WAKELY RISK ASSESSMENT MODEL

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[A Working Paper]

This paper provides an overview of the Wakely Risk Assessment (W.R.A) model. The development, implementation, and performance of the model are discussed, in particular against the backdrop of healthcare reform. The paper includes an introductory discussion of implementation issues. For additional information including any updates to this paper, please visit **wramodel.com**.

wramodel.com

wakely.com

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1. INTRODUCTION

This white paper introduces the Wakely Risk Assessment (W.R.A) model. The paper focuses on the design, development, and performance of this model. Additional discussion includes desirable characteristics of a model that is intended to adjust payments, especially in the context of the risk adjustment program established under the Affordable Care Act (ACA).

This paper is intended to be introductory and relatively non-technical. While a number of concepts, issues, and ideas are discussed in the paper – their treatment is brief. References are provided for a more in-depth discussion of select topics.

The W.R.A model was developed to provide a transparent and a high-performance risk adjustment model for a commercial population. It is provided free of charge and is an open-source model.

Promoting the W.R.A model is not the main goal of this paper. A major theme in this paper is that while risk *assessment* is about statistical modeling – risk *adjustment* is about methodology and implementation. Implementation details are just as important, if not more, to the success of a risk adjustment program as a particular model or software that is used.

Implementation details include validating the model for a given population (including accuracy as a measure), the data that is used, the timing of the program, mechanisms to ensure consistent treatment across various sources of data, interaction with other rating factors and overall program design, etc. These are discussed briefly in this paper with regards to ACA.

The W.R.A model was designed keeping in mind typical implementation challenges. For example, the model requires basic data elements for risk assessment, elements that are captured relatively consistently in claim data. There was some focus on reporting model results in a fairly detailed manner to allow sufficiently in-depth actuarial analysis, including a limited number of key model diagnostics that may enable detection of some of the more obvious (and common) data issues.

While there was a design emphasis on distributing a model that is easy / appropriate to use and with good performance *out of the box*, we expect that many users will want to build on this model for purposes of developing a final implementation approach. The ways in which the WRA model (and indeed any other risk assessment model) may be adapted include recalibration to application data, exclusion of services not at risk, risk coefficients that better reflect timing of the program, editing condition categories due to any local concerns regarding incenting of provider behaviors, and many other tweaks and variations.

We hope that you will find the discussion in this paper helpful, and that you will enjoy evaluating and using the WRA model. Please let us know of any comments or questions.

Note: *Appendix A provides a primer on risk assessment and adjustment. The rest of this paper assumes a basic familiarity with these topics*.

2. DESIGN GOALS

The following notes present some of the main design goals that guided the development of the WRA model.

1. **Transparent**: payment adjustment is a contentious issue, and transparency of the model helps stakeholder buy-in. Perhaps more importantly, transparency helps parties understand *why* payment is being adjusted - so that they are aware of the implied potential for improvement. This is consistent with a key goal of risk adjustment (i.e. encourage favorable behavior[1]).

2. **Open-Source**: transparency and simplicity alone are not enough. We ought not to think about a risk adjuster as *software*, and think of it more in terms of a *predictive model* - a model that needs to be calibrated to a specific population and application, and to predict the right variable (recognizing services not part of the contract, recognizing reinsurance arrangements, etc.). The WRA model was designed to be open-source, and is heavily documented to allow actuaries and other qualified professionals to be able to customize this model.

3. **Simple**: it turns out that a model need not be complex for it to perform adequately for most applications. For example, you may get 90% of the way to peak possible performance with a rather simple model, and it is the last stretch that requires all sorts of algorithmic acrobatics. One may well question whether that extra performance is worth complicating the process, making it more intractable and adding burden to already strained resources. For most applications, the right answer is to keep it simple. The WRA Model uses basic and ubiquitous data elements, such as age, gender, diagnosis code, and national drug code (NDC's) in an easy to understand linear additive framework.

4. **Treatment of Partial Months:** Actuarial soundness of a risk adjustment exercise has a lot to do with identifying any systematic over/under estimation (i.e. statistical *bias*) in the adjustment process. One source for such bias is partial eligibility of members. If not corrected for, a plan with a lower average eligibility may get under-compensated for assumed risk. Ideally a risk assessment model should include weights tailored to varying months of eligibility. The WRA model includes risk weights at this level of detail.

5. **Free**: The model is provided free of cost. Further the model is written in SQL code, which can be run using a commercial SQL server or the free SQL Server Express software or other free software (e.g. MySQL). Further, the code base is very portable and can be transitioned to another platform (e.g. SAS) in a feasible manner.

[1] (CCIIO, 2011)

6. **Robustness**: The WRA model's diagnosis mapping is developed utilizing, as a foundation, the Centers for Medicare & Medicaid Services' Hierarchical Condition Category Model (CMS-HCC). The CMS-HCC model is intended for a Medicare population and is widely used in the Medicare program. The mapping in this model was significantly adjusted to account for the incidence and cost of treatment of a younger population. The WRA model's pharmacy mapping was developed utilizing, as a foundation, the MedicaidRx model. The MedicaidRx model was developed for a Medicaid population and is also widely used. This mapping was modified after studying pharmacy utilization for a commercial population.

7. **Statistical & Clinical Review**: The mapping was based primarily on a statistical analysis of prevalence and cost of treatment of various conditions. As a secondary step a limited clinical review was solicited to make adjustments where needed.

8. **Fairness**: besides performance, another desired element for fairness is susceptibility to gaming. Certain diagnosis and pharmacy codes are excluded that are discretionary or susceptible to significant coding variation, abuse, or fraud.

9. **A Foundation**: The WRA model provides an open-source extensible foundation for professionals and researchers looking for a risk assessment model. For example, non-traditional predictor variables can be added, the mapping can be changed etc.

10. **Reporting**: A basic reporting tool (a Microsoft Excel exhibit) is included with the program code. This tool presents a fairly standard view of risk assessment results, along with a few diagnostics.

11. **Diagnostics**: Diagnostics are just as important as performance metrics in a risk adjustment application. They include checking whether the population that the model is applied to is similar to the one that the reference weights are based on, checking the relative prevalence of conditions, identifying anomalies, etc. The WRA Model comes with built-in routines that provide an initial check of the data. These include key metrics such as (1) # of individuals not grouped under diagnosis and/or pharmacy mappings, (2) average eligibility in the experience period, (3) % of members with diagnosis and/or pharmacy codes, (4) member months not mapped to an eligibility category (i.e. invalid values for age or gender), and (5) average number of unique diagnosis and/or NDC codes per claimant.

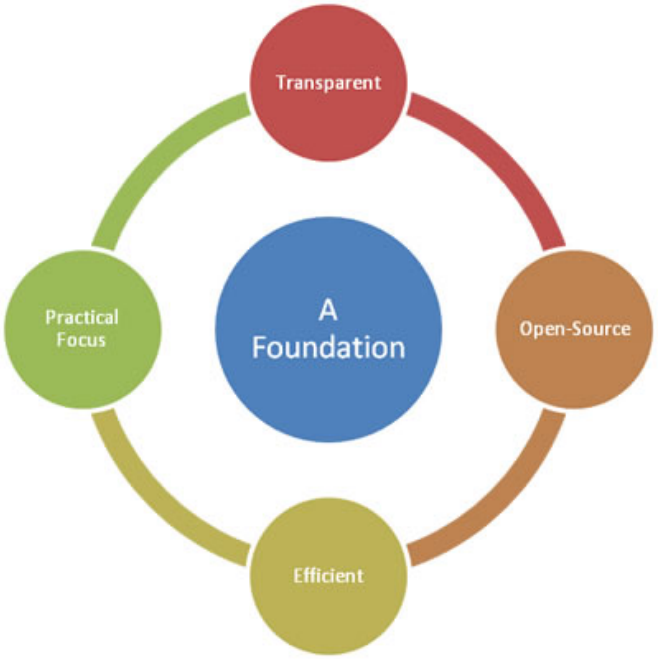
12. **ICD10 Ready**: The model includes a mapping of ICD9 to ICD10 codes (i.e. includes a preliminary mapping of ICD9 to ICD10 using the General Equivalency Mappings [GEMs] from CMS). ICD10 is scheduled to go into effect in the United States in October, 2013.

3. WRA Model Design

An overriding objective was to develop, from a user perspective, a predictive model and not *software*. Software entails a fairly static functionality and a prescriptive application. A predictive model needs to be adjusted, calibrated, and modified for every specific application and also be *completely* understood by the user. In order to accomplish this, the model needed to be transparent, simple, and open-source. The idea here was to develop something that offers encouragement for actuaries and other professionals to interact with the model from start to finish, and be able to execute the many modifications necessary for an appropriate risk adjustment process - not to mention having a full understanding of the risk assessment part.

In terms of specifics, the model is written in SQL. Risk assessment operates on large claim databases, and SQL has one of the best database capabilities, so it made sense there. Also SQL code is fairly portable across different software, including freely available ones. There is no use of external macros and the code is documented at every step - with the expectation that users will want to view and understand all the steps involved.

The model uses basic and ubiquitous claim data elements as inputs. Doing anything differently here runs the challenge of adding administrative burden and time, variance in quality and availability of elements across organizations etc. You may gain a marginal amount of predictive accuracy by adding more information - but that would probably not out-weigh the need for a consistent and timely application. This could also be described as model *efficiency*, i.e. focusing on the simplest model that produces the best performance.



Transparency, simplicity, and being open-source converge to a central expectation around the WRA model, i.e. it would serve as a foundation from which users could develop customized applications in a fairly painless manner. There are many, many questions in a risk adjustment application, right down to the level of which diagnosis or drug codes need to be included or excluded. It does not make sense to imagine software with a plethora of dials or controls in order to address any situation - what does make sense is having a user comfortable enough with a simple piece of code to make the necessary changes and updates from one application to the next.

We do not envision that the WRA model (or any other risk adjustment model for that matter) will be appropriate for all applications right out of the box. We focused on developing an approach with enough flexibility to address the more basic situations, and including enough detail in the platform and modeling approach for us or a user to extend the software to address any particular situation.

3.1 Available Risk Score Variations

The WRA model is a *linear additive model*[2]. It comes with a basic set of regression coefficients. The model can work with only diagnosis codes, only pharmacy codes, or a combination of both types of data. A major practical concern is that of partial eligibility - and the model comes with different sets of weights for members that are eligible for 1-3, 4-6, 7-9, and 10-12 months in the experience period. The model includes a prospective and concurrent set of weights.

	Weights
Prospective/Concurrent	2
Partial Member Months	4
Type of data (A/S Only, Dx, Rx, Combo)	4
Censor Levels	2
Total # of Weights	64

The model also comes with a version of weights that have a $200k censor[3] applied to the dependent (i.e. total medical and pharmacy cost) variable - to reflect situations where there is a reinsurance or other risk-sharing mechanism. Finally age-gender only weights are also included. This brings the total set of weights that are shipped with the WRA model to sixty four. While a large number, there are many more possibilities - chief among them the need to adjust the dependent variable to reflect the specifics of insurance contracts (e.g. what services are covered, etc.). The code produces an array of indicators that could be used to re-calibrate the model to reflect more closely the particulars of an application.

3.2 Designing a User Experience

The user experience is a very important factor from a design perspective, especially in a large scale implementation as envisioned under ACA. This includes reducing cost of running a model (in terms of time/resources), reducing steps in the running of the model, including only core /optimal number of user inputs at appropriate stages in the process, documentation that is easy to follow and makes the model transparent, streamlining programmatic flow to reduce inadvertent mistakes, and making the information flow obvious. Users will judge how the WRA model addresses these goals however the graphic below illustrates the process of producing WRA analytics from beginning to end.

