

SOLUCIA, INC.

Society of Actuaries Research Project:

"Introduction to Care Management Interventions and their Implications for Actuaries"

May 14, 2008

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Agenda

1. Background to our research.
2. Care Management Background.
3. Review of the SOA research.
4. Questions?

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Background to our research

- Traditionally, actuaries have been involved in healthcare *financial*, rather than clinical topics;
- Managed Care brings these two streams together: managing clinical activities and interventions for a financial outcome;
- Actuaries have begun to be more involved in the care management/outcomes side of the business;
- Creates a *need* for actuaries to learn a new vocabulary and new techniques;
- Creates *opportunity* for actuaries to demonstrate application of our skills in a new area.
- In the UK context, there will be a need for financial evaluation of different care management proposals as the NHS reforms.

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- SOA Health Section called for proposals for projects in 2003.
- Awarded a project to research: *"Evaluating the Results of Care Management Interventions: Comparative Analysis of Different Outcomes Measures"*.
- Includes all Care Management Interventions although focus is on Disease Management.
- Total of 9 papers published, including trend paper in NAAJ.
- Rigorous peer-review process by Project Oversight Group.

• Additional chapters on Wellness added for book – publication date Fall 2008.

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The 9 papers on Care Management:

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1. Programs and Interventions – description of different types of care management interventions.
2. Actuarial Issues in Care Management.
3. A review of the Literature on Program Evaluations.
4. Understanding the Economics of Intervention programs.
5. Measuring Disease Management Savings Outcomes.
6. An actuarial methodology for assessing Disease Management Outcomes.
7. A comparative analysis of Chronic and Non-chronic Member Cost Trends.
8. Practical application of different measurement methodologies.

•Additional chapters on Wellness added for book – publication date Fall 2008.

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Acknowledgements

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- And last but not least: the SOA Health Section and the Committee on Knowledge Extension Research for their financial support.

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Background on Care Management

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- Realization that a small % of members consume a large % of resources, AND
- Role of the member: how do you encourage the Member to take more responsibility for own care?

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- Result is Care Management Interventions: programs that attempt to impose best-practice care pathways on providers and encourage PATIENT responsibility for their own care.

Background on Care Management

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Interventions raise questions for actuaries:

- Medical Management Departments are Expensive Resources.
- In health plans, they tend to be under different management structures than actuaries.
- It is hard to measure their productivity and performance.
- They tend to get a “bye” financially because they demonstrably “do good.”

Background on Care Management

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- As the number and cost of intervention programs has risen, managements have begun to turn to their traditional financial advisors, the actuaries.
- Clinical metrics and evaluations are not part of the traditional actuarial syllabus.
- Change in focus: traditionally, actuaries have focused on services (inpatient, outpatient, Rx, etc.). Focus is shifting to the member, the member's condition.
 - What is a reasonable cost for a member with a particular condition?
 - What is the increase in cost (trend) for member with a particular condition?

Health Risk Management – Traditional View

Traditional focus is on *Services*:

Services	Utilization/ 1000	Cost/ Unit	TOTAL COST	Patients
Hospital I/p	150.0			
E/R Visit	200.0			
O/P Surgery	45.0			
Office Visits	450.0			
...etc.				
PMPM				

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Health Risk Management – New View

New focus is on *Patients*:

Patients	Utilization/ 1000	Cost/ Unit	TOTAL COST	Services
Non-chronic	50.0			
Chronic				
Heart Failure	1000.0			
Diabetes	350.0			
Heart Disease	450.0			
...etc.				
Catastrophic	35.0			
PMPM				

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Health Risk Management – New View

The ultimate goal is to determine appropriate best-practice care for patients, depending on their conditions, developing a cost and transferring the risk deviation to insurers and medical managers.

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Review of the SOA Research

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1: Introduction to Care Management Interventions.

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An introduction (for those not familiar with them) to common types of care management programs.

- Pre-Authorization Reviews
- Concurrent Review
- Case Management
- Demand Management
- Disease Management
- Specialty Case Management
- Population Health Management
- Wellness

2: Actuarial Issues in Care Management

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- Covers Measurement Principles, Study Design Issues and Risk Factors.
- Addresses some issues of particular importance including Regression to the Mean, Risk Adjustment, the need for control and reconciliation of data, and operational issues.

2: Results of Interventions - Financial Jury is Out

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The industry measures financial outcomes differently than we are accustomed to (ROI rather than pmpm).

- Unrealistic Claims.
- No GAAP for Financial Measurement.
- Poor Reconciliation Controls.
- Lack of understanding of, and attention to, the key drivers of financial outcomes.
- "So how come, if you saved me all this money, my trend is continuing to increase?"

