

An Actuarial Perspective on Disease Management ROI Measurement

May 10, 2006

Introduction

- Ian Duncan, FSA FIA FCIA MAAA. President, Solucia Inc.
- Solucia Inc. is a healthcare consulting company based in Hartford, CT solving client problems by:
 - Application of sound financial and actuarial analysis;
 - Data management/predictive modeling;
 - Care Management financial modeling and outcomes analysis;
 - Development of software applications to automate care management functions and reporting.

Significant practice in DM savings validation/certification.

Agenda

- State of DM program financial outcomes measurement.
- The Society of Actuaries study of DM outcomes measurement.
- Some promising techniques.

“Testing actuarial methods for DM savings evaluation”

Authors: Henry Dove, PhD, Ian Duncan FSA MAAA and Rebecca Owen, FSA MAAA FCA.

Sponsored by the Society of Actuaries Health Section.

Background to our research

This paper is part of a larger study sponsored by the Society of Actuaries Health Section. Study is entitled: "Evaluating the Results of Care Management Interventions: Comparative Analysis of Different Outcomes Measures."

Study responds to the growing involvement of actuaries in the area of DM outcomes evaluation.

Other papers may be found on the SOA website at:
<http://www.soa.org/ccm/content/areas-of-practice/health/research/eval-results-care-man-int/>

Prevalent Industry Methodology

The prevalent industry methodology is a trend-adjusted historical control (pre- post) methodology.

Trend = An actuarial concept.

Simple example:

Estimated Savings due to reduced pmpy =	
Baseline Cost pmpy * Cost Trend	\$6,000 * 1.12 = \$6,720
Minus: Actual Cost pmpy	<u>\$6,300</u>
Equals: Reduced Cost pmpy	\$420
Multiplied by: Actual member years in	
Measurement Period	<u>20,000</u>
Equals: Estimated Savings	\$8,400,000

Background to our research

What is the purpose of the trend paper?

- **In any pre-post study in which trend is used to adjust historical data, the analyst requires an assumption for the trend adjustment variable.**
- **Trend isn't well-understood, despite its prevalence.**
- **Chronic population trend is not a valid assumption because it is affected by the intervention.**
- **Different sources of the trend adjustment variable are used, including population trend and non-chronic population trend.**



**Our study: how valid are these estimators?
How well do they estimate chronic trend in
the absence of interventions?**

Trend Assumptions: Definition

Definition of Trend:

Trend from period t to period t+1 is defined as:

$$\text{Trend} = \frac{\text{Pmpm}_{t+1} - \text{Pmpm}_t}{\text{Pmpm}_t}$$

$$\text{Pmpm}_t = \frac{\sum_{j=1}^{12} \sum_{i=1}^{n_j} C_{ij}}{\sum_{j=1}^{12} n_j}$$

where: C_{ij} is the claims (or utilization, or other statistic being measured) of the i -th member in the j -th month; and n_j is the number of members enrolled in the j -th month

Trend Assumptions: Definition

SOLUCIA, INC.

Trend Example

Claims, year 2:	<u>\$1,000,000</u>	Claims, year 1:	<u>\$ 800,000</u>
Member Months, year 2:	8,000	Member Months, year 1:	7,000
PMPM Year 2:	\$125.00	PMPM Year 1:	\$114.29

TREND: $\frac{\$125.00}{\$114.29} = 9.4\%$

Trend Assumptions: Before we start

Remember: many studies use non-chronic trend as an estimate of chronic trend, absent intervention.

Which of the following do you think is True?



Chronic Member Trend is HIGHER than Non-chronic Member Trend.



Chronic Member Trend is LOWER than Non-chronic Member Trend.



Chronic and Non-chronic Trends are about the SAME

Calculated Chronic, Non-chronic and population trends for 1999 through 2002.

Ingenix data set – 1.5 million commercially insured members.