[2] Described further in Appendix A. We experimented with interaction terms however found that those did not significantly impact performance. This is consistent with analysis of the CMS model (Pope et al. 2011).

[3] *Censoring* refers to partial information regarding a variable. For example a $200k censor would imply that if the annual costs of an individual are over this threshold, they are set to $200k for purposes of modeling. The term *truncation* is often used interchangeably with censoring – however strictly speaking truncation means to remove individuals with claims over a threshold from the sample altogether.

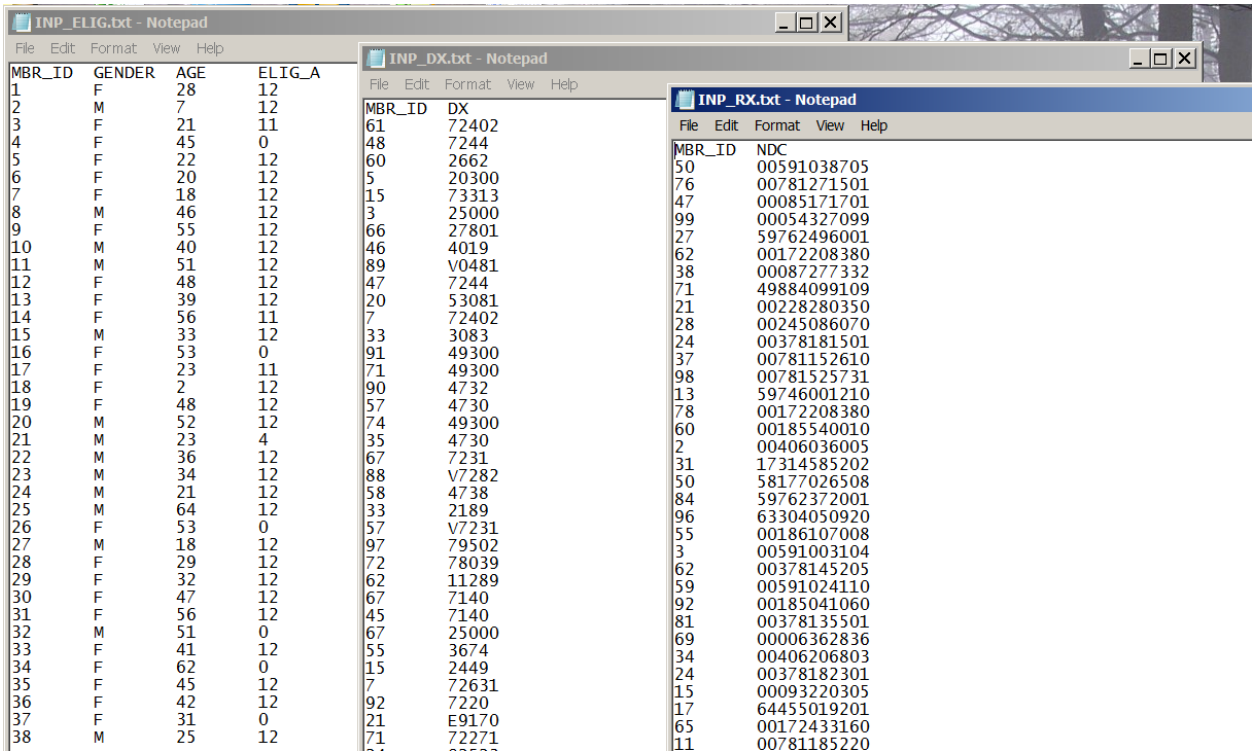
Step 1: Prepare Input files

The three files shown below illustrate the information required to run the WRA model. The data below is simulated[4] for 100 individuals and included in the distributable package for the WRA model (along with a quick start guide) to get users up and running quickly using these test files, as well as being useful to communicate the right input data formatting. An eligibility file is required, and at least one of pharmacy or diagnosis files is required to run the model. The elements needed for running the model are fairly basic and comprise[5]:

INP_ELIG (Eligibility): Unique member ID, gender, age, eligibility during experience period

INP_DX (Medical Claim): Unique member ID, diagnosis code (multiple diagnosis fields stacked)

INP_RX (Pharmacy Claim): Unique member ID, National Drug Code (NDCs)



INP_ELIG.txt - Notepad

File Edit Format View Help

MBR_ID	GENDER	AGE	ELIG_A
1	F	28	12
2	M	7	12
3	F	21	11
4	F	45	0
5	F	22	12
6	F	20	12
7	F	18	12
8	M	46	12
9	F	55	12
10	M	40	12
11	M	51	12
12	F	48	12
13	F	39	12
14	F	56	11
15	M	33	12
16	F	53	0
17	F	23	11
18	F	2	12
19	F	48	12
20	M	52	12
21	M	23	4
22	M	36	12
23	M	34	12
24	M	21	12
25	M	64	12
26	F	53	0
27	M	18	12
28	F	29	12
29	F	32	12
30	F	47	12
31	F	56	12
32	M	51	0
33	F	41	12
34	F	62	0
35	F	45	12
36	F	42	12
37	F	31	0
38	M	25	12

INP_DX.txt - Notepad

File Edit Format View Help

MBR_ID	DX
61	72402
48	7244
60	2662
5	20300
15	73313
3	25000
66	27801
46	4019
89	V0481
47	7244
20	53081
7	72402
33	3083
91	49300
71	49300
90	4732
57	4730
74	49300
35	4730
67	7231
88	V7282
58	4738
33	2189
57	V7231
97	79502
72	78039
62	11289
67	7140
45	7140
67	25000
55	3674
15	2449
7	72631
92	7220
21	E9170
71	72271

INP_RX.txt - Notepad

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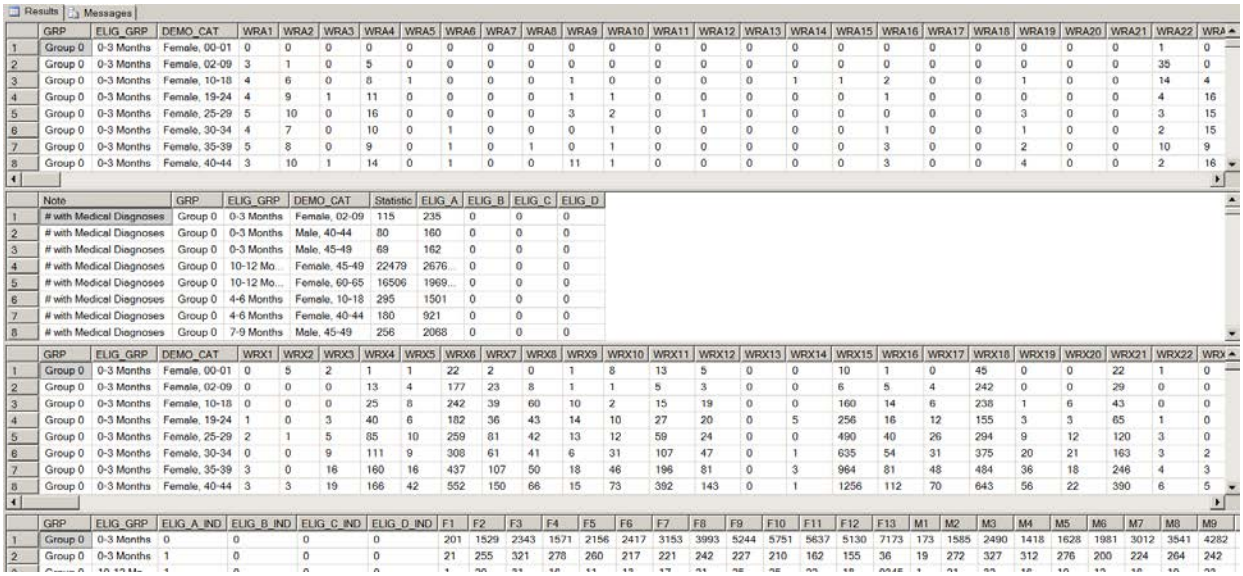
MBR_ID	NDC
50	00591038705
76	00781271501
47	00085171701
99	00054327099
27	59762496001
62	00172208380
38	00087277332
71	49884099109
21	00228280350
28	00245086070
24	00378181501
37	00781152610
98	00781525731
13	59746001210
78	00172208380
60	00185540010
2	00406036005
31	17314585202
50	58177026508
84	59762372001
96	63304050920
55	00186107008
3	00591003104
62	00378145205
59	00591024110
92	00185041060
81	00378135501
69	00006362836
34	00406206803
24	00378182301
15	00093220305
17	64455019201
65	00172433160
11	00781185220

[4] Using random selections for age, gender, and Dx/Rx codes

[5] Additional fields may be necessary to get the required input file. For example, service dates / enrollment dates will be needed in order to get data for the appropriate time period to use for assessing risk.

Step 2: Run the WRA Model

The code is run and directions are provided in the code to adjust any user inputs (e.g. risk weight selection, described later in the report / appendix F). The SQL code produces (1) member level output file with all condition markers and selected risk scores, and (2) the following four tables in the output window which can be copied/pasted in the excel reporting tool in order to produce very detailed statistics. The reporting tool is an optional step, i.e. if you need to produce detailed statistics such as prevalence reports by demographic category, or tracking the risk profile of individuals across plans, or movements of risk among plans, etc. Section 8 has additional details on the reporting tool.



	GRP	ELIG_GRP	DEMO_CAT	WRA1	WRA2	WRA3	WRA4	WRA5	WRA6	WRA7	WRA8	WRA9	WRA10	WRA11	WRA12	WRA13	WRA14	WRA15	WRA16	WRA17	WRA18	WRA19	WRA20	WRA21	WRA22	WRA
1	Group 0	0-3 Months	Female, 00-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2	Group 0	0-3 Months	Female, 02-09	3	1	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35	0
3	Group 0	0-3 Months	Female, 10-18	4	6	0	8	1	0	0	0	1	0	0	0	0	1	1	2	0	0	1	0	0	14	4
4	Group 0	0-3 Months	Female, 19-24	4	9	1	11	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	4	16
5	Group 0	0-3 Months	Female, 25-29	5	10	0	16	0	0	0	0	3	2	0	1	0	0	0	0	0	0	3	0	0	3	15
6	Group 0	0-3 Months	Female, 30-34	4	7	0	10	0	1	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	2	15
7	Group 0	0-3 Months	Female, 35-39	5	8	0	9	0	1	0	1	0	1	0	0	0	0	0	3	0	0	2	0	0	10	9
8	Group 0	0-3 Months	Female, 40-44	3	10	1	14	0	1	0	0	11	1	0	0	0	0	0	3	0	0	4	0	0	2	16

	Note	GRP	ELIG_GRP	DEMO_CAT	Statistic	ELIG_A	ELIG_B	ELIG_C	ELIG_D
1	# with Medical Diagnoses	Group 0	0-3 Months	Female, 02-09	115	235	0	0	0
2	# with Medical Diagnoses	Group 0	0-3 Months	Male, 40-44	80	160	0	0	0
3	# with Medical Diagnoses	Group 0	0-3 Months	Male, 45-49	69	162	0	0	0
4	# with Medical Diagnoses	Group 0	10-12 Mo...	Female, 45-49	22479	2676...	0	0	0
5	# with Medical Diagnoses	Group 0	10-12 Mo...	Female, 60-65	16506	1969...	0	0	0
6	# with Medical Diagnoses	Group 0	4-6 Months	Female, 10-18	295	1501	0	0	0
7	# with Medical Diagnoses	Group 0	4-6 Months	Female, 40-44	180	921	0	0	0
8	# with Medical Diagnoses	Group 0	7-9 Months	Male, 45-49	256	2068	0	0	0

