Professional Series

Healthcare Risk Adjustment AND Predictive Modeling

Ian Duncan, FSA, FIA, FCIA, MAAA

ACTEX Publications, Inc.
Winsted, CT

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ACTEX Publications
PO Box 974
Winsted, CT 06098

Manufactured in the United States of America

10 9 8 7 6 5 4 3 2 1

Cover design by Christine Phelps

Library of Congress Cataloging-in-Publication Data

Duncan, Ian G., 1950-
Healthcare risk adjustment and predictive modeling / Ian Duncan.
p. ; cm.
Includes bibliographical references and index.
ISBN 978-1-56698-769-1 (pbk. : alk. paper) 1. Health risk assessment. 2. Medical care, Cost of. 3. Health status indicators. I. Title. [DNLM: 1. Risk Adjustment--methods. 2. Health Care Costs--trends. 3. Health Care Reform. 4. Health Status Indicators. 5. Models, Statistical. W 84.4]
RA427.3.D87 2011
368.4'2012--dc22
2011014188

ISBN: 978-1-56698-769-1

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SECTION ONE
INTRODUCTION AND BACKGROUND 1

FOREWORD

Regina Herzlinger
Professor of Business Administration
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What percentage of healthy people will become catastrophically ill one year later? And what percentage of the chronically or catastrophically ill will become healthy a year later?

Hint: The right answer is not zero.

Give up? The answer is in Ian Duncan's analysis – a surprisingly high 20% and 15% respectively. *Healthcare Risk Adjustment and Predictive Modeling* is full of interesting statistics like these. But this book contains much more than that.

As healthcare payers increasingly require providers to accept pay for performance or bundled payments for episodes of care, disease or disability focused bundles, or even global care, it is important to separate payments for things providers can control (their medical management) from those they cannot (the underlying health status of the enrollees and acts of God). The ability to differentiate payment for *performance* from payment for *health risk* is important for health care policy makers, related academics, and think tanks as well.

Ian Duncan had previously literally written THE book on the evaluation of intervention programs (you see it on the bookshelf of every disease manager for example). And now as bundled payments and P4P loom, he has performed the same valuable service for health risk analysis.

The analytical techniques Duncan discusses range from the readily approachable, requiring no more than basic algebra and calculus knowledge – various grouping methodologies, statistical regression analytics, parsing decision trees – to artificial neural networks (don't ask). But to be useful this kind of book must be a blend of mathematics and pragmatism. Have no fear. A series of concluding chapters provides helpful case studies on how to use health risk analysis for designing programs in health care reform initiatives (such as the "Connector," the Massachusetts version of an Exchange) and evaluating provider efficiency, with vivid examples drawn from both U.S. and Europe.

All in all, this is the work of a superbly mathematical yet practical mind:

- A brilliant exposition of analytical techniques, coupled with
- A masterful explanation of how to apply health risk analysis in a series of relevant, real world case studies.

Regina E. Herzlinger is the Nancy R. McPherson Professor of Business Administration at the Harvard Business School. She was the first woman to be tenured and chaired at Harvard Business School and the first to serve on a number of corporate boards. She is widely recognized for her innovative research in health care, including her early predictions of the unraveling of managed care and the rise of consumer-driven health care, a term that she coined. *Money* has dubbed her the "Godmother" of consumer-driven health care.

PREFACE

This book resulted from a brief conversation with Nancy Turnbull of the Harvard School of Public Health, my colleague on the Board of the Massachusetts Health Insurance Connector Authority, and Associate Dean of the Harvard School of Public Health. Risk Adjustment of payments to health plans is a topic discussed by the board from time to time, and Nancy suggested that, as the momentum for national health reform built in 2008-9, a text on predictive modeling and risk adjustment would provide a timely and useful contribution to the practical implementation of reform. I had conducted seminars for the Society of Actuaries on healthcare predictive modeling and risk adjustment for a number of years, so the basic material existed. As with my previous book, *Managing and Evaluating Healthcare Intervention Programs* (ACTEX Publications, 2008) the rounding out of the basic material required contributions from a number of individuals. I would like to recognize and thank those individuals who have made contributions to the writing or review of early drafts of this book.

A number of co-authors and research assistants have contributed to different chapters. Primary among these is my colleague Qijuan (Emily) Li, MPH of Solucia Consulting, who has performed data analysis and constructed the examples in this book using Solucia's extensive health claims databases. Other Solucia colleagues who have made contributions are Tamim Ahmed, PhD, MBA; Christian Birkmeyer, MS; Mark Howland, ASA, MAAA; Arthur Robb, PhD; Lisa Tomei, MS; and Greger Vigen, FSA, MBA. Outside of Solucia Consulting, contributors to chapters are Professors Xiaogang Su, PhD, School of Nursing of the University of Alabama at Birmingham and Wu-Chyuan Gau, PhD, ASA, Department of Mathematics and Actuarial Science, Robert Morris University, to whom I am indebted for the statistical chapters (Chapters 7 through 12). I am also grateful to my able TA at the UCSB Department of Statistics and Applied Probability, Nate Bennett, PhD, for proof-reading the statistical chapters.