Chronic members identified with:

- **Asthma**
- **COPD**
- **CHF**
- **Diabetes**
- **IHD**

Trend Results

Average 3-year trends*

Chronic	5.6%
Non-chronic	13.8%
Population	16.0%

* Prospective chronic identification

Interaction of Chronic Disease and Trend

Costs and Trends using "Prospective chronic" identification

Year	Chronic Member Months	Chronic Prevalence	Chronic Cost PMPM	Chronic Cost Trend	Total Chronic Cost (\$'000)	Chronic Cost as % of Total
1999	463,196	4.1%	\$ 745.87	-	\$ 345,483	14.5%
2000	701,398	6.0%	\$ 746.42	0.1%	\$ 523,538	18.3%
2001	845,883	7.0%	\$ 820.27	9.9%	\$ 693,856	20.3%
2002	990,646	8.6%	\$ 879.71	7.2%	\$ 871,485	23.1%
3-Year Annualized				5.6%		

Year	Non-Chronic Member Months	Non-Chronic Cost PMPM	Non-Chronic Cost Trend	Total Non-Chronic Cost (\$'000)	Non-Chronic Cost as % of Total
1999	10,956,779	\$ 186.26	-	\$ 2,040,836	85.5%
2000	11,067,274	\$ 211.41	13.5%	\$ 2,339,693	81.7%
2001	11,241,633	\$ 242.83	14.9%	\$ 2,729,790	79.7%
2002	10,591,169	\$ 274.44	13.0%	\$ 2,906,654	76.9%
3-Year Annualized				13.8%	

Year	Total Member Months	Total Cost PMPM	Total Cost Trend	Total Cost (\$'000)
1999	11,419,975	\$ 208.96	-	\$ 2,386,319
2000	11,768,672	\$ 243.29	16.4%	\$ 2,863,231
2001	12,087,516	\$ 283.24	16.4%	\$ 3,423,646
2002	11,581,815	\$ 326.21	15.2%	\$ 3,778,138
3-Year Annualized				16.0%

Less than 1/2

Trend Results: Alternatives

Adjusted for high-cost outliers

Average 3-year trends*

Chronic	4.9%
Non-chronic	13.9%
Population	16.2%

* Prospective chronic identification

Trend Results: Alternatives

SOLUCIA, INC.

Adjusted for chronic service mix*

Non-chronic, unadjusted	13.8%
Non-chronic, adjusted	13.2%

*** Prospective chronic identification**

Trend Results: Alternatives

Re-qualification

Year	Chronic Prevalence - Original	Chronic Prevalence - with re- qualification
1999	4.1%	4.2%
2000	6.0%	4.6%
2001	7.0%	4.7%
2002	8.0%	5.3%

Trend Results: Alternatives

Effect of Re-qualification on Trend

Year	BASE TREND			RE-QUALIFICATION TREND		Ratio chronic/ non- chronic
	Chronic	Non-chronic	TOTAL	Chronic	Non-chronic	
1999	-	-	-	-	-	-
2000	0.1%	13.5%	16.4%	9.4%	12.2%	77.1%
2001	9.9%	14.9%	16.4%	14.6%	16.0%	90.9%
2002	7.2%	13.0%	15.2%	8.1%	14.1%	57.8%
Three year Average	5.7%	13.8%	16.0%	10.7%	14.1%	75.7%

Trend Results: Alternatives

Chronic vs. Non-chronic trend with retrospective classification

SOLUCIA, INC.

Chronic

Year	Mem Months	Retrospective Identification	Prospective Identification
1999	1,410,116	-	-
2000	1,440,371	15.5%	0.1%
2001	1,437,872	17.2%	9.9%
2002	1,317,536	16.3%	7.2%
Three year	annualized	16.3%	5.6%

Non-chronic

Year	Mem Months	Retrospective Identification	Prospective Identification
1999	10,009,859	-	-
2000	10,328,301	17.8%	13.5%
2001	10,649,644	17.0%	14.9%
2002	10,264,279	16.8%	13.0%
Three year	annualized	17.2%	13.8%

TOTAL

Year	Mem Months	Retrospective Identification	Prospective Identification
1999	11,419,975	-	-
2000	11,768,672	16.7%	16.4%
2001	12,087,516	16.2%	16.4%
2002	11,581,815	15.3%	15.2%
Three year	annualized	16.0%	16.0%

Trend Results: Alternatives

Application of Risk Adjustment (DxCG prospective score)

Average 3-year trends*

Chronic	12.5%
Non-chronic	11.9%

* Prospective chronic identification

Conclusions

- **Trend has a large potential impact on the results of an adjusted pre- post study.**
- **When chronic members are identified using a prospective methodology, neither the non-chronic nor population trend is particularly close to chronic population trend. In particular, the chronic trend is lower than either the non-chronic or population trend.**
- **The authors term this effect “Migration Bias”.**

Conclusions (contd.)