	GRP	ELIG_GRP	DEMO_CAT	WRX1	WRX2	WRX3	WRX4	WRX5	WRX6	WRX7	WRX8	WRX9	WRX10	WRX11	WRX12	WRX13	WRX14	WRX15	WRX16	WRX17	WRX18	WRX19	WRX20	WRX21	WRX22	WRX
1	Group 0	0-3 Months	Female, 00-01	0	5	2	1	1	22	2	0	1	8	13	5	0	0	10	1	0	45	0	0	22	1	0
2	Group 0	0-3 Months	Female, 02-09	0	0	0	13	4	177	23	8	1	1	5	3	0	0	6	5	4	242	0	0	29	0	0
3	Group 0	0-3 Months	Female, 10-18	0	0	0	25	8	242	39	60	10	2	15	19	0	0	160	14	6	238	1	6	43	0	0
4	Group 0	0-3 Months	Female, 19-24	1	0	3	40	6	182	36	43	14	10	27	20	0	5	256	16	12	155	3	3	65	1	0
5	Group 0	0-3 Months	Female, 25-29	2	1	5	85	10	259	81	42	13	12	59	24	0	0	490	40	26	294	9	12	120	3	0
6	Group 0	0-3 Months	Female, 30-34	0	0	9	111	9	308	61	41	6	31	107	47	0	1	635	54	31	375	20	21	163	3	2
7	Group 0	0-3 Months	Female, 35-39	3	0	16	160	16	437	107	50	18	46	196	81	0	3	964	81	48	484	36	18	246	4	3
8	Group 0	0-3 Months	Female, 40-44	3	3	19	166	42	552	150	66	15	73	392	143	0	1	1256	112	70	643	56	22	390	6	5

	GRP	ELIG_GRP	ELIG_A_IND	ELIG_B_IND	ELIG_C_IND	ELIG_D_IND	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	M1	M2	M3	M4	M5	M6	M7	M8	M9
1	Group 0	0-3 Months	0	0	0	0	201	1529	2343	1571	2156	2417	3153	3993	5244	5751	5637	5130	7173	173	1585	2490	1418	1628	1981	3012	3541	4282
2	Group 0	0-3 Months	1	0	0	0	21	255	321	278	260	217	221	242	227	210	162	155	36	19	272	327	312	276	200	224	264	242

4. WRA Model Development

The sections below describe development of major aspects of the WRA model.

4.1 Development of Diagnosis Mapping

The following table shows a few high level statistics on the WRA diagnosis mapping.

WRA Ver 1.01	Total # of diagnosis codes	17,275
	# of Demographic Categories	24
	# of Clinical Categories	90
	Total % of codes marked as excluded	16.8%
	Coverage of typical commercial diagnoses	100.0%
	Coverage of typical commercial (IP+OP) spe	100.0%

The model maps 17,275 ICD-9 diagnosis codes to 90 condition categories. The model collapses some HCC categories (i.e. non-representative of an <65 population) and adds new ones. The performance from the model is driven by key conditions and starts to plateau after condition #50 or so – however we add more conditions to have an <65 morbidity profile to be fairly comprehensively captured. We tried to strike a balance between performance and specificity. There are statistical issues associated with calibration if the mapping is too specific, and it may also lead to volatility in assessed risk. There are twenty-four demographic categories (12 for male, and 12 for female). About 17% of all included ICD-9 codes are specifically excluded from the mapping (i.e. mapped to condition category 32, which is not included in the regression modeling and therefore has no risk coefficient assigned to it). These codes are excluded due to various reasons including incentives for gaming, being too vague, or not coded consistently by care providers. The diagnoses included in the mapping encompass all of the diagnoses included in the commercial encounter data set used to develop the WRA model (hence the 100% coverage), and therefore also encompass all of the cost associated with valid diagnoses in the data. These statistics will later be compared to the Chronic Disability Payment System (CDPS) and the Centers for Medicare and Medicaid Services' Hierarchical Condition Category (CMS-HCC) model.

The following table shows the 90 diagnosis categories and their descriptions that are included in the WRA model. Appendix D includes the demographic categories included in the WRA model, while the pharmacy-based categorization is presented later in this paper.

WRA Category Description	WRA#
Arthropathies	WRA1
Bone/Joint/Muscle Infections/Necrosis	WRA2
Central Nervous System (H[6])	WRA3
Central Nervous System (L)	WRA4
Cerebral Palsy, Hemorrhage and Other Paralytic Syndromes	WRA5
Cerebrovascular Disease	WRA6
Chronic Ulcer of Skin, Except Decubitus	WRA7
Circulatory/Cardiovascular (H)	WRA8
Circulatory/Cardiovascular (L)	WRA9
Circulatory/Cardiovascular (M)	WRA10
Cirrhosis of Liver	WRA11
Congestive Heart Failure	WRA12

[6] H – High, L – Low, M – Medium (based on expected cost differences)

WRA Category Description	WRA#
Cystic Fibrosis	WRA13
Diabetes with Ophthalmologic or Unspecified Manifestation	WRA14
Diabetes with Renal or Other Specified Manifestation	WRA15
Diabetes without Complication	WRA16
Dialysis Status	WRA17
Diseases of the Blood (H)	WRA18
Diseases of the Blood (L)	WRA19
Diseases of the Blood (M)	WRA20
Diseases of the Blood (VH)	WRA21
Diseases of the Ear/Mastoid Process	WRA22
Diseases of the Genitourinary System	WRA23
Disorders of Immunity	WRA24
Disorders of the Eye & Adnexa	WRA25
Dorsopathies (H)	WRA26
Dorsopathies (L)	WRA27
Drug/Alcohol Psychosis or Dependence	WRA28
Endocrine, Metabolic, and Immunity Disorders (H)	WRA29
Endocrine, Metabolic, and Immunity Disorders (L)	WRA30
End-Stage Liver Disease	WRA31
EXCL (Excluded, Vague or Ill-Defined Diagnoses)	WRA32
Fracture/Dislocation	WRA33
Gastrointestinal/Infectious/Parasitic (H)	WRA34
Gastrointestinal/Infectious/Parasitic (L)	WRA35
Gastrointestinal/Infectious/Parasitic (M)	WRA36
HIV/AIDS	WRA37
Inflammatory Bowel Disease	WRA38
Injury/Poisoning	WRA39
Ischemic or Unspecified Stroke	WRA40
Lymphatic, Head and Neck, Brain, and Other Major Cancers (H)	WRA41
Lymphatic, Head and Neck, Brain, and Other Major Cancers (L)	WRA42
Lymphatic, Head and Neck, Brain, and Other Major Cancers (M)	WRA43
Major Complications of Medical Care and Trauma	WRA44
Major Depressive, Bipolar, and Paranoid Disorders	WRA45
Major Organ Transplant Status	WRA46
Mental Disorders (H)	WRA47
Mental Disorders (L)	WRA48
Metastatic Cancer and Acute Leukemia	WRA49
Multiple Sclerosis	WRA50
Neonate	WRA51
Neoplasm of Bone, Connective Tissue, Skin, & Breast (H)	WRA52
Neoplasm of Bone, Connective Tissue, Skin, & Breast (L)	WRA53
Neoplasm of Digestive/Peritoneum	WRA54
Nephritis	WRA55

WRA Category Description	WRA#
Osteoarthrosis	WRA56
Other Congenital Anomalies	WRA57
Other Digestive System Diseases	WRA58
Other Heart Disease	WRA59
Other Infectious & Parasitic Diseases (H)	WRA60
Other Infectious & Parasitic Diseases (L)	WRA61
Other Musculoskeletal System & Connective Tissue	WRA62
Other Mycoses	WRA63
Other Neoplasm	WRA64
Other Pulmonary/Respiratory	WRA65
Other Rare	WRA66
Other Transplant Related	WRA67
Parkinson's and Huntington's, other motor control Diseases	WRA68
Polyneuropathy	WRA69
Pregnancy (Incomplete)	WRA70
Pregnancy Related	WRA71
Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	WRA72
Protein-Calorie Malnutrition	WRA73
Pulmonary/Respiratory (H)	WRA74
Pulmonary/Respiratory (L)	WRA75
Pulmonary/Respiratory (M)	WRA76
Quadriplegia, Other Extensive Paralysis	WRA77
Renal Failure (H)	WRA78
Renal Failure (L)	WRA79
Renal Failure (M)	WRA80
Respirator Arrest, Dependence/Tracheostomy Status	WRA81
Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	WRA82
Schizophrenia	WRA83
Seizure Disorders and Convulsions	WRA84
Septicemia/Shock	WRA85
Skin & Subcutaneous Tissue (H)	WRA86
Skin & Subcutaneous Tissue (L)	WRA87
Vascular Disease	WRA88
Vertebral Fractures, Spinal Cord Diseases/Injury	WRA89
Very Severe Neoplasm / Cancer	WRA90

4.1.1 Comparison of Mapping to CMS-HCC

The diagnosis-based condition categories of the Wakely Risk Assessment Model are based on the CMS-HCC model. The mapping definitions were significantly revised in order to provide a reasonable coverage of cost in a commercial population.

According to the commercial dataset used in the development of the WRA model, the CMS-HCC diagnosis mapping accounts for less than a quarter of the diagnoses found in a commercial setting. This does not imply that there are diagnoses "missing" in the mapping, since the CMS-HCC model is intended to focus on chronic conditions of an older population and therefore not all diagnosis codes are mapped to a condition category. The diagnoses that are mapped to HCC categories map to about a quarter of paid encounters (inpatient & outpatient) on commercial data (using the diagnosis field on encounters). The following table shows some high level statistics on the application of the CMS-HCC mapping to commercial utilization.

CMS HCC 2012	Total # of diagnosis codes	2,916
	# of Categories	71
	Total % of codes marked as excluded	0.0%
	# of codes not in WRA Mapping	0.0%
	Coverage of typical commercial diagnoses	16.9%
	Coverage of typical commercial (IP+OP) spend	25.7%

All of the diagnosis codes in the CMS-HCC model are mapped in the WRA model. The following table cross-references CMS-HCC categories with WRA category descriptions. Since the WRA model is based on the CMS-HCC categorization and mapping, most of the category names are similar. The "Overlap" column is the proportion of the number of diagnosis codes in the CMS-HCC category that also appear in the corresponding WRA category. The corresponding WRA category is determined by that having the most overlap with the CMS-HCC category. This table is only intended for providing a high level view of similarities between the two sets of mappings. In some cases HCC categories are further split out (more/less severe) in order to further specify variances within commercial spend, however in some cases categories are collapsed. For example, Parkinson's is grouped together with other motor control diseases as the prevalence in a commercial population is not as high as in Medicare.