Others who have contributed to different chapters are:

Chapter 6: Development of DRGs: Henry Dove, PhD, MBA; Yale University.

Chapter 13: Medicaid Risk Adjusters: Ross Winkelman, FSA, MAAA; Wakely Consulting.

Chapter 14: Medicare Advantage and HCCs: Jim Galasso, FSA, MAAA, CERA; Actuarial Modeling.

Chapter 15: Health Care Reform – the Example of Massachusetts: Jonathan Gruber PhD, Professor of Economics, Massachusetts Institute of Technology and board member, Massachusetts Health Insurance Connector Authority.

Chapter 20: Predictive Modeling and Risk adjustment in the UK and Europe: Geraint Lewis, MB BChirg FRCP FFPH and Martin Bardsley, PhD, of the Nuffield Trust, London contributed to the section on the United Kingdom. Other parts of this chapter are taken from material published in *Contingencies*, the periodical of the American Academy of Actuaries and are used with permission of the Academy. The Section on Israel was contributed by Yair Babad, PhD, Emeritus Professor of the University of Illinois at Chicago and the Section on Risk Adjustment in South Africa contains contributions from Barry Childs, FIA and Francois Millard, FSA, FIA, MAAA.

As with other actuarial texts, the active participation of a number of reviewers was also valuable. I must thank the reviewers for this book for their time and helpful comments.

Joan Barrett, FSA, MAAA; United Healthcare
Michael Cousins, PhD; CIGNA
P. Anthony Hammond, FSA, MAAA; Humana
Margery Rosenberg, PhD, FSA, MAAA; University of Wisconsin
Laurence Weissbrot, FSA, MAAA; Northeast Delta Dental
Ross Winkelman, FSA, MAAA; Wakely Consulting
Ruthann Woodley, FSA, MAA; Ruark Consulting

As always, great credit for setting and reviewing the text go to my publisher and editor, Gail Hall, FSA, MAAA, and format editor, Marilyn Baleshiski of ACTEX Publications.

And last but not least, this book is dedicated to my wife, Janet Duncan FCAS, MAAA, who has (again) had to spend weekends alone while I worked on another book about health insurance.

Ian Duncan FSA, FIA, FCIA, MAAA
Chicago, IL and Santa Barbara, CA
April 2011

A Guide to the Contents of this Book

The first two Chapters are background reading that cover the essentials of health risk, a key concept that must be understood before any risk adjustment or predictive modeling may be performed. Chapter 3 covers claims data in a great deal of detail - probably more detail than the average actuary or analyst is accustomed to. Since health claims data is the raw material for so much modeling, mastering its nuances is a valuable skill for actuaries and other health professionals.

Chapters 4 and 5 cover two sides of the same issue: if you are going to identify patients or health plan members with a particular condition from claims, how do you do it? You either build an algorithm (Chapter 4) or use a clinical grouper (Chapter 5). Understanding how these groupers and algorithms are constructed is an important component of model building. Chapter 6 discusses in more detail the development of some commonly-encountered models. Chapters 7 through 12 are technical chapters, covering different models. We provide a test data set, and suggest a number of different analytical systems, including R (freeware) for those readers who want to test out different models with the test data.

Chapters 13 through 20 are case studies that cover different predictive modeling and risk adjustment examples, ranging from Medicare and Medicaid through provider profiling and creation of models for different care management uses. We end with a brief survey of predictive modeling and risk adjustment in the United Kingdom, Europe, Israel, and South Africa.

17 PROVIDER EFFICIENCY ASSESSMENT AND REIMBURSEMENT USING RISK ADJUSTMENT

In the first part of this chapter we look at the use of different risk adjuster models as part of an assessment of provider efficiency and reimbursement. In the second part, we examine the impact of care management on risk adjusters and the potential for provider practice and care management to confound the efficiency assessment and reimbursement calculations that use risk adjustment.

17.1 PROVIDER EFFICIENCY ASSESSMENT

Overview

The core concept in provider assessment is the measurement of all resources and related costs of treatment used for specific patients. The newer techniques assess and compare various providers with respect to cost and utilization of their patient panels. They also normalize for the illness of the patient, and group illnesses into similar categories. Current methods adjust for risk and/or severity by normalizing potential differences in the underlying morbidity of a provider's patients or actual cost and utilization, and then compare these results with those of the provider's peers (or other providers who treat the same diagnoses, either from a different specialty or a different geography). An efficient provider is one who uses fewer or less costly resources to treat patients after normalizing for the patient risk profile.

In addition to adjustments for relative risk of the patient population, consideration should be given to other factors that may influence resource utilization and cost, such as plan design and geographic location. In some model types, comparisons are made narrowly to ensure comparability between the patient populations. In other models (particularly where populations are smaller) adjustments may have to be made to ensure comparability.

A number of provider assessment and reimbursement models have been developed. There are two principal models, one an episode-based approach, and the other a Risk-score based approach. On more complex assignments, both of these approaches may be used.