- **Some obvious adjustments (for catastrophic claims and for differences in services) do not affect the difference much.**
- **Using a retroactive identification algorithm, chronic, non-chronic and population trends are much closer.**
- **Adjusting PMPM claims for changes in risk-score also causes trends to be more comparable.**

Implications for DM purchasers

- **Trend matters a lot.**
- **In some circumstances, migration can result in the use of inappropriate trend which, in turn, can overstate the calculated savings.**
- **Ask questions about how populations are identified and how trend is calculated.**
- **Effect of bias may be corrected by risk-adjustment or retrospective identification; also helpful is re-qualification.**

Paper 8: Practical Health Plan Application

- Partnered with Highmark, Inc.
- 2-1/2 million members covered by a DM program administered by Health Dialog, Inc.
- Focused mostly on 200,000-member Medicare Advantage members.
- Study period 10/1/2001-9/30/2003.

Paper 8: Practical Health Plan Application

Base-case plus 5 alternatives.

- Alternative 1: Cohort Study.
- Alternative 2: 3 different chronic identification algorithms.
- Alternative 3: Retrospective Identification of Chronic Members.
- Alternative 4: No continuous eligibility requirement.
- Alternative 5: Commercial HMO/POS population.

Paper 8: Base-case analysis

<u>Measure</u>	<u>Baseline 8/00 – 7/01</u>	<u>Intervention Year 1 10/01 – 9/02</u>	<u>Intervention Year 2 10/02 – 9/03</u>
Ave no. Members	158,177	180,290	186,246
Ave. no. Chronic Measured Members	33,628	44,251	50,739
Chronic Measured Prevalence	21.3%	24.5%	27.2%
Trend			
Chronic Measured Population		0.5%	5.5%
Index Measured Population		9.7%	9.9%
Claims per member per month, Chronic Measured Population			
Projected	\$448.26	\$491.88	\$540.55
Actual	\$448.26	\$450.34	\$475.27
Total Cost Savings, PMPM		\$41.54	\$65.28
Total Savings (\$ millions)		\$22.1	\$39.7
Savings as % of total claims for the Line-of-business		2.0%	3.0%

Paper 8: Effect of Design

Changing to a Cohort Design has little impact on savings

<u>Measure</u>	<u>Baseline 8/00 – 7/01</u>	<u>Intervention Year 1 10/01 – 9/02</u>	<u>Intervention Year 2 10/02 – 9/03</u>
Ave. no. Chronic Measured Members	33,628	34,957	29,252
Trend			
Chronic Measured Population		0.9%	6.7%
Index Measured Population		9.7%	9.9%
Claims per member per month, Chronic Measured Population			
Projected	\$448.26	\$491.88	\$540.55
Actual	\$448.26	\$452.29	\$482.62
Total Cost Savings, PMPM		\$39.59	\$57.93
Total Savings (\$ millions)			
Savings as % of total claims for the Line-of-business		\$16.6	\$20.3
		1.5%	1.5%

Paper 8: Effect of Chronic Identification

Chronic Member Identification (in this case, primary Dx only) has significant effect on savings

<u>Measure</u>	<u>Baseline 8/00 – 7/01</u>	<u>Intervention Year 1 10/01 – 9/02</u>	<u>Intervention Year 2 10/02 – 9/03</u>
Ave. no. Chronic Measured Members	29,190	39,526	49,344
Trend			
Chronic Measured Population Index Measured Population		(1.7%) 8.7%	1.4% 8.0%
Claims per member per month, Chronic Measured Population			
Projected	\$484.58	\$526.66	\$568.63
Actual	\$484.58	\$476.44	\$483.31
Total Cost Savings, PMPM		\$52.22	\$85.32
Total Savings (\$ millions)			
Savings as % of total claims for the Line-of-business		\$24.8 2.2%	\$50.5 3.8%