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3: Review of Published, Peer-reviewed literature

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Intervention	# Studies
Preauth/Utilization Review	9
Concurrent Review	5
Case Management	22
Specialty Case Mgmt	5
Demand Management	6
Population Management	7
Disease Management	52
TOTAL	106

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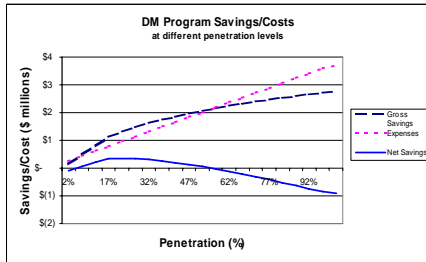
3: Review of Published, Peer-reviewed literature

Intervention	Total Number of Studies	Major Findings
Preauthorization/Utilization Review	9	Early studies show admission and bed-day reductions from UR in the range of 10% to 15%. Recent International studies of data not subject to managed care show considerable opportunity for utilization reduction. Early gains were not maintained as medical management models changed; there is also evidence of increased outpatient utilization due to inpatient UR. More recently these reductions are in the range of 2% to 3%; savings are estimated at between \$25 and \$74 per member per year; we estimate ROI of 4.60 based on reported intervention cost of \$30/member for this study.
Concurrent Review	5	Early gains due to Concurrent Review were not maintained as medical practice patterns changed. Current evidence that Concurrent Review can reduce bed-days by 2% to 3%. One study in a hospital setting showed ROI of 0.9 (savings < cost of review).
Case Management	22	Reported results are variable (depending on target condition and program). Evidence exists of clinical improvement and reduction in utilization due to CM, particularly for heart disease. A survey of CM financial outcomes for Diabetes found no valid studies. ROIs in the range of 1.37 to 3.74 reported.
Specialty Case Management	5	Relatively few studies. Prevalence of members with target conditions makes them a poor candidate for randomized control trials. Evidence shows support for financial outcomes in mental health and some high-cost diseases, such as Renal Diseases.
Demand Management	6	Evidence exists that Demand Management reduces unnecessary physician and ER visits. Financial results indicate a return of between 1.37 to 3.86 to 1.0.
Population Management	7	Evidence reported of dollar savings within population wide programs. One study reported an ROI of 5.0 to 1.0. Studies of programs to intervene within entire chronic condition sub-populations report measurable pmpm savings.
Disease Management	52	For one population (multi-disease) program that reported pmpm savings, gross savings are estimated around \$1.45 pmpm. For programs that report ROI, the range is 1.2 to 6.4. Highest savings are reported for heart diseases. Moderate savings are reported in diabetes and mental results (in some cases no savings) for Autism. A recent study using a randomized control showed no discernible savings.
TOTAL	106	

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4: The Economics of Care Management

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5: Evaluating Savings Methodologies

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What makes for a good savings estimate?

- **Reference Population:** Outcomes measurement requires a reference population against which to evaluate the statistic(s) of interest.
- **Consistent Statistics:** The outcome variable(s) should be measured identically in the reference and intervention populations.
- **Appropriate Measurement:** Measure only what the intervention is designed to manage.
- **Exposure:** The calculation of an actuarial statistic requires clear definition of the numerator and denominator = clear definitions of categories of members and time-periods.

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5: Evaluating Savings Methodologies

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Evaluating different designs

- Validity/rigor.
- Familiarity.
- Replicability (ability for the client to reproduce the results).
- How the method is applied in practice.
- Other issues and comments on the use of the design.

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Method Type	Method	Validity/Scientific Rigor	Family	Replicability/Auditability	Application	Evaluation of Methodology	Other Issues
1	Randomized control	High	High	Difficult to replicate and audit; need another randomized group	Requires untouched, randomized control group. Metric in the intervention group is compared with the same metric in the control group, and the difference is assigned to the effect of the intervention.	Gold Standard" method, although requires deconvolution of equivalence, based for insured claims results in delays in evaluations.	Practical to implement and avoids adjustment issues, although requires sufficient number of members. However, health plans are difficult to implement and potentially unethical. Randomization must occur at the population level if results are to be applied to the population.
2	Temporal (historical) control	High	High	Replicable and auditable	Requires population chosen according to identical rules from two periods. Metric from the intervention period is compared with the same metric from the baseline period, adjusted with trend. Requires adjustment of the comparison population to be equivalent to the intervention population.	According the most widespread methodology in the industry. Need for insured claims results in delays in evaluations.	Implicit assumption that regression to the mean is uniformly distributed in the baseline and intervention periods, and that a cohort trend estimate is available.
3	Geographic or product line control	High/Medium	High/Low	Replicable and auditable	Requires population chosen according to identical rules from two different groups (e.g. geographies). Metric from the intervention period is compared with the same metric from the control, adjusted for all appropriate risk factor differences.	No widely used.	Sometimes difficult to adjust for the many risk factors that affect a population and its utilization (see Paper 10).
4	"Patient as their own control"	Low	High	Replicable and auditable	Patients are identified pre-intervention and then followed post-intervention. Pre-intervention metrics are compared with post-intervention metrics.	Widely used, but regression to the mean biases are masking post-trends to re-evaluate (see Paper 23).	Theoretically possible to correct for the effect of regression, but no method has yet been developed to do so.
5	Participant vs. Non-participant	Low	High	Replicable and auditable	Patients are invited to enroll in a program. Those who choose to enroll are subject to treatment; those who choose not to enroll form the control group.	Widely used, but selection bias makes the methodology to be highly suspect.	Theoretically possible to correct for the effect of selection bias, the effect of a member's "willingness to change" is unmeasurable.