Three common Episode Groupers that may be used for this purpose are: Episode Treatment Groups (ETGs) from Ingenix (see Chapter 6), Cave Consulting's Marketbasket System, and Thompson Medstat's Medical Episode Grouper (MEG).

17.1.1 EPISODE BASED MODELS

In an episode-based model, all episodes for members are assessed and assigned a level of severity. Each episode contains a relative weight or "score" that represents the relative resource use that may be expected for an individual with the specific diagnosis(es).

These episodes for each member are then attributed back to physicians. Attribution of members to providers may range from the simple (all members have HMO coverage and are required to register with a primary care physician) to the complex (members are in an open access plan such as a PPO and may choose to see numerous primary care and specialty physicians, often at the same time). The method used may depend on the ultimate purpose of the analysis (for example, an evaluation of each individual provider or the entire provider group). Multiple physician identifiers (e.g. tax identity numbers) even within the same practice make the identification of unique physicians challenging as well. Physician specialty may also help to identify the "medical home" for the member, although physician specialty is not always coded unambiguously. Algorithms may help with the assignment in the latter case. One example: the physician most recently consulted (within a certain time window, perhaps with a minimum number of encounters during that time) or physician who has billed the most in claims over a period of time. If the patient has experienced surgical episodes, another approach is to attribute such episodes to the surgeon with the highest allowed charges.

An average or predicted cost is calculated based on the cost of all providers within the comparison population for the specific episode and episode severity combination. Expected cost could be calculated based on either the average cost across the entire health plan (all provider groups) or a normative cost (what the cost "should" be for that episode). A lower-cost geography can be used, for example, as the basis for comparison. Each provider's expected cost to treat members with the episode and severity defined by the member's underlying condition profile is then compared with the provider's actual cost for that mix of members and episodes.

An example of an individual provider calculation is shown in Table 17.1. In this example, Level 1 represents lowest risk, and Level 4 represents highest risk patients. The provider is relatively inefficient at treating diabetes patients, because the provider's overall Actual/Expected Cost ratio is 1.07, implying that the provider's costs are 7% higher than that of the peer group on a risk-adjusted basis. (The comparison takes into account the severity distribution of the provider's panel.) The provider, however, is increasingly more efficient at treating patients as the risk level increases, as evidenced by the ratio of actual to expected costs by Severity Level.

TABLE 17.1

Example of Provider Efficiency Measurement Using Episodes

Episode	Severity Level	Number of Episodes	Actual Cost per Episode	Expected Cost per Episode	Total Actual Costs	Total Expected Costs	Ratio
Diabetes	1	45	$ 4,825	$ 4,200	$ 217,125	$ 189,000	1.15
Diabetes	2	75	$ 3,125	$ 2,800	$ 234,375	$ 210,000	1.12
Diabetes	3	125	$ 2,129	$ 2,000	$ 266,125	$ 250,000	1.06
Diabetes	4	165	$ 1,112	$ 1,150	$ 183,480	$ 189,750	0.97
Diabetes	All	410	$ 2,198	$ 2,046	$ 901,105	$ 838,750	1.07

As the example shows, the expected cost per episode varies by more than 100% across different diabetes severity levels. A severity adjustment methodology is required for the Episodes because of differences in severity and treatment within each episode. The advantages and disadvantages of these adjustments are beyond the scope of this book. The interested reader should consult the Society of Actuaries study (Duncan, Vigen and Coughlin [23]).

One common episode grouper approach involves eight steps:

1. Create episodes of care. Assign claims to appropriate episodes using an appropriate Episode Grouper Software.

2. Address outliers. Remove the highest and lowest cost episodes of care (if desired).

3. Attribution. There are different ways to attribute episodes to providers. Many involve a hierarchical algorithm of some sort. As might be expected, assignment of a single provider can become challenging. The method used may depend on the ultimate purpose of the analysis (an evaluation of each individual provider or the entire provider group, for example). One approach is to attribute s*urgical episodes* to the surgeon with the highest allowed charges. If the episode is *non-surgical*, the physician with the highest number of visits, most recent services or highest dollar services can receive the attribution of the episode.

4. Expected cost per episode (case-mix adjusted). The episodes of care for individual patients are adjusted for severity based on age, co-morbidities, and complications. Additional variables may be added to the case mix (such as benefit, product, year of service, pharmacy rider, gender) in the efficiency measurement. A case-mix adjusted expected cost per episode for each specialty, market, and commonly managed type of episode is calculated based on actual observed costs in that market. The expected amount is then assigned to each episode of care in the same specialty, market, and episode type.

5. Physician total episode cost. Each physician's total episode cost is calculated.

6. Physician expected episode cost. Each physician's total "expected" episode cost is calculated, consistent with the decisions discussed in earlier steps. In many cases, this average cost is weighted by the mix of episodes to determine the expected cost for the physician.

Additional normative adjustments may be used to reflect a market basket of episodes, regional results, a broader data base, or adjustments for unit price differences to create an alternative estimate of what the cost for that episode "should" be.

7. Physician composite index. The physician's cost for each episode and the expected cost for each episode are used to create a composite index. The composite index represents the individual physician's severity-adjusted comparison of costs to same-specialty, same-geographic area peers treating the same or similar condition.