Paper 8: Retrospective Identification

Retrospective Chronic Member Identification avoids “migration bias” and has significant effect on savings

<u>Measure</u>	<u>Baseline 8/00 – 7/01</u>	<u>Intervention Year 1 10/01 – 9/02</u>	<u>Intervention Year 2 10/02 – 9/03</u>
Ave no. of Members	158,177	180,290	186,246
Ave. no. Chronic Measured Members	50,699	54,278	54,575
Chronic measured prevalence	32.1%	30.1%	29.3%
Trend			
Chronic Measured Population		11.9%	11.7%
Index Measured Population		11.7%	12.5%
Claims per member per month, Chronic Measured Population			
Projected	\$375.92	\$420.01	\$472.63
Actual	\$375.92	\$420.48	\$469.62
Total Cost Savings, PMPM		(\$0.47)	\$3.01
Total Savings (\$ millions)		(\$0.3)	\$2.0

Paper 8: Continuous Eligibility

Removing all waiting period criteria: 6 months prior eligibility and the 3-month post-identification waiting period.

<u>Measure</u>	<u>Baseline 8/00 – 7/01</u>	<u>Intervention Year 1 10/01 – 9/02</u>	<u>Intervention Year 2 10/02 – 9/03</u>
Ave. no. Chronic Measured Members	39,811	50,394	56,063
Trend			
Chronic Measured Population Index Measured Population		10.8%	10.3%
Claims per member per month, Chronic Measured Population			
Projected	\$550.45	\$610.07	\$672.71
Actual	\$550.45	\$545.50	\$561.49
Total Cost Savings, PMPM		\$64.57	\$111.22
Total Savings (\$ millions)			
		\$39.0	\$75.0
Savings as % of total claims for the Line-of-business			
		3.5%	5.6%

Paper 8: Alternative Scenarios

SOLUCIA, INC.

Scenario Number	Scenario	Intervention Year 1 10/01 – 9/02 PMPM Savings	% change compared with Base-case	Intervention Year 2 10/02 – 9/03 PMPM Savings	% change compared with Base-case
0	Base-case	\$41.54	-	\$65.28	-
1.	Cohort	\$39.59	(4.7%)	\$57.93	(11.3%)
2a.	Medical claims only identification	\$49.96	20.3%	\$77.16	18.2%
2b.	Primary diagnosis only identification	\$52.22	25.7%	\$85.32	30.7%
2c.	Hospital claims only identification	\$44.14	6.3%	\$57.93	(11.7%)
3.	Retrospective identification	(\$0.47)	(100.0%)	\$3.01	(95.4%)
4.	No continuous eligibility or “waiting period” requirement	\$64.57	55.4%	\$111.22	70.4%
5.	Commercial HMO Product	\$35.12	n/a	\$49.88	n/a

Paper 8: Conclusions – further study

- Savings results can vary considerably depending on identification, method, and assumptions.
- Methods that identify more members/higher prevalence generally produce higher savings.
- In order to understand specific savings results, a great deal of information and disclosure is required.
- More than one assumption can be varied: we did not test multi-variate results.
- We continue to test other assumptions: one of these is the “no re-qualification” assumption.
- Many purchasers want to know the results by disease.