HCC	Category Description	Best Match WRA	Overlap
HCC1	HIV/AIDS	HIV/AIDS	100.0%
HCC96	Ischemic or Unspecified Stroke	Ischemic or Unspecified Stroke	100.0%
HCC95	Cerebral Hemorrhage	Cerebral Palsy, Hemorrhage and Other Paralytic Syndromes	100.0%
HCC92	Specified Heart Arrhythmias	Circulatory/Cardiovascular (M)	100.0%
HCC9	Lymphatic, Head and Neck, Brain, and	Lymphatic, Head and Neck, Brain, and Other Major Cancers (L)	60.5%
HCC83	Angina Pectoris/Old Myocardial	Circulatory/Cardiovascular (M)	100.0%
HCC82	Unstable Angina and Other Acute	Circulatory/Cardiovascular (M)	100.0%
HCC81	Acute Myocardial Infarction	Circulatory/Cardiovascular (M)	83.3%

HCC	Category Description	Best Match WRA	Overlap
HCC80	Congestive Heart Failure	Congestive Heart Failure	100.0%
HCC8	Lung, Upper Digestive Tract, and Other	Lymphatic, Head and Neck, Brain, and Other Major Cancers (M)	84.1%
HCC79	Cardio-Respiratory Failure and Shock	Other Heart Disease	47.1%
HCC78	Respiratory Arrest	Pulmonary/Respiratory (H)	100.0%
HCC77	Respirator Dependence/Tracheostomy	Respirator Arrest, Dependence/Tracheostomy Status	100.0%
HCC75	Coma, Brain Compression/Anoxic	Central Nervous System (H)	100.0%
HCC74	Seizure Disorders and Convulsions	Seizure Disorders and Convulsions	100.0%
HCC73	Parkinson's and Huntington's Diseases	Parkinson's and Huntington's, other motor control Diseases	100.0%
HCC72	Multiple Sclerosis	Multiple Sclerosis	100.0%
HCC71	Polyneuropathy	Polyneuropathy	100.0%
HCC70	Muscular Dystrophy	Polyneuropathy	100.0%
HCC7	Metastatic Cancer and Acute Leukemia	Very Severe Neoplasm / Cancer	43.1%
HCC69	Spinal Cord Disorders/Injuries	Vertebral Fractures, Spinal Cord Diseases/Injury	100.0%
HCC68	Paraplegia	Parkinson's and Huntington's, other motor control Diseases	100.0%
HCC67	Quadriplegia, Other Extensive Paralysis	Quadriplegia, Other Extensive Paralysis	100.0%
HCC55	Major Depressive, Bipolar, and Paranoid	Major Depressive, Bipolar, and Paranoid Disorders	100.0%
HCC54	Schizophrenia	Schizophrenia	100.0%
HCC52	Drug/Alcohol Dependence	Drug/Alcohol Psychosis or Dependence	100.0%
HCC51	Drug/Alcohol Psychosis	Drug/Alcohol Psychosis or Dependence	100.0%
HCC5	Opportunistic Infections	Other Infectious & Parasitic Diseases (H)	53.3%
HCC45	Disorders of Immunity	Disorders of Immunity	93.8%
HCC44	Severe Hematological Disorders	Diseases of the Blood (M)	90.0%
HCC38	Rheumatoid Arthritis and Inflammatory	Other Musculoskeletal System & Connective Tissue	51.4%
HCC37	Bone/Joint/Muscle Infections/Necrosis	Other Musculoskeletal System & Connective Tissue	94.1%
HCC33	Inflammatory Bowel Disease	Inflammatory Bowel Disease	100.0%
HCC32	Pancreatic Disease	Other Digestive System Diseases	77.8%
HCC31	Intestinal Obstruction/Perforation	Other Digestive System Diseases	84.5%
HCC27	Chronic Hepatitis	Other Rare	100.0%
HCC26	Cirrhosis of Liver	Cirrhosis of Liver	100.0%
HCC25	End-Stage Liver Disease	End-Stage Liver Disease	100.0%
HCC21	Protein-Calorie Malnutrition	Protein-Calorie Malnutrition	100.0%
HCC2	Septicemia/Shock	Septicemia/Shock	100.0%

HCC	Category Description	Best Match WRA	Overlap
HCC19	Diabetes without Complication	Diabetes without Complication	100.0%
HCC18	Diabetes with Ophthalmologic or	Diabetes with Ophthalmologic or Unspecified Manifestation	100.0%
HCC177	Amputation Status, Lower	EXCL[7]	93.3%
HCC176	Artificial Openings for Feeding or	Injury/Poisoning	67.7%
HCC174	Major Organ Transplant Status	Major Organ Transplant Status	66.7%
HCC17	Diabetes with Acute Complications	Diabetes with Ophthalmologic or Unspecified Manifestation	100.0%
HCC164	Major Complications of Medical Care	Major Complications of Medical Care and Trauma	84.2%
HCC161	Traumatic Amputation	Injury/Poisoning	53.3%
HCC16	Diabetes with Neurologic or Other	Diabetes with Renal or Other Specified Manifestation	100.0%
HCC158	Hip Fracture/Dislocation	Other Musculoskeletal System & Connective Tissue	57.1%
HCC157	Vertebral Fractures w/o Spinal Cord	Vertebral Fractures, Spinal Cord Diseases/Injury	100.0%
HCC155	Major Head Injury	Other Musculoskeletal System & Connective Tissue	68.3%
HCC154	Severe Head Injury	Other Musculoskeletal System & Connective Tissue	66.7%
HCC150	Extensive Third-Degree Burns	Injury/Poisoning	100.0%
HCC15	Diabetes with Renal or Peripheral	Diabetes with Renal or Other Specified Manifestation	100.0%
HCC149	Chronic Ulcer of Skin, Except Decubitus	Chronic Ulcer of Skin, Except Decubitus	100.0%
HCC148	Decubitus Ulcer of Skin	Skin & Subcutaneous Tissue (H)	60.0%
HCC132	Nephritis	Nephritis	100.0%
HCC131	Renal Failure	Renal Failure (M)	56.5%
HCC130	Dialysis Status	Dialysis Status	100.0%
HCC119	Proliferative Diabetic Retinopathy and	Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	100.0%
HCC112	Pneumococcal Pneumonia, Empyema,	Other Pulmonary/Respiratory	72.4%
HCC111	Aspiration and Specified Bacterial	Pulmonary/Respiratory (L)	64.3%
HCC108	Chronic Obstructive Pulmonary Disease	Pulmonary/Respiratory (L)	80.0%
HCC107	Cystic Fibrosis	Cystic Fibrosis	100.0%
HCC105	Vascular Disease	Vascular Disease	57.4%
HCC104	Vascular Disease with Complications	Circulatory/Cardiovascular (M)	68.6%

[7] There are 15 diagnosis codes in this HCC category, most of which map to EXCL as our clinical review found these codes to not be very well specified, or not typically coded consistently

HCC	Category Description	Best Match WRA	Overlap
HCC101	Cerebral Palsy and Other Paralytic	Cerebral Palsy, Hemorrhage and Other Paralytic Syndromes	100.0%
HCC100	Hemiplegia/Hemiparesis	Cerebral Palsy, Hemorrhage and Other Paralytic Syndromes	100.0%
HCC10	Breast, Prostate, Colorectal and Other	Other Neoplasm	39.5%

4.1.2 Comparison of Mapping to CDPS

The following table provides a few snapshot statistics for the CDPS model after application to commercial utilization. The model has a similar number of diagnosis codes as those contained in the WRA model. Additionally the proportion of diagnosis codes that are excluded from the mapping is similar (there are some differences in the exclusions, e.g. WRA excludes a few more codes). A comparison of the overlapping diagnosis codes in CDPS and nearest-match WRA category indicates that categories are similar in terms of clinical relevance (however there are a number of categorization differences).

	Total # of diagnosis codes	16,835
	# of Demographic Categories	11
CDPS	# of Clinical Categories	58
Ver	Total % of codes marked as excluded	15.6%
5.1	Coverage of typical commercial diagnoses	97.5%
	Coverage of typical commercial (IP+OP) spend	95.9%
	CDPS diag not included	0.0%

4.2 Development of Pharmacy Mapping

The pharmacy mapping is based on modified version of the MedicaidRx (version 5.2) model. The MedicaidRx model was developed using 2000-2002 data from 44 state Medicaid programs. This model contains mappings for about 77,094 NDCs to 45 MedicaidRx categories. This mapping was modified by an additional (about) 9,500 NDCs that are found in typical commercial drug claims as well as splitting some categories into high / medium or low up to a total of 60 categories. Hierarchies are introduced where an individual is grouped into various severities of the same condition. Further, a few specific drugs were excluded due to their tendency to be abused. More details on these exclusions are provided after the following table, which shows the pharmacy-based categories in the WRA model (while diagnosis based condition variables are labeled as WRA1-WRA90 through the model, pharmacy based condition variables are labeled WRX1-WRX60).

WRX Cat Description	WRX #
Alcoholism	1
Alzheimers	2
Anti-coagulants	3
Antitussives, Expectorants	4
Asthma/COPD (High)	5
Asthma/COPD (Low)	6
Asthma/COPD (Medium)	7
Attention Deficit	8
Burns & Other Skin Related	9
Cardiac (High)	10
Cardiac (Low)	11
Cardiac (Medium)	12
CMV Retinitis	13
Cystic Fibrosis	14
Depression / Anxiety	15
Diabetes	16
Diabetic, Gastric Supplies, Diagnostic Agents	17
EENT	18
ESRD / Renal	19
Folate Deficiency	20
Gastric Acid Disorder	21
Glaucoma	22
Gout	23
Growth Hormone	24
Hemophilia/von Willebrands	25
Hepatitis	26
Herpes	27
HIV	28
Hyperlipidemia	29
Infections, high	30
Infections, low	31
Infections, medium	32
Inflammatory /Autoimmune	33
Insomnia	34
Insulin Analogue (Chemical/Ingredient)	35
Iron Deficiency	36
Irrigating solution	37
Leukocyte Growth Factor, Increased Myeloid Cell Production	38
Liver Disease	39
Malignancies	40

WRX Cat Description	WRX #
Misc. Anti-Inflammatory	41
Multiple Sclerosis / Paralysis	42
Nausea	43
Neurogenic bladder	44
Osteoporosis / Pagets	45
Other Central Nervous System	46
Pain	47
Parkinsons / Tremor	48
Prenatal care	49
Protein Kinase Inhibitors	50
Psychotic Illness / Bipolar	51
Quinolone Antimicrobial	52
Recombinant Human Interferon beta, Recombinant Proteins	53
Replacement solution	54
Seizure disorders	55
Serotonin-3 Receptor Antagonist	56
Thyroid Disorder	57
Transplant	58
Tuberculosis	59
Excluded/Not Mapped	60

4.2.1 Drug Exclusions

It is important for a risk adjustment model that it does not provide incentives for overuse. Some drugs are more susceptible to abuse and overuse than others, or there is substantial disagreement about the appropriate indications for their use. The list below shows the exclusions that were made. This list is informed by the U.S. Department of Justice's National Drug Intelligence Center's list of the most commonly abused prescription drugs in the United States.

Note that these exclusions are in addition to those already excluded in the development of the MedicaidRx model. Some drugs (e.g. Ritalin) are mostly excluded in the MedicaidRx mapping, but some other forms of packaging (e.g. Ritalin LA Capsules Extended Release, NDC 00078037105) are included. These other variants are further excluded from the WRA mapping. The associated drug names shown in the table below (one drug name may map to multiple NDCs given packaging differences etc.).

Opioids / narcotics / pain relievers	Dilaudid
	Lorcet
	Lortab
	OxyContin
	Percocet
	Percodan
	Tylox
	Vicodin
Depressants	Librium
	Valium
	Xanax
Stimulants	Adderall
	Concerta
	Ritalin

4.3 Development of Diagnosis & Pharmacy Combined Mapping

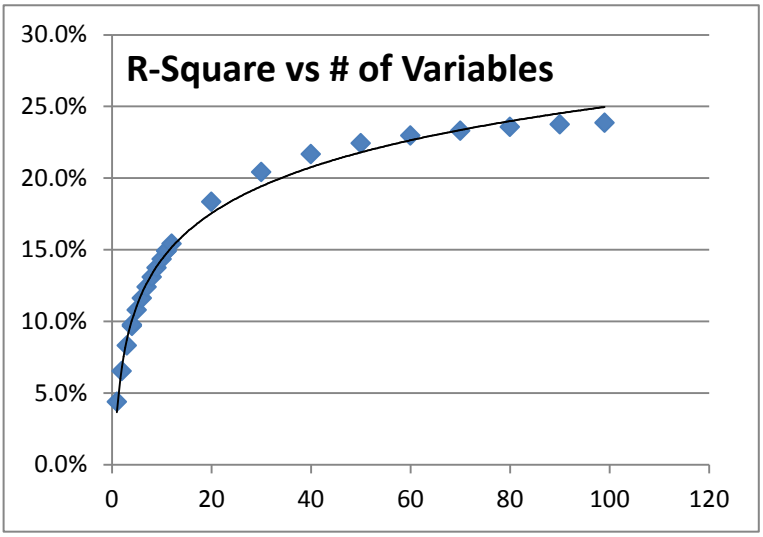
A risk adjuster application may use medical data, pharmacy data, or both. A combination risk adjuster produces higher performance[8] (Winkelman & Mehmud, 2007).