8. Efficiency and statistical significance. Each physician's composite index is compared to the peer average. A statistical analysis, such as confidence intervals, can be applied to the composite index to determine if the physician's composite score is significantly different from the peer average.

Comparison between Actual and Expected cost of treating each provider panel's members allows the assessment of provider efficiency (Current Performance "Ratio"). Depending on the efficiency of the provider group, a payer may include or exclude certain provider practices from a network, or pay a bonus to the better-performing practices for achieving higher efficiency.

17.1.2 POPULATION-BASED COMPARISONS

An alternative model that has been used for provider assessment and reimbursement is a Population-based calculation in which the experience of the provider group is compared with that of a larger comparison population. This is used when a provider group is credibly-sized, or operates a "**Medical Home**" model (accepting responsibility for all the care of a group of members, often those with Chronic conditions).

A number of risk factors will, of course, differ between the provider group population and the comparison population. These risk factors typically include issues such as condition-based risk profile, facilities (for inpatient or rehabilitation services), geography or benefit plan. It may be appropriate to make an adjustment for differences in the condition-based risk profiles. Other adjustments can be used depending on the responsibility of the provider. If the provider is responsible to channel members to lower-cost institutions, it would not be appropriate to remove (for example) differential use of facilities.

Once the (adjusted) population cost is calculated, it is possible to determine whether the provider group is more efficient (lower cost) or less efficient (higher cost) than the comparison group.

An example of this model is shown in Table 17.2 which provides the basic data used for the provider calculation that follows in Table 17.3. Note that this calculation uses net paid cost PMPM (and then applies a benefit differential adjustment). Alternatively, the calculation could be based on the allowed charge level.

TABLE 17.2

Population-Based Provider Efficiency – Data			
Provider Group Population		**Comparison Population (Healthplan)**	
Number of Members	10,000	Number of Members	100,000
Average Concurrent Risk Score	1.10	Average Concurrent Risk Score	1.05
Cost PMPM	$500.00	Cost PMPM	$495.00
Relative value factors for Plan Design, Geography, etc.	0.99	Relative Value Factors for Plan Design, Geography, etc.	0.98

At first glance, it appears that the Comparison Population (health plan's) costs are lower than those of the Provider group population. Without further analysis we would conclude that the Provider group had lost $5.00 PMPM on each of its patients (compared with the Plan as the benchmark), or $600,000. However, as Table 17.2 shows, the provider group and plan member profiles are different and adjustments should be made. The Provider Group population has a higher Concurrent Risk Score than that of the Comparison (Healthplan) population. The Provider Group's average cost is also higher, as is the "relative value" factor (a measure of the other risk factors such as plan designs of Provider Group members and their geographic residence). We adjust the Comparison population's average cost ($495.00 PMPM) to normalize the risk and relative value factors and calculate the Provider Group's cost advantage or disadvantage.

TABLE 17.3

Population-Based Provider Efficiency - Calculation	
Comparison Population – Adjusted	
Cost PMPM $\$495.00 \times \frac{1.10}{1.05}$	$518.57
Risk Adjusted cost, adjusted for relative value $\left(\text{Cost PMPM} \times \frac{0.99}{0.98}\right)$	$523.86
Actual Population Cost	$500.00
Lower cost for this provider group	**($23.86)**

17.2 IMPACT OF PROVIDER PRACTICE AND CARE MANAGEMENT ON RISK ADJUSTMENT

The first part of this section describes the problem that may arise in the use of risk adjustment models due to the effect of provider practice or interventions on patient risk scores. The second part of the section describes an empirical study of the effect of a care management intervention program on risk scores, and the resulting effect of this program on estimated provider reimbursement.

Any model derived from condition-based risk adjustment relies crucially on the independence of the member's condition-based risk from the underlying medical treatment and other forms of patient support that the physician provides. The models that we reviewed previously depend on a number of factors. Two factors that tend to be overlooked are the independence between risk scores (and Episode risk levels) and provider practice patterns and interventions.

Why do clinical practice and intervention programs impact member risk scores? Before we consider the issue of independence in risk scores and the impact of care management, we will first review the discussion of complications, levels of risk and severity from Chapter 4 (Table 4.4). Table 17.4 reproduces some of the data from that chapter to illustrate the principle.

Table 17.4 shows an important practical issue. As a patient develops complications of the disease, the member's relative risk score (and associated cost) rises. This effect is particularly prevalent in chronic diseases which comprise a large subset of episodes. If a provider (or care management program) is successful in managing a patient's condition and if the member stays at level 1 (no complications) rather than acquiring complications such as renal manifestations or neurological damage, the member's relative risk will remain at 1.00 rather than increasing to 1.71 or 2.31. The impact of the member's lower risk score on the overall group risk is illustrated in Table 17.5.