Another promising avenue

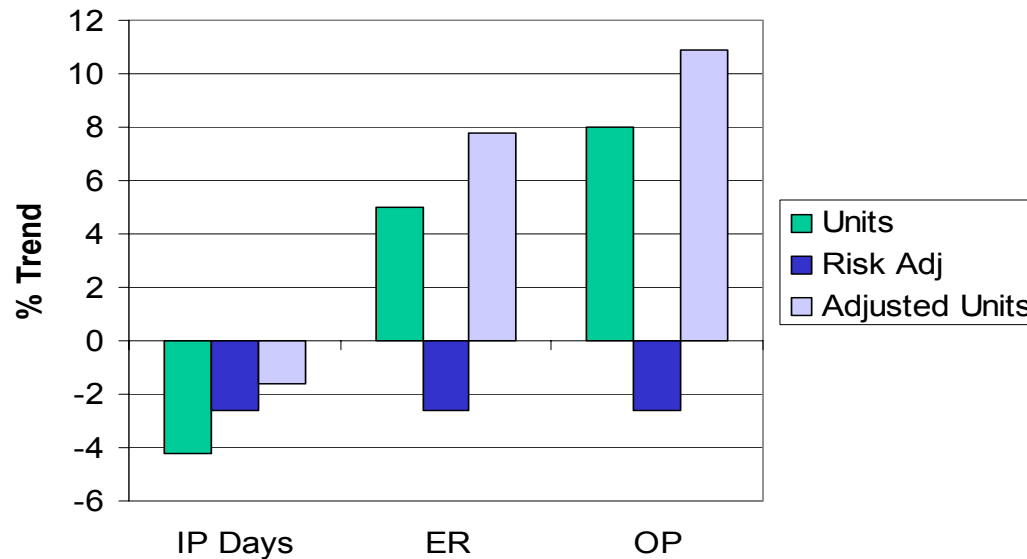
SOLUCIA, INC.

Using Risk-Adjustment to adjust Trends

Using Predictive Modeling in DM ROI

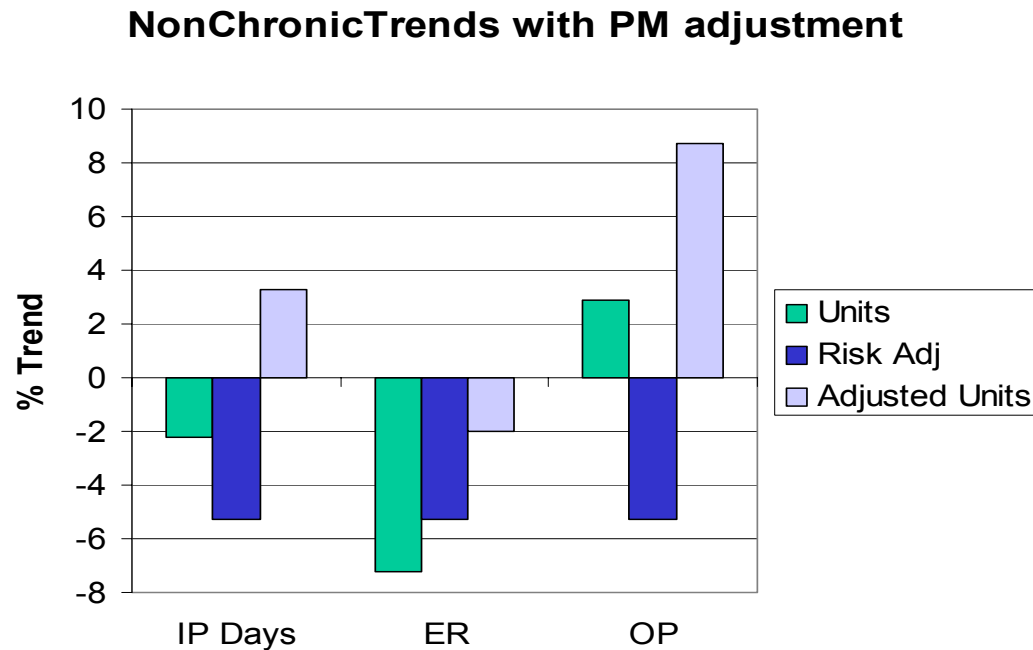
- Can shed light when results are counter-intuitive
- Actuaries understand and are comfortable with concept.
- Or reinforce a message