The WRA model includes weights for all three versions of application. The model can switch between Medical Only, Pharmacy Only, and Combination risk assessment, depending upon the input data that is presented to the model and the choice for weights selected by a user. An eligibility file is required for the model to run, and the user may provide a medical input file (INP_DX), a pharmacy input file (INP_RX) or both. If both files are provided, the model automatically switches and groups members according to both WRA (medical) and WRX (pharmacy) groupings.

In developing the combination model, we did not want to simply include all WRA (90) and WRX (60) indicators in a 150 indicator model. The main reason is that there may be highly correlated indications from medical to pharmacy data (e.g. a condition diagnosis which nearly always requires treatment with a specific drug). Such correlations do not add to the predictability of the model however do cause difficulty in adequate determination of risk coefficients. Another reason to reduce the number of variables in the combined model is to maintain model parsimony. One of the goals of risk adjustment is to produce stable risk scores across plans and over time – and this is easier to accomplish if a model is not over-specified or over-fit, with credible condition categorization.

[8] Though it can be a marginal increase, especially for concurrent application where costs are driven more by medical diagnoses

We initially ran statistical models to determine the best (in terms of R-Square) model at each value for model size (e.g. the best 10 variable model, the best 20 variable model, etc.). We included both the WRA and WRX indicators in this process – so that we only added a variable to the model (from either medical or pharmacy grouping) if it added significant value beyond variables already added to the model. In this fashion we compiled a list of variables that together best explain the dependent variable (i.e. future or concurrent cost[9]). The chart shows the improvement in R-Squared performance statistic for each variable that is added. We see that the incremental improvement in the model becomes small after 100 variables.



Next we reviewed this list for clinical appropriateness (i.e. if a condition did not get picked up from the perspective of explaining variation in cost, but is important from perspectives of assessing adequate delivery of care, or if conditions got picked up from both medical and pharmacy models that are too specific and too similar, etc.). We made a few edits from a clinical and overall reasonableness perspective and in this manner determined the combination model including 100 categories (65 from WRA, and 35 from WRX).

Appendix C shows the WRA and WRX categories that are picked up.

4.4 HIERARCHIES

A number of WRA and WRX categories include variation by severity of the underlying condition. For example Other Mental Disorders are further broken down into low/high categories. The implemented hierarchy recognizes the higher manifestation of a certain condition, and so an individual does not receive multiple indications (and additions to the risk score) for the same underlying condition[10].

[9] Differences in determination of the best model for prospective or concurrent adjustment for not as vast in order for us to contemplate different combination models for the two purposes.
[10] Also may incent multiple coding at varying severity levels (especially for sicker patients) for the same condition

4.5 Statistical Considerations

We evaluated the mappings from a number of statistical considerations. These included looking at the mean cost within each grouping of diagnosis codes and the cost dispersion around the mean (for establishing statistical homogeneity of a grouping), studying the prevalence captured within each condition (both in terms of member months and in terms of cost – to ensure some conditions were not too broad and some were not too narrow[11]), and analyzing the incremental improvement in performance when a condition category is added to the model. In addition to statistical testing, a limited clinical review process[12] was employed for current release of the model.

4.5.1 Constrained Regression & Credibility Blending

The modeling technique used to determine risk coefficients is linear regression, consistent with other widely used models (e.g. CMS-HCC, CDPS, etc.). However we did not want the procedure to yield negative weights for conditions. This can happen if, for example, a condition (A) is highly co-morbid with another expensive condition (B). Condition B may get a higher weight (due to its co-morbidities with conditions more expensive than A), while A gets a negative weight to offset the higher weight of B when the two conditions are coincident. There are two main reasons for not wanting negative coefficients. One reason is that while from a statistical perspective this is all well and good, it does not look great if condition A exists by itself and the member risk score gets to be negative. We do not expect plans to credit individuals for having certain conditions in the real world, so one way to deal with the issue is to constrain member-level risk scores to be zero and above – and this can decrease the performance, albeit marginally, of a risk assessment model. Another method is to constrain risk weights themselves to be non-negative. The setting of weights in a linear regression procedure is mutually independent by variable and so editing coefficients in this manner is not statistically sound. We used a constrained linear regression program in order to have strictly non-negative weights without compromising performance or statistical soundness. Additionally we reviewed credibility metrics such as *p*-value and coefficient confidence intervals in order to adjust coefficients in the few cases where they were not credible.

4.6 Clinical Considerations

Theoretically one could fashion a risk adjustment model with diagnosis codes grouped into various categories guided only by statistical methods. Such a model may even exhibit a good statistical performance. However it would be inappropriate to use this model to adjust payments made to healthcare providers. Clinical meaningfulness of groupings and risk coefficients is important for several reasons.

[11] OK for rare, high cost conditions to have very low prevalence, they still contribute significantly to explaining variation in cost

[12] Dr. Sadaf Farasat MD assisted us with a limited clinical review. The review was limited to higher level reasonability checks for this first version of the model.

These reasons include (a) providing an explanation and justification for risk score levels, (b) accuracy in risk scoring, and (c) information for providers so that they are able to understand reasons driving charges or payment. We solicited the help of a clinician to help perform a limited review of the WRA mapping and to provide guidance on condition categorization. The following illustrative examples provide some insight into the clinical discussions and review process that went into finalization of the WRA mapping. **Note**: The clinical review of WRA should be considered to be very limited. For example, CMS used a panel of physicians to get a wider range of input on the CMS-HCC model whereas for this initial version of WRA we used a single physician in a review that was limited to a few conditions and at a high level.

4.6.1 Too Narrow vs. Too Broad

In developing the mapping we tried to strike a balance between defining categories too narrowly, or too broadly. A narrow definition would be where too few diagnoses are grouped from a prevalence perspective, and it goes against a goal of developing a parsimonious model. If a condition is too broad (too much cost, prevalence, variance of clinical and financial outcomes within a condition) then it may not contribute meaningfully to the important goal of creating an accurate model to adjust payments. The following narrative provides two examples, one in which it made sense to group two different diagnosis codes together – and another in which it made clinical sense to keep them apart.

ICD 72672 (Tibialis Tendinitis) and 72881 (Interstitial Myositis): While there are some differences amongst these two diagnoses, their treatment and clinical / financial outcomes do not dictate a separate categorization. Tibialis tendinitis is the inflammation/degenerative condition of the tendon of the calf muscle, whereas interstitial myositis is an inflammation of the muscles, mostly involving the proximal muscles of the limbs. The treatment of tibialis tendinitis is local care with ice packs and physical therapy, and NSAIDS are used for symptomatic relief. In additional Gluco-cortocoids can be used when symptoms do not improve on these conservative measures. For Myositis gluco-corticoids are the mainstay of treatment. The treatment costs of these two conditions are similar on average. Subsequent year's cost of treatment for these conditions is also similar.

ICD 25042 (Diabetes with renal manifestations, type II or unspecified type, uncontrolled) and 25052 (Diabetes with ophthalmic manifestations, type II or unspecified type, uncontrolled): For Ophthalmic manifestations you have to go see an ophthalmologist, and for renal you have to see a nephrologist – and that is where management of condition, clinical resource use, and clinical and financial outcomes may part ways. The management for these conditions is very different. For diabetic nephropathy treatment is basically dialysis depending upon the renal function and for diabetic retinopathy laser photo-coagulation and a number of surgical procedures are used in treatment. The ongoing cost of treatment for these two conditions is very different. While these two conditions can happen in a patient with uncontrolled diabetes, there are good clinical reasons to categorize these differently.

4.6.2 Confusing Diagnoses

There are diagnosis codes that are too similar to each other – that it does not make clinical sense to group them into separate conditions. For example:

ICD 27400 (Gouty arthropathy, unspecified), 27401 (Acute gouty arthropathy): A doctor could code a condition as either of these codes for a patient with the same condition (i.e. acute Gout), therefore both of these codes are grouped under the same WRA category.

ICD 31534 (Speech and language developmental delay due to hearing loss), 31535 (Childhood onset fluency disorder): If a child has hearing loss (31534), then probably will also have 31535. And since these conditions are highly co-morbid, it does not make clinical or statistical sense to put them in two different categories.

4.6.3 Similar Condition but Very Different Costs of Treatment

Conversely our clinical review identified categories which were similar in terms of the part of the body the disease targeted however their clinical and financial outcomes were very different. For example:

*ICD (28739 - Other primary thrombocytopenia) and 2860 (Von Willebrand Disease / Congenital factor VIII disorder)***:** Both of these conditions are bleeding disorders, but idiopathic thrombocytopenia is a self-limited disease (especially in children) and in adults it is usually treated with gluco-corticoids. It is treatable and the patient need not get lifelong treatment.

For Von Willebrand's disease treatment is with replacement therapy with Von Willebrand factor and factor VIII generally measured as ristocetin co-factor. This treatment is much more expensive relative to treatment for thrombocytopenia. This condition is a lifelong condition whereas idiopathic thrombocytopenia does not have sustained high costs of treatment. The natural history of both diseases is very different. In the WRA model they are grouped as very high cost / low cost within the same category (i.e. Diseases of the Blood).

4.6.4 Ill-defined Diagnoses

Some diagnosis codes are vague or ill-defined from a clinical perspective. This is to say that it is hard for a clinician to adequately describe underlying morbidity (if any) using these codes, and as such these codes would be very hard to clinically audit. Such codes are excluded from the WRA mapping. Examples include:

ICD 33829 (Other chronic pain): Pain is very ill-defined, and sometimes you cannot pin-point where a person has pain. Pain is subjective and it is not always clear what underlying condition is causing the pain.

ICD 79029 (Other abnormal glucose): This code is also ill-defined, for example we do not know whether this is related to hypoglycemia or hyperglycemia, and the two can have very different outcomes for a patient.

ICD 99527 (Other drug allergy): Drug allergies can range from very severe (e.g. Severe broncho-spasms requiring intubation and admission into an ICU) to very benign (e.g. mild pruritis / itching which can be treated with tropical steroids or can even resolve on its own).

4.7 Data Used for Modeling

WCG used a proprietary commercial claim database to develop the WRA model. The database contains more than 500,000 individuals. Data from calendar years 2008-2009 was used in the development.

The data used in the development is geographically concentrated. This is a limitation of the weights provided with the model and it is recommended that the model is validated or recalibrated[13]. This validation and re-calibration can be performed by the user, or WCG has a standardized process to help with this task as well.

4.8 Diagnostic Exclusion

It is generally recommended that diagnostic codes (e.g. diagnostic radiology, lab tests, etc.) are excluded for purposes of risk adjustment. These represent a potential source of error when a diagnosis code is used to justify a diagnostic procedure (e.g. a procedure to rule-out a certain diagnosis). Since delay in treatment may be harmful, a diagnosis code may be coded (without confirmation) together with a diagnostic test. A risk assessment mapping will then erroneously consider a person of actually having that condition. Many risk assessment tools include a procedure-code based logic to exclude diagnostic tests. The weights provided with the WRA model were developed using data that had diagnostic codes removed. The criterion for removal of diagnostic codes is presented in appendix E.