Method Type	Method	Validity/Scientific Rigor	Family	Replicability/Auditability	Application	Evaluation of Methodology	Other Issues
6	Service Provider (also called pre-intervention control)	Medium	High	May be difficult to replicate; auditable	Record intent of different patients, track for a period of time to determine actual outcome, and assign a dollar value to the recorded progress (such as case management, if any).	Frequently used for small, highly-specialized programs (such as case management).	This issue: participant bias (participants who are more likely to change their minds seek information and support) and evaluation and recording of intent is subjective.
7	Clinical improvement method	Medium	Medium	Difficult to replicate; difficult to audit; comparable clinical results	Measure clinical improvement and estimate financial savings using a model based on the difference in cost of well-managed and other results.	Useful for small volume studies and when a result is required more quickly than data-based evaluation.	Requires review of the significant literature on clinical improvement, and a method for projecting financial from clinical improvement. To our knowledge there is no comparative study of results of clinical improvement and other methods.
8	Regression-discontinuity	Unknown	Low	Replicable and auditable	A regression line is fitted on the relationship between Year 1 and Year 2 costs in a population. Year 1 and Year 2 costs for the intervention group are then fitted and compared. A "jump" in the regression line indicates that the intervention has had an effect.	Highly-regarded as a theoretical method in the specific literature, but we are not aware of a specific practical DM application.	To be determined.
9	Time-series	Low	Low	Replicable and auditable	Extension of the Adjusted historical control methodology to multiple periods.	Not widely used in commercial evaluations.	The effect of changes in risk-factors (often reflected in variations in Trend) is compounded over a period of years, making it very difficult to control the calculation.
10	Benchmark	Low	Low	Replicable, difficult to audit; comparison data	Metric in the intervention group is compared with the same metric in another group/population. The difference is assigned to the effect of the intervention and savings are estimated accordingly.	Occasionally encountered in commercial applications.	Comparison populations are unlikely to be described in sufficient detail to determine their degree of comparability for the extent to which adjustment is required.

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6: An actuarial methodology for DM savings evaluation

- Most commonly-used in the industry: a trend-adjusted historical control methodology.
- Trend = actuarial concept.
- Other adjustments (plan design, geography, age/sex) = actuarial concepts.
- Simple Example:

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

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7: Trend Assumptions – Before we start

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Because you are all actuaries, a trend question.....
Which of the following is True?

- A. Chronic Member Trend is HIGHER than Non-chronic Member Trend.
- B. Chronic Member Trend is LOWER than Non-chronic Member Trend.
- C. Chronic and Non-chronic Trends are about the SAME.

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7: Data/Methods

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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
- CAD

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7: Trend Results

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Average 3-year trends*

Chronic	5.6%
Non-chronic	13.8%
Population	16.0%

* Prospective chronic identification

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7: Costs and Trends using "Prospective chronic" Identification						
SOLUCIA, INC.	Chronic					
	Year	Member Months	Prevalence	Chronic Cost PMPM	Chronic Cost Trend	Total Chronic Cost (\$'000)
	1999	463,198	4.1%	\$ 745.87		\$ 945,483
	2000	701,398	6.0%	\$ 746.42	0.1%	\$ 523,538
	2001	846,883	7.0%	\$ 820.27	8.2%	\$ 693,856
	2002	890,646	8.6%	\$ 879.71	7.2%	\$ 871,485
	3-Year Annualized				5.6%	
	Non-Chronic					
	Year	Member Months		Non-Chronic Cost PMPM	Non-Chronic Cost Trend	Total Non-Chronic Cost (\$'000)
	1999	10,956,779		\$ 186.26		\$ 2,040,886
	2000	11,067,274		\$ 211.41	13.5%	\$ 2,339,693
	2001	11,241,633		\$ 242.83	14.2%	\$ 2,729,790
	2002	10,591,169		\$ 274.44	13.0%	\$ 2,908,654
	3-Year Annualized				13.8%	
	Total					
	Year	Member Months		Total Cost PMPM	Total Cost Trend	Total Cost (\$'000)
	1999	11,419,975		\$ 206.96		\$ 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