Chronic Trends with PM adjustment



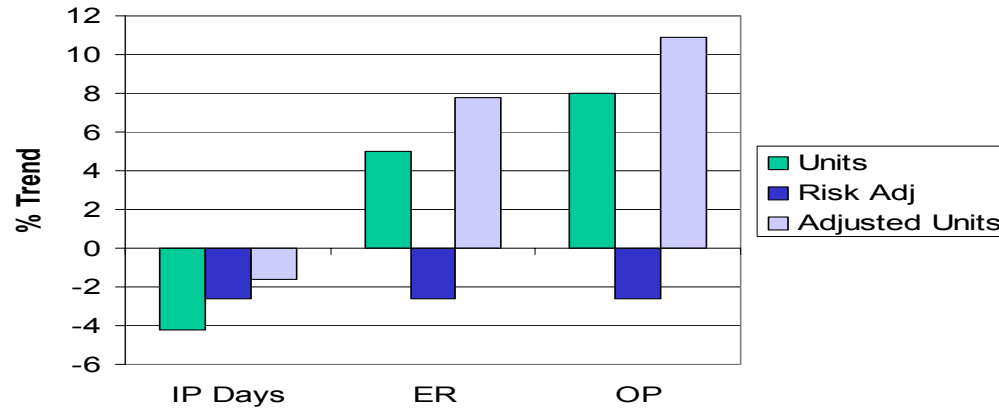
Using Predictive Modeling in DM ROI

- Especially when the non-chronic trend is doing something different...

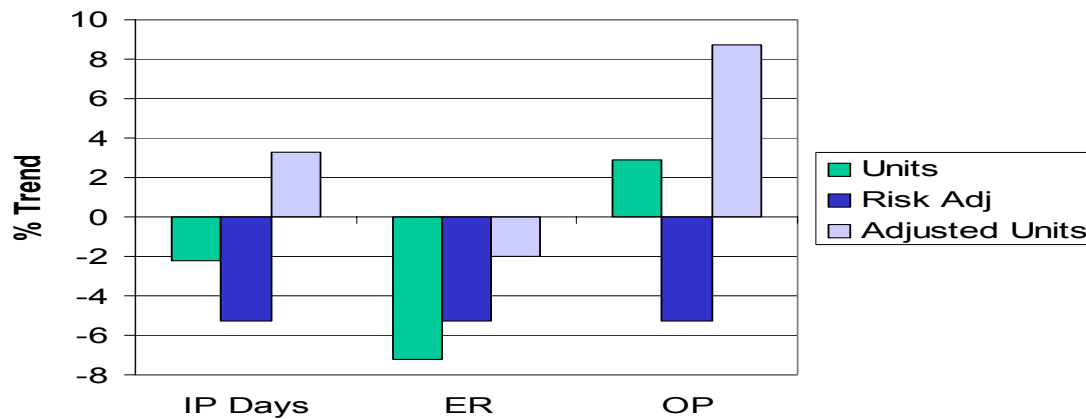


Using Predictive Modeling in DM ROI

Chronic Trends with PM adjustment



NonChronicTrends with PM adjustment



Using Predictive Modeling in DM ROI

Application of prior numbers

Chronic Population

Inpatient days, pre-program	100
Inpatient days, post-program	96

Non-Chronic Population

Inpatient days, pre-program	100
Inpatient days, post-program	98

"Unadjusted" Savings Calculation:

Inpatient days, pre-program	100
Projected inpatient days, post-program	98
Actual Inpatient days, post-program	<u>96</u>
"Savings" due to program (days)	2

Using Predictive Modeling in DM ROI

Application of prior numbers (contd.)

Chronic Population

Inpatient days, pre-program	100
Inpatient days, post-program	96
Inpatient days, post-program (adjusted for change in relative risk)	98

Non-Chronic Population

Inpatient days, pre-program	100
Inpatient days, post-program	98
Inpatient days, post-program (adjusted for change in relative risk)	103

"Unadjusted" Savings Calculation:

Inpatient days, pre-program	100
Projected inpatient days, post-program	103

Actual Inpatient days, post-program 98

"Savings" due to program (days) 5

Effect of risk-adjustment

Sometimes increases savings; more often decreases them.

Example: one client reduced vendor ROI calculation from 4.6: 1.0 to 1.5: 1.0.

Still positive outcome, but more believable.

Actuaries/finance more comfortable with approach and results.

Questions?

SOLUCIA, INC.

**THANK YOU FOR YOUR
PARTICIPATION**