TABLE 17.4

Condition Complications, Costs and Relative Risk Scores

Severity Level	Diagnosis Codes Included	Sample Descriptions	Average Cost	Relative Risk
1	250; 250.0	Uncomplicated diabetes	$10,664	1.00
2	250.5; 250.9; 362; 366.41; 648	Diabetes with ophthalmic Manifestations	$12,492	1.16
3	250.1; 250.3; 250.6; 250.7; 357.2	Diabetes with ketoacidosis; other coma; neurological damage	$18,267	1.71
4	250.2; 250.4	Diabetes with renal manifestations	$24,621	2.31
5	250.8	Diabetes with other specified Manifestations	$31,323	2.93

The issue of non-independence (or dependence) may now be clearly seen in the following example (which ignores cost inflation for simplicity):

TABLE 17.5

The Measurement Problem - The Intervention Impacts the Risk Score						
Scenario	**Risk Score (Year 1)**	**Risk Score (Year 2)**	**Cost (Year 1)**	**Cost (Year 2)**	**Risk-adjusted Cost (Year 1)**	**Risk-adjusted Cost (Year 2)**
1	1.00	1.25	$500.00	$625.00	$500.00	$500.00
2	1.00	1.25	$500.00	$595.00	$500.00	$476.00
3	1.00	1.10	$500.00	$595.00	$500.00	$540.91

This example illustrates the same member under three different scenarios.

1. In Scenario 1, the member is not managed by any type of program or intervention, and the member's condition deteriorates over time. From Year 1 to Year 2, the deterioration in the member's condition (as a result of perhaps additional co-morbidities) results in a higher risk score at the same time that the member experiences higher cost of care.

2. In Scenario 2, the member participates in an intervention program (or more focused provider-based care). In this scenario, the member continues to have the same conditions present in the member record, which in turn drive the same risk score as in Scenario 1. The member exhibits the same condition-based risk score as in Scenario 1, but experiences lower cost outcomes than in Scenario 1.

3. In Scenario 3, the member experiences lower cost outcomes, as in Scenario 2, but the member's risk score, while it increases, does not increase as much as in Scenarios 1and 2. This difference could be as a result of the care that the member receives, which prevents the member migrating to more severe forms of a condition, or acquiring additional co-morbidities.

The impact of these three situations can be seen by calculating Risk-adjusted costs for Year 1 and Year 2. Savings are equal to:

Year 2 Risk Score/ Year 1 Risk Score

Year 2 Cost **Year 1 Cost**

$$\text{Scenario 1:} \quad \frac{\$625}{1.25/1.00} - \$500 = \$500 - \$500 = \$0$$

$$\text{Scenario 2:} \quad \frac{\$595}{1.25/1.00} - \$500 = \$476 - \$500 = (\$24)$$

$$\text{Scenario 3:} \quad \frac{\$595}{1.10/1.00} - \$500 = \$540.91 - \$500 = \$40.91$$

Scenarios 2 and 3 are identical except that the member risk score is only 1.10, not the 1.25 that was previously calculated.

In Scenario 1, the increase in cost mirrors the increase in member risk score; thus there are no program- or provider-driven "savings."

In Scenario 2, the Risk-adjusted costs fall from Year 1 to Year 2 by $24 PMPM, reflecting the impact of a program or provider driven care.

But in Scenario 3, in which provider intervention actually results in a decline in *both* cost and risk score, the Risk-adjusted cost actually *increases*, implying that the intervention has increased the cost of care. Since we know that the reduction in member risk score is a result of provider driven actions, and the member's cost would have been $625.00 PMPM if the member had received no focused care, we have an anomalous result - the provider's care management actually appears to have *increased* rather than decreased the risk-adjusted cost of care. This anomaly results from the lack of independence of the condition-based risk adjuster model from the medical care the member receives. In the next section we will examine an actual example of this in a real-life situation, and suggest a method that corrects for the anomaly.

17.3 AN EMPIRICAL STUDY OF PROVIDER REIMBURSEMENT AND INDEPENDENCE OF OUTCOMES

17.3.1 BACKGROUND

A physician group has, for a number of years, provided care management services to its patients who are also members of a large health plan. The physician group is paid a bonus based on the savings that result from its patient management and care co-ordination services. The savings that accrue within the provider group population are calculated using a Population-based comparison method (method 2, as discussed in Section 17.1.2). We illustrate the impact on the calculation of the Physician group's outcomes of the physicians' interventions. Data in Table 17.6 represents an actual calculation of savings (that is, not the illustrative data in Section 17.1.2).

For some years, the ongoing savings calculations showed a disproportionate impact on the provider group's population risk, potentially affecting the savings calculation. An analysis of the differential trends in risk scores between the plan and provider group populations shows that there appears to be some effect of the care coordination interventions on risk. An example of the observed differences is shown in Table 17.6.