It may be important that information on excluded diagnoses is collected from plans if diagnostic exclusions are being applied. These should be studied to ensure that appropriate exclusions are being made. The concern here is mostly around how data is formatted. If data from a plan is on a per-service level, excluding diagnostic tests using a piece of logic (as in appendix E) is proper. However if it is at a summary level (e.g. four CPT codes on a line, one of which is diagnostic – and up to eight diagnosis codes on the same line) – then we may be erroneously excluding too many diagnoses.

[13] Weights are calculated using data from an application of interest, and blended in with weights offered with the model using credibility theory

Conversely if diagnostic codes are *not* removed prior to running the WRA (or any other) adjuster[14], an effort should be made at determining whether diagnostic testing is performed consistently across plans such that inclusion of these diagnoses does not introduce a bias.

6. WRA Model Performance

Statistically measured accuracy is critical to the success of a risk adjustment exercise since without it payment transfers would have no sound basis.

Performance is typically measured in terms of R-squared statistic[15]. This is a measure of the amount of variation in cost (i.e. dependent variable) that is explained by the model relative to the average of the actual. This is a value in the 0-1 range, with 1 representing a perfect fit (and 0 for a model that does just as well as using the average of the dependent variable as the prediction for each individual).

The following table shows the performance of the model for concurrent and prospective prediction. The performance of the model compares favorably to studies reporting on the performance of commercial risk assessment models (Winkelman & Mehmud, 2007).

Table: WRA R-Square Performance Metrics by data type and application

	No Censor		200k Censor	
	Prospective	**Concurrent**	**Prospective**	**Concurrent**
A/S, Diagnosis	18%	48%	23%	54%
A/S, Pharmacy	11%	26%	18%	33%
A/S, Diagnosis, Pharmacy	19%	49%	25%	56%

The table below shows the performance of the model split by demographic category. We see that the model performs at more than an acceptable level across the commercial demographic distribution.

Table: WRA R-Square Performance by Demographic Category (A/S, Dx, Rx, 200k Censor, Full Eligibility)

Demographic	Prospective	Concurrent
Female, 00-01	33%	66%
Female, 02-09	52%	68%
Female, 10-18	33%	49%
Female, 19-24	19%	50%
Female, 25-29	14%	44%

[14] This could be due to CPT or revenue codes not being available, or available consistently across plans, or having poor quality, etc.

[15] This is related to the coefficient of determination in linear regression, however technically a bit different as what is used can be termed a *pseudo* R-Squared statistic.

Demographic	Prospective	Concurrent
Female, 30-34	19%	49%
Female, 35-39	22%	51%
Female, 40-44	22%	49%
Female, 45-49	28%	53%
Female, 50-54	30%	58%
Female, 55-59	25%	56%
Female, 60-65	32%	60%
Male, 00-01	46%	29%
Male, 02-09	42%	59%
Male, 10-18	29%	48%
Male, 19-24	24%	56%
Male, 25-29	21%	38%
Male, 30-34	20%	46%
Male, 35-39	23%	49%
Male, 40-44	14%	49%
Male, 45-49	20%	57%
Male, 50-54	21%	53%
Male, 55-59	25%	60%
Male, 60-65	25%	55%
Total	**25%**	**55%**

6.1 Comparison with Other Models

The table below compares the performance of WRA with the CMS-HCC, CDPS, and MedicaidRx models. As one would expect, a commercial-calibrated model such as WRA performs well in relation to the Medicare and Medicaid models (using offered weights).

The offered risk score from CDPS, MedicaidRx or the CMS-HCC model may not normalize to 1.00 over a commercial population, since they were not developed for this population. In order to compare the performance from offered weights from these models, we first normalized the risk scores to 1.00 (which improves the measured performance from these models).

Since the CMS-HCC/CDPS were not developed for a commercial population, the comparison in the table below is not really appropriate. However we note that if these models are recalibrated to the commercial population (same process / data as used for WRA calibration), the performance increase is significant and sits at around 15% for a diagnosis-only model. For Medicaid Rx a recalibration puts the score at 10%, close to WRA performance which makes sense since the WRA pharmacy mapping is to a significant extent based on the MedicaidRx mapping.

WRA Performance Compared with CDPS, MedicaidRx and CMS-HCC (Prospective, No Censor)

		Offered Weights		
	WRA	**CDPS**	**MRx**	**CMS-HCC**
AS, Diagnosis	18%	10%		11%
AS, Pharmacy	11%		7%	
AS, Diagnosis, Pharmacy	19%			

We have not compared the WRA model beyond comparing to CDPS and CMS-HCC models. It is difficult to compare performance statistics to published studies since different data and/or processes used to produce results can easily explain any observed differences. The author of this paper co-authored the 2007 Society of Actuaries' (SOA) study comparing the performance of commercial risk assessment models (Winkelman & Mehmud, 2007). In that study the top diagnosis-only model performance (no censor, prospective) was 17%, and the WRA model compares favorably to that (at 18%).

The CDPS performance in the 2007 SOA study (using offered weights) was 12.4%. In the sample used to develop the WRA model, its performance is 10%. Reasons for lesser performance are explained below (under MedicaidRx discussion) however note that this lower performance is *with* a substantially improved version of the CDPS model (this study used version 5.2 vs. 2.5 used in the SOA study). If the WRA statistics are adjusted[16] using CDPS as a common denominator, the comparable performance of WRA on the SOA study data may be in the 20-22% range (much higher[17] than the next best model – however we note that the models tested in the 2007 study may have improved significantly since).

The MedicaidRx *offered* model performance on that dataset was 13%, compared to its performance at 7% using the data used to develop the WRA model. Additionally, this difference is observed after using a much improved, much later version of MedicaidRx (5.2 vs. 2.5). A difference in demographics is a likely contributor to this difference. While the data used in the 2007 SOA study was significantly weighted towards older adults (e.g. individuals over the age of fifty comprised over 45% of the sample / individuals under thirty comprised 28%), the data underlying the WRA model is not similarly weighted (individuals over fifty are 31% of the sample / individuals under 30 are 36% of the sample). As noted in the SOA study, the sample used was not consistent with a typical commercial population, while the demographics underlying the WRA model are somewhat more typical of a commercial demographic mix. This difference leads to higher utilization of drugs and a higher average number of unique NDC codes per pharmacy benefit utilizer. If the WRA performance is adjusted using MedicaidRx *offered* weight

[16] In a linear/somewhat non-scientific manner
[17] Over 300 basis points higher

performance as a point of reference/commonality between this paper and the SOA study, the pharmacy-only WRA model performs very well compared to the models included in the 2007 SOA study (performance at about 18-20% compared to the top pharmacy-only performance of 17%).

6.2 Performance on Partial Year Members

Proper treatment of partial year members is very important in a risk adjustment exercise. Typically heuristic rules are used in order to account for partial member months. An example would be to assign a risk score to an individual if the individual has six months or more of eligibility in the experience period. A few options are available on the type of score to assign to members with less than six months of data (or where experience is considered not to be 'credible'). One method is to assign them a pure age-gender score. However this may under-recognize the risk for plans that attract a sicker population. Another method is to assign the average plan-specific demographic curve to new entrants, or some combination thereof.

The more important point is that even using the 6-month minimum for 'credible' data, the bias is not removed entirely in risk estimates. The table below shows the predictive ratios for a large Medicare population used together with the CMS-HCC model. Data for individuals with a full calendar year of claims (e.g. 10-12 Months), or less (e.g. 7-9 Months), were passed through the risk assessment tool in order to compute any bias in overall predictions. If we consider the 10-12 Month risk to be 1.00, we see a striking 7% bias when applying the data to members that are eligible for more than 6 months (but less than 10). If uncorrected for, this can introduce serious bias in risk score predictions for plans with materially different average overall eligibility during the experience period.

The WRA model addresses this practical issue through development of weights that are specific to months of eligibility. As we can see by the predictive ratios below, there is no bias for members with eligibility of 1 month through 12.

Months	WRA	CMS-HCC
1-3 Months	100%	74%
4-6 Months	100%	85%
7-9 Months	100%	93%
10-12 Months	100%	100%

6.3 Predictive Ratios by Demographic Categories

It may be important in a risk assessment application to ensure that the risk scores produced do not systematically over or under-compensate for risk by demographic category. This is important since the

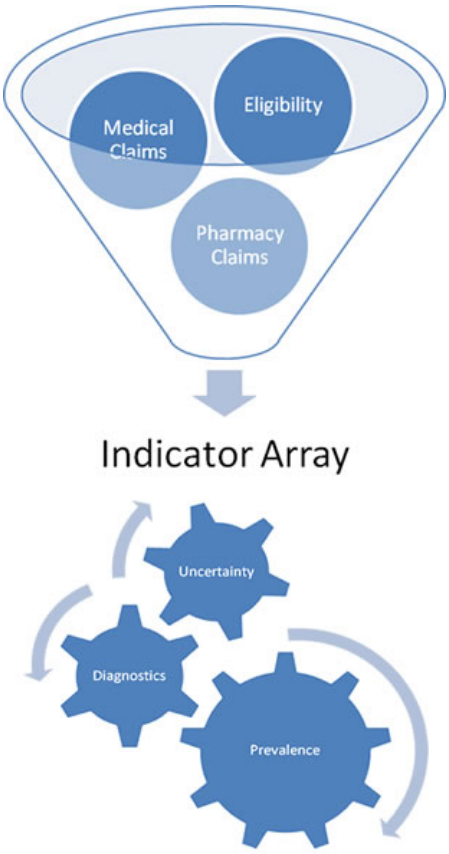
adjustment should not produce payments that systematically reward or penalize plans having a certain demographic mix.

The table below shows predictive ratios by demographic category for the WRA model. While this shows no systematic bias by demographic category, an actuary may want to review these statistics for any particular application of WRA (or any other) model.

WRA Predictive Ratios by Demographic Categories (No Censor, A/S, Dx, Rx, Fully Eligible)

Demographic	Prospective
Female, 00-01	100%
Female, 02-09	100%
Female, 10-18	100%
Female, 19-24	100%
Female, 25-29	100%
Female, 30-34	100%
Female, 35-39	100%
Female, 40-44	100%
Female, 45-49	100%
Female, 50-54	100%
Female, 55-59	100%
Female, 60-65	100%
Male, 00-01	100%
Male, 02-09	100%
Male, 10-18	100%
Male, 19-24	100%
Male, 25-29	100%
Male, 30-34	100%
Male, 35-39	100%
Male, 40-44	100%
Male, 45-49	100%
Male, 50-54	100%
Male, 55-59	100%
Male, 60-65	100%
Total	**100%**

7. WRA Model Reporting



Understanding the output of risk assessment is crucial to a successful risk adjustment process. There are many, many questions one needs to answer in order to conclude that the process is actuarially sound. And these questions are of course very significant as significant sums of money exchange pockets in a budget neutral application.

A few of these questions are answered already in the performance section. These include reviewing the accuracy of the tool used, and recognizing uncertainty in risk assessment at the individual and group level, and testing the statistical significance of average risk score differences.

However this is just the start. Does the tool produce biased estimates at the age-cohort level such that two plans with different demographics will get biased scoring? Is the tool appropriate for the current population? Is the data quality suspect or has significant variance amongst stakeholders? What is the prevalence of conditions? What conditions drive the differences in average risk scores? These questions help us to understand the output of risk assessment and thus have more confidence in the conclusions, not to mention providing actionable information.

Most commercially available risk assessment tools include reporting tools, and these vary in the type of information they present and associated detail and complexity. There is not one ideal way to report on the output. However there are a few key considerations.