7: Trend Results - Alternatives	
SOLUCIA, INC.	Adjusted for high-cost outliers
	Average 3-year trends*
	Chronic 4.9%
	Non-chronic 13.9%
	Population 16.2%
	* Prospective chronic identification

7: Trend Results - Alternatives	
SOLUCIA, INC.	Adjusted for chronic service mix*
	Non-chronic, unadjusted 13.8%
	Non-chronic, adjusted 13.2%
	* Prospective chronic identification

7: Chronic vs. Non-chronic trend with retrospective classification				
SOLUCIA, INC.	Chronic			
	Year	Men 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	Men 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	Men 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%

7: Application of Risk Adjustment (DxCG prospective risk score)		
SOLUCIA, INC.	Average 3-year trends*	
	Chronic	12.5%
	Non-chronic	11.9%
	* Prospective chronic identification	
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7: Conclusions	
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	• 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".
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7: Conclusions

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- Some obvious adjustments (for catastrophic claims and for differences in services) do not affect the trend differences 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.

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7: Conclusions - Postscript

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In a paper published subsequently, we demonstrate that equivalence requires adjustment – not only of the trend calculation, but also of the intervention population.

We address ways to do this in a paper in the Journal *Disease Management* which is reproduced in a forthcoming book.

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7: Conclusions for DM purchasers

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- 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.

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8: Application to Health Plan DM Data

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- 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 (over-65) members.
- Study period 10/1/2001-9/30/2003.

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8: Application to Health Plan DM Data

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- Base-case (per Paper 6) 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.

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8: Alternative Scenarios

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

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8: Application to Health Plan DM Data

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- Savings results can vary considerably depending on identification, method, and assumptions.
- 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 requalification" assumption.
- Many purchasers want to know the results by disease.

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9: Wellness Programs

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- Wellness Programs are the fastest-growing area in employer-sponsored interventions in the US.
- Common program components are:
 - Assessment through HRA;
 - Interventions such as DM, nutrition coaching, substance abuse counseling, health information, etc.;
 - Distribution channel (coaches/electronic/paper, etc.);
 - Biometric testing/collection;
 - Integration with other programs (DM, case management, disability management etc.);
 - Outcomes measurement.

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9: Wellness Program Measures

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	Health Measure Risk		Health Measure Risk
Self reported measures	Exercise	Biometric measures	Weight
	Alcohol Consumption		Blood glucose
	Nutrition		Cholesterol
	Current tobacco use		Blood Pressure
	Former tobacco use	Other	Chronic Disease History
	Stress		Influenza/ Pneumonia
	Height/Weight (BMI)		"Confidence"
	Depression		
	Perception of health		
	Safety belt use		
	Use of drugs for relaxation		
	Illness days		

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9: Wellness Program Value

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- Regression analysis of the relationship between risk factors and claims costs (Female Model example).

Risk Factor	Coefficient	Risk Factor	Coefficient
1. Intercept	\$ 190	9. Pregnancy status/plan	\$ 590
2. History of COPD, CHF, CHD, PCD or Stroke	10.553	10. Body Mass Index	118
3. Sigmoidoscopy within the last 5 years?	2.045	11. Moderate intensity exercise-min. per day	(46)
4. Influenza in last 12 months?	1.176	12. In the last month, how often injured?	1.632
5. Never diagnosed any of 27 major conditions?	(1.220)	13. Rate confidence on annual skin check	224
6. TIA, HA, Angina, Breast Cancer, Emphysema	2.589	14. High intensity activities? (hrs/week)	(306)
7. Pneumonia	1.118	15. Servings of grain per day?	(868)
8. Currently planning hormone replacement therapy?	999	16. Rate confidence to not smoke when blue	(294)

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Conclusion

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An important and growing area for health payers, irrespective of system.

An opportunity for actuaries, if we want to take it.

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Questions?

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THANK YOU FOR YOUR PARTICIPATION

Ian Duncan, FSA FIA FCIA MAAA
Solucia Ltd.
#4, 16 Cadogan Gardens
London SW3 2RS
US: (001) 860-614-3295
UK: 07726 283 331

iduncan@soluciaconsulting.com
www.soluciaconsulting.com

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