17.3.2 RESULTS

TABLE 17.6

Comparison of Physician Group and Health Plan Risk Score Trends Over Time

Year	Provider Group			Plan			Difference
	Year 1	Year 2	Trend	Year 1	Year 2	Trend	
2005-6	1.341	1.585	18.2%	1.347	1.596	18.5%	-0.3%
2006-7	1.497	1.623	8.4%	1.498	1.666	11.2%	-2.8%
2007-8	1.558	1.699	9.1%	1.563	1.765	12.9%	-3.9%

Table 17.6 shows the first year and following year risk scores for cohorts of health plan members. The same risk adjustment model is used in each year. Patients of the physician group are actively managed by providers; the Plan population receives "normal care." In Table 17.6, we report the average risk score of members who were continuously-enrolled in Year 1 and Year 2 for each cohort; so (for example) the 2005-6 Provider group members have an average risk score of 1.341 in 2005 and 1.585 in 2006. The risk score trend is relatively high, consistent with the closed cohort. We illustrate these observations graphically in Figure 17.1. For each year-cohort the physician group population risk scores increase more slowly, with the amount of the divergence growing over time from 0.2% to 3.9%.

Comparison Between Provider Group and Health Plan Risk Score Trends Over Time (Population Comparison)

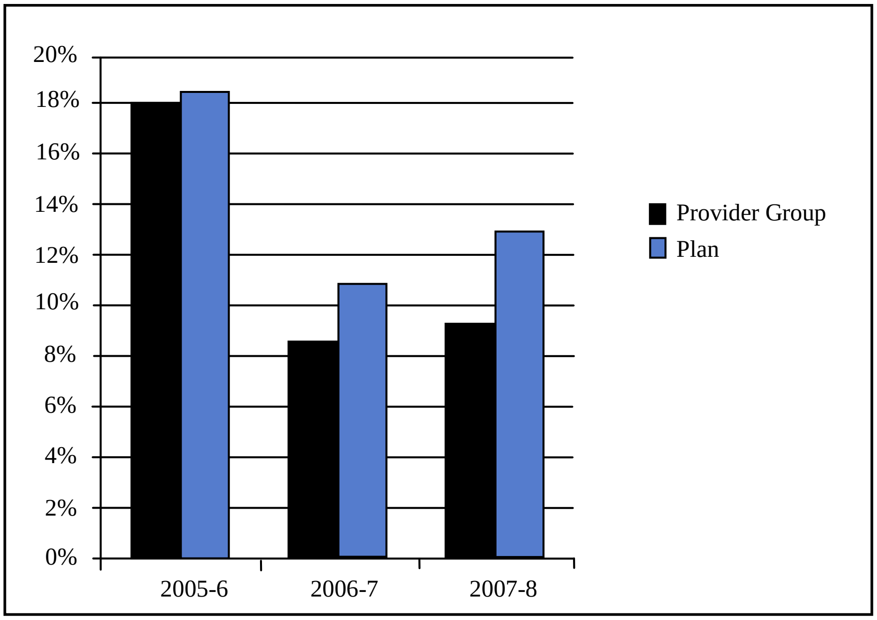

FIGURE 17.1

Table 17.6 and Figure 17.1 show the one year trends in risk scores in the two populations. The population that is included in each year consists of members who continue in enrollment from the prior year, as well as new members who enter the group prior to the start of the following year. In Table 17.7 and Figure 17.2, we track risk scores trends over time in a single cohort of members who were continuously enrolled between 2005 and 2008. Note that the definition of the cohorts differs between Table 17.6 and Table 17.7: in Table 17.6, the cohort is re-defined for each of years 2005, 2006 and 2007, and then the risk-level of the same cohort is measured in the following year. In Table 17.7, a single cohort is defined in 2005 and tracked through successive years to 2008.

TABLE 17.7

Risk Score trends in Provider Group and Health Plan Cohorts			
	Year	**Provider Group**	**Plan**
Scores	2005	1.34	1.31
	2006	1.51	1.52
	2007	1.61	1.66
	2008	1.76	1.87
Trends	2006/2005	12.8%	17.2%
	2007/2006	6.7%	9.4%
	2008/2007	9.0%	12.7%
	2008/2005	31.1%	43.2%
Annualized Risk Score trends (4 year):		9.5%	12.6%

Trends in Risk Scores in Cohorts over time
(Cohort Comparison)

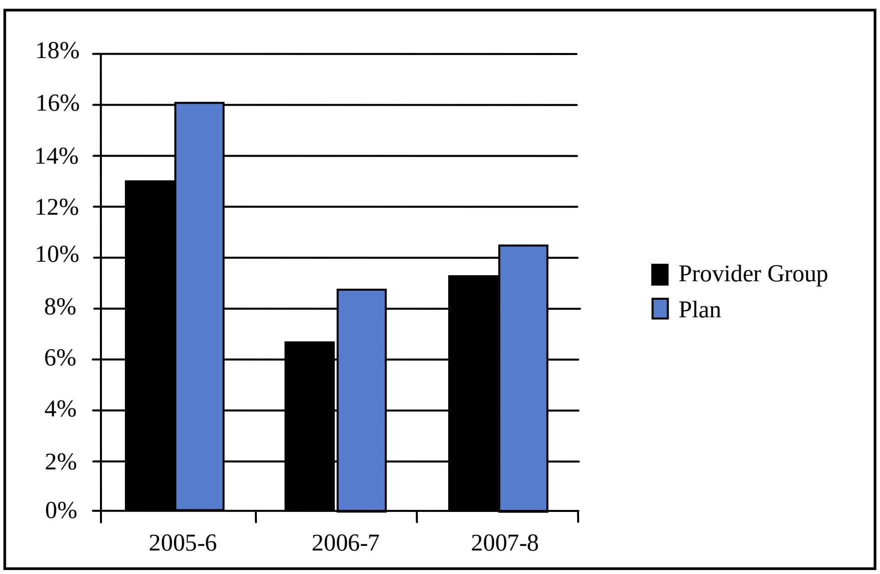

FIGURE 17.2

A similar result is seen in the Diabetes sub-populations. Table 17.8 and Figure 17.3 show the trends in risk scores in the Diabetes-only population only.