A good way to design a deliverable is to work backwards. Designing the report should not be an after-thought, i.e. we should not be looking to extract metrics after developing an application. Instead, for the WRA model the report design was developed first, and the application design then focused on how best to deliver that report. As a practitioner, I asked myself what would I want from a risk assessment output? If I could boil down all the possible reports you could run to the most important, critical information - what would it look like? To me, it would look like the following:

- An ability to access the output array including all members and their demographics, WRA (medical) and WRX (pharmacy) indicators - this data set would allow any ancillary reports to be run that are not included in the summarization described below
- A report that summarizes the indicators to provide prevalence by conditions

- A report that provides an ability to apply different risk scores (e.g. concurrent, prospective, censor levels, pharmacy-only, diagnosis-only, combination-models) without having to run data through a model again. The bounded-coefficient development (described earlier) is a key to this goal.
- Often a single member can switch amongst plans whose risk relativities we are trying to measure. Therefore we need to be able to take the member month weighted average risk score, weighted by the proportion of eligibility that a member has in each of the plans
- Often we have discrete groups that members belong to. The reporting summary ought to be able to split the results by these groups
- The report needs to be at a level that allows the additive risk score model to be applied in Microsoft Excel (this is very useful for checking and gleaning insight). For the WRA, this means that the report needs to include demographic and eligibility duration breakdowns.
- The prevalence itself needs to be broken down by demographics (note that this is a different layer of detail than above), as different demographics not only drive differences in the age-gender portion of the risk model, but also the condition part. In order to make a consistent comparison, this detail is important.
- The report needs to provide basic diagnostic information (i.e. average eligibility, claimant ratios, average number of diagnosis/NDC code per claimant).

The WRA model comes with a Microsoft Excel reporting tool, which is also provided without fee. The SQL code produces up to four output tables, and these can directly be copied / pasted into the Excel model, which then updates to provide the information described above. The WRA Quick Start Guide, provided as appendix F to this paper provides some further information.

8. WRA Model Updates

The WRA model will be updated periodically to address user feedback, updated data, and other changes. The versions of the model that have been publicly released will be tracked to the extent possible and earlier versions made available if requested. Users who have downloaded the WRA model will be notified via e-mail when an updated model becomes available.

Users of the WRA model (or another model) will want to tailor the model to address a host of unique situations. Examples of these include (1) calibration to state or application-specific data, (2) exclusions of services not at risk, (3) exclusion of services for which data cannot be collected or is not reliable, (4) consideration of methodological issues (e.g. interaction with reinsurance provisions or other rating factors), etc.

An open source model such as WRA makes it feasible for users to carry out such calibrations / model changes. However Wakely actuaries or other qualified professionals can help with this task as well.

9. Quantification of Risk Score Uncertainty

Performance of a risk adjustment tool has typically been measured in terms of accuracy, and specifically through the R-square statistic. However there are many other aspects of a risk assessment that are worthy of measurement and consideration from a performance perspective.

Actuarial expertise in risk assessment is a work in progress. There has been research into the accuracy of risk assessment methodologies, potential applications, and implementation issues. However the quantification of uncertainty in risk assessment has been missing from a comprehensive understanding. For example, we have the tools to measure that a risk score of 1.2 for an individual or group is x% accurate on average (e.g. R-squares), however we do not have well-developed tools to say the risk score is between y and z with a certain degree of confidence.

Quantifying uncertainty in risk adjustment is an active topic of research (sponsored by the Society of Actuaries' Health Section, anticipated release in 2011 [Mehmud, Rong Yi, 2012]). Such quantification is important as risk assessment has a very significant impact on the bottom line results of health plans, and we current utilize heuristics or rules of thumb to deal with uncertainties such as partial eligibilities, sample size credibility, lag, turnover, and varying accuracy of tools used amongst a host of other practical concerns. Understanding and quantifying uncertainty brings much needed rigor to recognition of practical constraints and fairness to the process of risk adjustment.

Included in the download package is a small tool (….Interval Lookup.xlsx) that allows a user to look up a confidence interval around individual and group level risk scores given a few inputs. Stay tuned on SOA.org for a report sponsored by the Health Section that will provide details on how these intervals are calculated. *Please note that currently this tool is experimental and for research use only*.

The tool provided with the WRA model is fairly straightforward. The following screen capture shows the inputs required to determine a confidence interval. These are:

1. Type of prediction (i.e. concurrent or prospective)
2. Size of group average risk score for which an interval is required (i.e. individual up to 5,000)
3. Recognizing heteroscedasticity in risk scores, the calculated risk score percentile in order to get an appropriate interval around it (e.g. 0-7th percentile risk score)

Enter Inputs for Corresponding WRA Interval Estimate

Risk Score Type	**Concurrent**
Group Size	**5000**
Risk Score %ile	**All**

Confidence Intervals (as +/- adj.)		
80%	**90%**	**95%**
{-0.04,0.044}	{-0.05,0.06}	{-0.059,0.074}

10. Risk Adjustment Under Health Reform

While the WRA model is not exclusively designed for use under ACA – the process of its development included a strong emphasis on the appropriateness of its use by states in their risk adjustment programs. For example, the Department of Health and Human Services (HHS) has indicated that the federal risk adjustment model will be similar to the Centers of Medicare and Medicaid's (CMS) Hierarchical Condition Category (HCC) model. The WRA model builds up its mapping from the CMS-HCC model significantly expanding and revising it for use with a commercial population.

The discussion below provides the salient points of risk adjustment under health reform, including some observations on how the WRA model addresses key objectives of reform.

The Affordable Care Act (ACA) establishes a risk adjustment program for all non-grandfathered individual and small group plans inside and outside of Healthcare Exchanges (HIXs) (CCIIO, 2011). The goal of the program is to stabilize premiums in the marketplace. The way this is accomplished is by transferring money from issuers with lower risk enrollees to those with higher risk enrollees. The intent is to reduce or eliminate differences in premium that are due to expectations of favorable or unfavorable selection, or plan choices by higher (or lower) risk enrollees. Running statewide risk adjustment calculations is aimed at stabilizing premium growth and curbing market instability inside and outside of the exchange.

The Notice of Proposed Rulemaking (NPRM) (45 CFR Part 153) issued in July 15, 2011 proposed that the Department of Health and Human Services (HHS) develop a Federally-certified risk adjustment methodology and that states have the option to develop and propose alternate methods for certification by HHS.

The goals outlined for a risk adjustment program in the Standards Related to Reinsurance, Risk Corridors and Risk Adjustment (DHHS, 2011) includes the following:

1) An accurate explanation of cost variation within a given population
   The WRA model performs at a level comparable with publicly available models (such as CDPS and CMS-HCC) as well as other commercially sold models.
2) Clinically meaningful risk factors
   The development of the mapping was guided by statistical as well as clinical factors. Examples of clinical review are included above in this report.
3) Encourage favorable behavior and discourage unfavorable behavior
   An example would be limiting pain medications and diagnoses in the WRA mapping, shifting incentives from symptomatic treatment towards diagnosing and treating the underlying condition. Another example is the production of very detailed and automated reporting that will help plans to identify drivers of risk and areas for cost-containment and other improvement.
4) Limit gaming of the risk adjustment program
   Vague diagnoses or heavily abused prescriptions are explicitly excluded from WRA mappings. These are intended to limit gaming of the program through over-utilization and over-coding.

5) Use data that is complete, high quality, and available in a timely fashion

   The WRA model includes options for whether to use only diagnosis data, only pharmacy data, or a combination of both. Diagnosis codes and pharmacy NDC codes are typically captured data elements in transaction claim data, and are usually available in a timely fashion (especially pharmacy codes).

6) Provide stable risk scores over time and across plans

   One emphasis in the development of the WRA approach was model-parsimony. A balance was sought between specificity of the model and credibility of data that will ultimately be used in the application or recalibration of the model. This balance is intended to provide stable risk scores over time and across plans.

7) Minimize the administrative burden

   The WRA model is free and runs on software that is available free of cost. The model uses very simple inputs that are fairly universally available. The operation of the model is also simple and transparent.

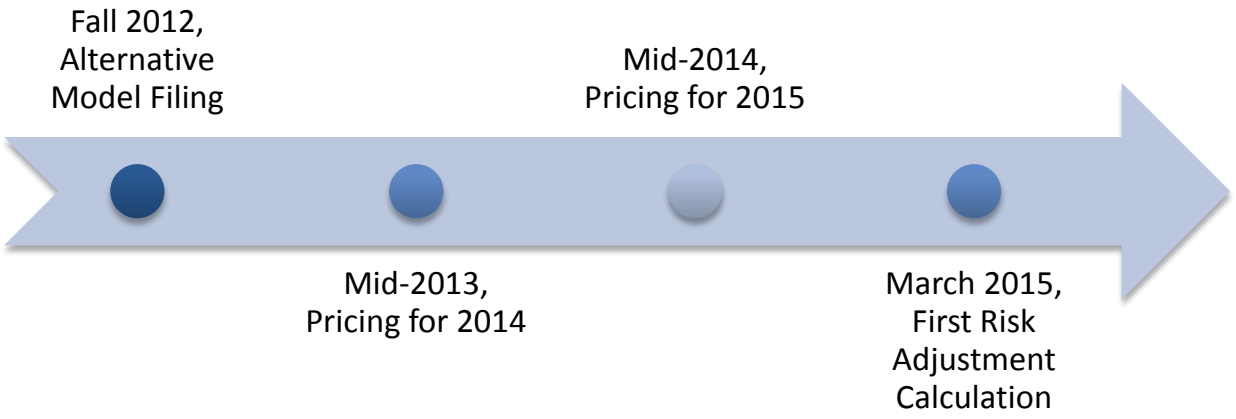
10.1 TIMING

ACA mandates that all non-grandfathered small group and individual carriers inside and outside of a state healthcare exchange undergo their first risk adjusted payment transfers starting calendar year 2014. States can opt to use the federal risk adjustment methodology (expected to become available in the fall of 2012) or file an alternative risk adjustment methodology for HHS certification. This filing is due very soon (i.e. a month) after the federal model becomes available. The alternative risk adjustment methodology could mean a different model or using different parameters for the federal model.

Some states have voiced concern that the timing may not allow for sufficient review and testing of the federal methodology to see if it serves their markets. Such testing may include everything from data submission timelines, type of data that is available, development of rating areas, the schedule of payment transfers, stakeholder engagement and buy-in, and a simulation of the amounts that are transferred from each carrier. The WRA (and other publicly available models) provide an opportunity for states to test their decision of whether to file for an alternative methodology. It also provides states with an opportunity to set up analytical processes (e.g. data input files, programming for comparative performance statistics, test and identify key metrics from a decision-making perspective, validation exercises, etc.) to be able to test the federal model relatively quickly as well.

From a risk adjustment perspective, the following graphic presents key points in time towards the first full ACA risk adjustment exercise in 2015. The potential filing for an alternative model is discussed above. If a state is looking to test the impact of the federal model on markets, or compare performance metrics to an alternative methodology (required documentation for HHS certification of an alternative methodology), then the work needs to commence much before fall 2012. Subsequently health plans will require information on *simulated* relative risk in order to aid in actuarial pricing of their products in

2014. This exercise has limitations, mostly due to lack of information on the uninsured, however still vital from the perspective of plans to set competitive rates, as well as from the goals of health reform to discourage conservatism in rates for 2014/2015 due to uncertainty.



10.2 Implementation Issues

There is a difference between *model* and *methodology.* This paper deals primarily with the WRA model, however this model (or any other) needs to be implemented within a larger methodology that addresses many of the questions that surround risk adjustment implementation. These questions are presented below and draw largely from the discussion in CCIIO's highly informative white paper on risk adjustment (CCIIO, 2011). For a further discussion please see the referenced white paper.

10.2.1 Decision Points

1. Prospective or Concurrent Application
    a. The WRA model comes with prospective and concurrent weights. The data that is run through the model may be the same under prospective or concurrent application, however under the prospective case more (e.g. two years) data may be needed for appropriate calibration of a model.

