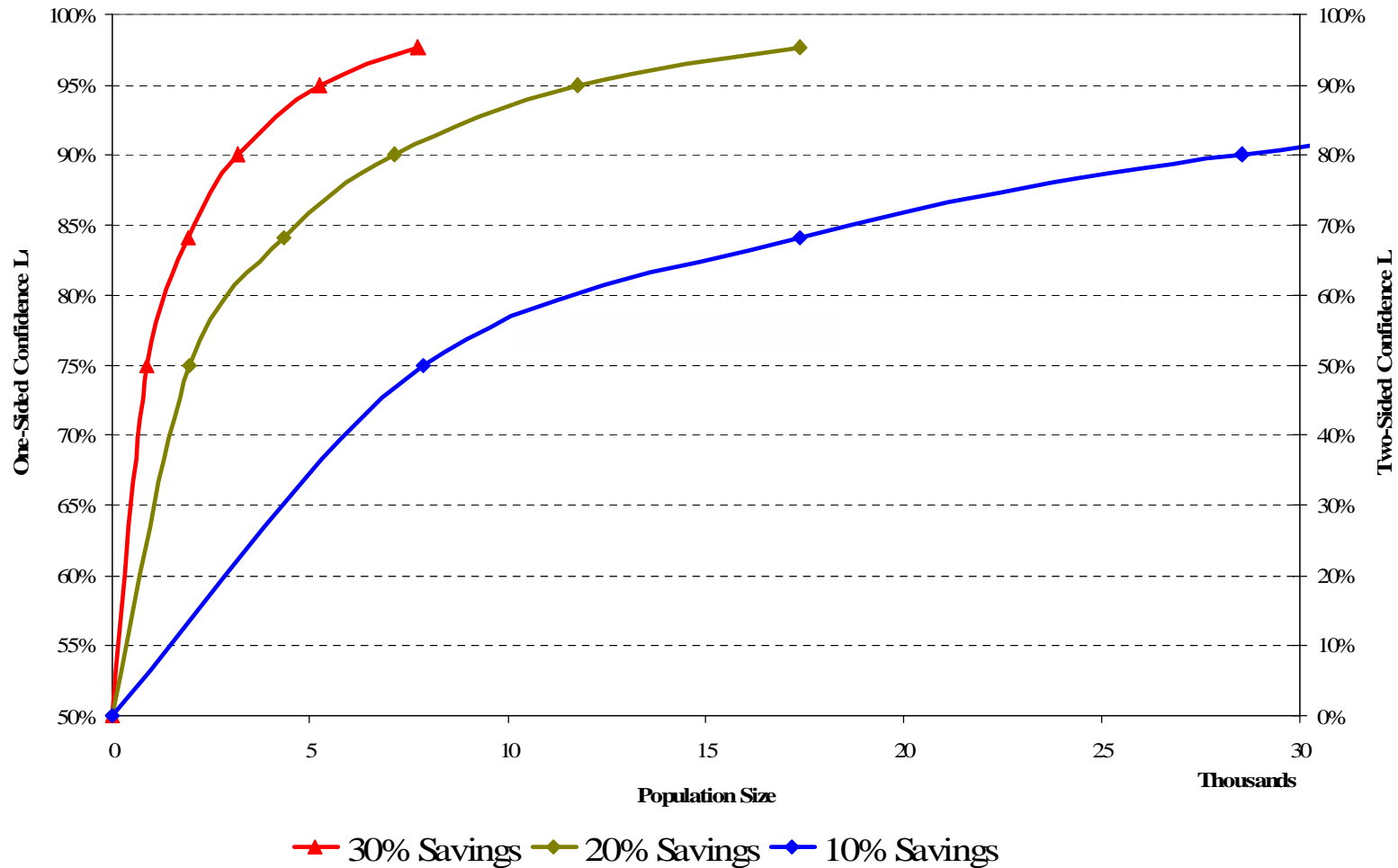
10% DM Program Effect



# Population Size Vs. Confidence Intervals

“Random Fluctuations and Validity”

Program Effect Measured by Admissions



# Conclusions

## “Random Fluctuations and Validity”

- **Smaller Confidence Level or “1-sided” confidence interval may be necessary and adequate**
- **Truncation of high cost claims is helpful but no panacea**
- **“Well” trend introduces uncertainty – use alternatives if possible**
- **Utilization measures may be valid substitute for cost measures**

# Questions?

**“Random Fluctuations and Validity”**

***Questions are welcome!***

# Addresses for follow-up

“Random Fluctuations and Validity”

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