TABLE 17.8

Risk Score trends in Provider Group and Health Plan Diabetes Cohorts			
	Year	**Provider Group**	**Plan**
Scores	2005	3.05	2.73
	2006	3.33	3.30
	2007	3.66	3.65
	2008	3.96	4.12
Trends	2006/2005	9.4%	20.7%
	2007/2006	9.9%	10.7%
	2008/2007	8.3%	12.9%
	2008/2005	30.1%	50.9%
Annualized Risk Score trends (4 year):		9.2%	14.7%

Figure 17.3 shows the absolute values of the Risk Scores in the Diabetes Populations of the Plan and the Provider Group over 4 years.

Risk Scores in Diabetes Cohorts Over Time

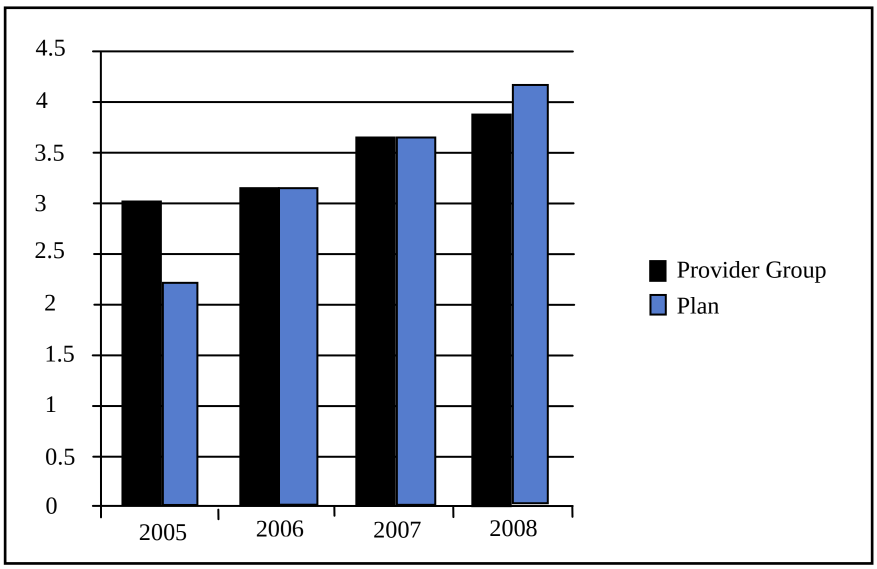

FIGURE 17.3

Figure 17.4 shows trends in Risk Scores in the Diabetes Populations of the Plan and the Provider Group over 4 years.

Trends in Risk Scores in Diabetes Cohorts Over Time

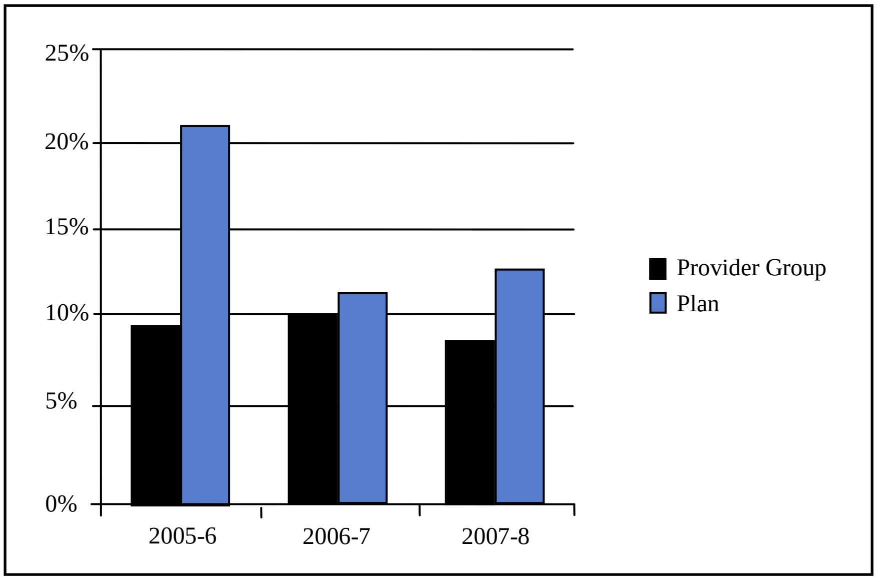

FIGURE 17.4

17.3.3 IMPLICATIONS OF THESE RESULTS

The practical implications of the dependence of risk scores on interventions was previously illustrated in Table.17.5. The lack of independence of risk scores and a provider's management of his patients means that a physician must be cautious when using risk adjustment alone to ensure comparability between different populations. The proposed Exchanges under the new healthcare reform law (*Patient Protection and Affordable Care Act* (PL 111-148) are intended to use risk-adjustment to re-allocate funds between insurers and providers to offset selection on the part of members. The results of this section suggest that an insurer or provider entering a risk-adjustment arrangement with a payer should carefully weigh the requirements (is the provider responsible for actively managing the member's care?). The potential for the provider's care to impact reimbursement through a reduction in risk score needs to be considered when developing contracts.

One method that could be used to allow for non-independence of Risk Scores is to use an external risk score trend, such as that of the comparison (health plan) population. Applying this method to the data of Table 17.5:

TABLE 17.9

Risk Score Adjustment to Correct for the Impact of Care Management on Risk Scores					
Scenario	**Risk Score (Year 1)**	**Risk Score (Year 2)**	**Cost PMPM (Year 1)**	**Cost PMPM (Year 2)**	**Risk Adjusted Cost PMPM (Year 2)**
1	1.00	1.25	$ 500.00	$ 625.00	$ 500.00
2	1.00	1.25	$ 500.00	$ 595.00	$ 476.00
3	1.00	1.10	$ 500.00	$ 595.00	$ 540.91
3 (revised)	1.00	1.25*	$ 500.00	$ 595.00	$ 476.00
* 1.25 = 1.00 x 1.25/1.00					

The revised Year 2 risk score is calculated by using the Population Risk score trend (1.25/1.00) and applying this trend to the baseline Risk Score. Applying this correction we calculate the numbers in Table 17.9, Line 3 (revised). The result is an overall savings in Cost, compared with an overall loss using the adjusted costs based on risk scores that are potentially affected by providers and their management.

17.4 IMPLICATIONS FOR EXCHANGES

The implications of this analysis are profound at a time when the U.S. is implementing "Obamacare" (*The Patient Protection and Affordable Care Act* (PL 111-148). One provision of the proposed Exchanges is that insurers will be held harmless, to some degree, for the risk selection that may result from members choosing different health plans. The proposed risk adjustment method will likely be similar to that currently used by CMS for Medicare Advantage plans and by Massachusetts for the Commonwealth Care program (see Chapters 14 and 15). In these models plans receive an adjusted rate based on the relative condition-based risk of members that they enroll. As this chapter shows, however, in an environment in which a plan is providing superior care management and constraining the relative risk of its members, the plan will be penalized because its risk score will be relatively lower than that of other, less-successful plans. As this chapter (which is based on real client data) shows, this is a real phenomenon. Use of risk adjustment without further consideration in the proposed exchanges could result in perverse incentives, because plans will be rewarded if their populations experience *increases* in risk scores, while plans that manage populations effectively could experience reductions in risk scores and lower reimbursements.

There are several ways to address this dilemma in Exchanges. In Table 17.9 we saw a method for adjusting risk scores based on an external risk score trend. This is unlikely to be available for an Exchange. Note that use of Prospective risk scores, as in the Massachusetts Exchange, does not address this issue, because a well-managed patient with fewer co-morbidities and lower risk score will contribute less to the relative risk score of the provider's group than a poorly-managed patient with a higher risk-score, and therefore attract relatively lower risk-based reimbursement.

An alternative method for correcting this problem would be to apply risk adjustment as described in Chapters 14 and 15, while at the same time rewarding a plan for either reducing its risk score below a trend adjusted level, or providing a pay-for-performance reward system to reward providers who are raising clinical and other process measures above a target level. The conclusion from this analysis is, however, that risk adjustment *alone* cannot be the basis of variable compensation of plans that participate in the exchanges.

17.5 CONCLUSIONS

There is an increasing interest in provider efficiency assessment as a building-block for efforts toward network design, provider reimbursement, payment reform models and, ultimately, healthcare reform. Depending on the specific need, different assessment models may be constructed, as illustrated in this chapter. The preceding section introduces an important cautionary note: all risk adjustment models depend crucially on the assumption that patient severity, as represented by risk score or severity level, is not affected by the provider's treatment or a program designed to manage the member's care. An empirical study, reported here, shows that this effect is not merely a theoretical possibility that an analyst may wish to examine in the course of performing a provider efficiency calculation. Treatments, such as surgical procedures or complications can produce a perverse result (an increase in risk score) at the same time that the treatment results in higher treatment costs, negating the value of the risk adjustment in producing comparability of populations.

Nevertheless, the use of risk adjustment is an important component of provider efficiency and quality assessment. There have been some major developments in measuring physician efficiency in recent years, resulting in assessments for all costs and procedures. Risk and severity adjustment tools are becoming more robust, and faster technology allows sensitivity testing. Some providers are using these techniques for their own internal improvement projects. Finally, these techniques are beginning to be applied in a variety of real world situations to improve affordability and reduce complication rates.