2. Recognizing transitional reinsurance payments[18] in risk adjustment
    a. If unadjusted, a plan with very high risk enrollees may receive risk adjustment payments due to these enrollees, and may also receive reinsurance payments in addition. One way

[18] From the 3-year transitional reinsurance program in the individual market

the WRA model recognizes reinsurance arrangements is through censoring[19] of the cost / dependent variable during development of the model.

b. Adjusting the model to recognize reinsurance payments will require (a) variations of censoring since the parameters of the reinsurance program may vary by state, and (b) separate models for individual and small group markets (who are not subject to reinsurance payments). Analysis can be conducted using the WRA model to determine the impact to the coefficient weights upon censoring the cost variable at various levels, in order to ascertain whether the additional effort to develop customized weights by state / markets is needed.

3. Addressing Limited Claim Experience
    a. The WRA model includes weights that are specific to the level of claim experience that is available for a member. This is discussed in more detail in section 6.2. This is serious concern as (a) a lot of movement in and out of the individual and small group market and / or an exchange is expected, and (b) there is a clear statistical bias in looking at predictive ratios by limited claim experience that needs to be addressed. The approach used by the WRA model to develop separate weights by levels of limited claim experience ensures that there is no bias by limited claim experience and that the risk assessment performance is not significantly compromised for members with limited experience.

4. Addressing Receipt of Cost Sharing Reductions
    a. ACA establishes cost sharing reductions for the individual market, and this in turn may affect the utilization of services in the individual market. One way to recognize this effect would be to calibrate the WRA model (or another model) separately to the individual and small group markets.

5. Using a Pharmacy Model
    a. The CCIIO white paper (CCIIO, 2011) includes comments regarding the 'powerful incentives' associated with using pharmacy data to risk adjust. For example, the treatment of a condition for some patients may benefit more from behavioral changes rather than prescription medicines. However the plan receives more funds if drugs are prescribed in a pharmacy-based model (since the risk score may recognize the additional prescriptions). The MedicaidRx model, upon which the WRA pharmacy model is based – excludes several drugs on the basis of their susceptibility to be over-utilized. The WRA model makes a few further exclusions based on information on the more abused drugs in the United States. However CCIIO (CCIIO, 2011) envisions a more stringent criterion where only those drugs may be considered in a pharmacy model (to

[19] Censoring of a cost variable communicates partial information. For example if annual costs only up to $200,000 for an individual are at risk, the cost is set to this amount if it is actually over this amount. While *truncation* and censoring are used interchangeably in literature, technically truncation means to remove the high cost *individual* entirely from the analysis rather than to recognize partial information.

supplement a diagnosis model, not as stand-alone) where there is 'virtually universal clinical agreement about when they should be used'.

b. However CCIIO indicates (CCIIO, 2011) that pharmacy data may be used in a transitional model only. This may be very helpful for states where medical data is unavailable, too old, or of very poor quality – while it generally much easier to access high quality pharmacy data without timing concerns. The WRA model supports all three combinations (i.e. diagnosis-only, pharmacy-only, diagnosis and pharmacy) and its pharmacy component can be used as a transitional model.

6. Accounting for Benefit Differences
   a. Paid amounts (after cost sharing) may vary by metal tiers (e.g. will be affected by lower deductibles in a platinum plan vs. bronze plan). As such if a risk assessment model is calibrated to paid amounts (assuming a certain benefit package or a mix), then the model may over-estimate the risk borne by a plan with greater enrollment (than average) in low actuarial value plan. The effect of benefit differences on risk coefficients could be simulated using any risk assessment model, including the WRA.

10.2.2 Interaction with Other Rating Factors

Plans may vary rates within a maximum variation defined for age, as well as for factors such as smoking, geographic area, and family size. Ideally risk adjusted payment transfers should not include a recognition of these rating factors (since they are already reflected in collected premium). While it may be difficult to collect member-level information on smoking, geography, and family size – age is something that is available on the risk scoring input file.

In 2014, issuers will be able to vary rates by age category up to a 3:1 ratio for adults. However risk scores reflect the full variation of cost by age and this is likely to be greater than a 3:1 ratio. If risk scores are not adjusted to reflect *only the difference* between the 3:1 allowable premium variation and the full age/gender cost then the net revenue for older adults may be too high, and that for younger adults too low. This may lead to a decreased premium charged to older adults, and an increased premium for younger adults. Based on the net revenue calculations, plans may set rates at a lower than 3:1 ratio.

There are two main methods of accomplishing this (CCIIO, 2011). One is to apply an allowed rating curve and remove it from risk scores (at a member level). The other method is to develop risk scores through a constrained regression approach such that risk scores already reflect the ability of plans to rate older adults at three times the premium for a younger adult. Relevant to the second method, the WRA model currently does not provide rates adjusted for allowable age-rating variation. However these could be generated and provided to states looking to remove the age-rating factors from risk scores.

10.2.3 Risk Adjustment & Selection

Users of risk adjustment models have long known that these models underestimate costs for higher cost individuals, and overestimate costs for low cost individuals. The table below shows predictive ratios by actual cost deciles. We can see that the predicted costs are much lower for the 90-100th percentile, while they are much higher on average for the lower cost individuals (e.g. lots of individuals with zero cost in the prediction period). This table is also consistent with other published research (Winkelman & Mehmud, 2007). The column 'With BCF' will become clearer later in this section – however as a quick explanation this shows results after application of *bias correction factors* to adjust for apparent bias in predictive ratios by *predicted decile*. As this column shows, the adjustment made to address bias by *predicted* decile does not strongly impact an apparent bias by *actual* decile.

Predictive Ratios by Actual Cost (Year 2) Deciles for a Medicare & Commercial Population

	Predictive Ratios	
Actual Deciles	**Original**	**With BCF**
90-100%	50%	49%
80-90%	110%	107%
70-80%	149%	145%
60-70%	185%	183%
50-60%	222%	224%
40-50%	274%	282%
30-40%	357%	373%
20-30%	506%	541%
10-20%	1209%	1293%
0-10%		
Total	100%	99%

However while the information in the table above is helpful to understand the performance of a model, it is not helpful for any potential selection of risks. After all, we do not know in year 1 who is *actually* going to be higher or lower cost in year 2. All we know in year 1 is the *expected* year 2 costs for individuals from the risk assessment model. Looking at predictive ratios by *actual* deciles is not actionable information from the perspective of any potential for selection.

Let us ask the same question a different way. What are the actual costs for individuals in year 2 by deciles of their predicted costs in year 1? If there is any systematic bias by risk score predicted deciles, this information *may be* actionable. The table below is reproduced from CMS's evaluation of the CMS-HCC (version 12) risk adjuster used widely in the Medicare Advantage program (Gregory C., John, Melvin J., Sara, Rishi, & Cordon, 2011). This table shows the *predictive ratios*, the ratio of a cohort's predicted cost to its actual cost, broken out by deciles of predicted cost. The table also includes comparative numbers from a commercial dataset (i.e. part of data used in development of the WRA model).

Predictive Ratios by Predicted Risk Score Deciles for a Medicare & Commercial Population

Predicted Risk Decile	CMS-HCC	Commercial
90-100%	100%	102%
80-90%	104%	109%
70-80%	103%	108%
60-70%	101%	104%
50-60%	100%	98%
40-50%	99%	91%
30-40%	97%	83%
20-30%	96%	80%
10-20%	93%	65%
0-10%	89%	56%

This table essentially shows that the actual costs came out lower than expected for individuals above the 50th percentile, while actual costs were higher than expected below the 50th percentile. The 'Commercial' column indicates that variation in predictive ratios is even greater in a commercial population (more variation by age/risk). Following are some key issues:

- Someone at a plan looking at these ratios at year 1 would know which groups/individuals they would prefer for year 2. After all, those individuals in a 0-10 percentile of predictive risk are systematically under-compensated in a risk score based payment approach. As such this may provide incentives that run counter to the intent of risk adjustment to foster premium stabilization and mitigate risk selection.
- If the entire exchange is risk scored, and one plan gets a disproportionate share of the 0-50th percentile risks – then that plan may get systematically underpaid for assumed risk.
- If there is a selection dynamic in an exchange, where higher or lower percentile risks are moving from one plan to another – the risk score from a model that follows those individuals may systematically over- or under- compensate for the underlying risk transfer.
- There is concern amongst experts that potential may exist for plans to use non-traditional risk adjustment variables (e.g. income) in order to identify and select risks through marketing activities, network strategy etc. We need to consider the potential for selection using the risk assessment scores themselves for such activities, which display an actionable pattern in the predictive ratios by predicted risk score deciles.

This is likely not a significant issue with Medicare Advantage program where there is more stability in a covered population, but it may well be a bigger issue for an exchange environment where a significant population movement within an exchange is expected. It is important to stress that *no existing risk assessment model will correct for this*. This is not an issue with the modeling technique that is used. This is an issue of the method in which risk scores are implemented in a program. This issue can be addressed in a model (e.g. such as WRA) through a simple application of *bias correction factors (BCF)*. The table below shows the original predictive ratios, and ones after application of the correction factors.

Adjusting risk scores in a non-least mean squares estimation sort of way introduces the chance of affective performance of the risk assessment model. However we see from the table that the performance is not affected (i.e. performance stays at 18% R-Squared for a diagnosis only, prospective, no-censor application of the model).

	Predictive Ratios		R-Square	
Predicted Deciles	**Original**	**With BCF**	**Original**	**With BCF**
90-100%	102%	100%	23%	23%
80-90%	109%	100%	4%	4%
70-80%	108%	100%	0%	0%
60-70%	103%	100%	1%	1%
50-60%	98%	102%	3%	3%
40-50%	90%	101%	6%	6%
30-40%	84%	100%	12%	12%
20-30%	78%	102%	21%	22%
10-20%	69%	108%	18%	19%
0-10%	56%	102%	55%	56%
Total	**100%**	**100%**	**18%**	**18%**

Adjusting scores in this way further exacerbates (in a material, though not large) the issue of under prediction for high cost claimants when seen from the flip side (i.e. predictive ratios by *actual* deciles). Reinsurance provisions may help with that equation such that it becomes less of an issue. It is clear that more research needs to be done on this question.

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APPENDIX A: A PRIMER ON RISK ASSESSMENT & ADJUSTMENT

Healthcare provider reimbursement mechanisms can be broadly grouped in two categories. There is the Fee-for-Service arrangement, where payments are made for each individual service that is performed. Then there are capitated contracts where a fixed payment is made (e.g. for each individual that is covered). Risk assessment models typically operate in a setting where a capitated arrangement in in place. A 'baseline' capitated amount or premium can be adjusted in a budget-neutral way through the proper application of a model.

Health claim-based risk *assessment* is the process of determining the relative costs of a person based on their medical history. A typical process is to group the diagnosis and/or prescription drug history of a patient into condition categories. These groupings are intended to be as homogenous as possible with respect to clinical meaningfulness and cost. The categories serve as indicators for whether a person has that condition. For example, a table such as the one below may be constructed from claim data using a grouping mechanism.

Table 1 – Example of a risk adjuster interim output

	Age/Gender Categories			Condition Categories		
	M, 19-24	M, 25-29	F, 60-64	Asthma	Diabetes	Fracture
Patient A	0	1	0	1	0	1
Patient B	1	0	0	1	1	0
Patient C	0	0	1	0	0	0

This table shows that patient A is a male having an age between 25 and 29, and has asthma and suffered a fracture. A typical grouping table such as this would include about a dozen age and gender bins and anywhere from about forty to over a thousand condition categories. These categories are binary indicators, with a value of 1 indicating that the person belongs to the category. The actual number and logic for categorization varies by the several commercial and public-domain software tools that are available to the actuary.

Once grouped, typically an additive regression model is applied to get the risk score for each person. A general form of the model is:

$$\alpha + \sum_{i}^{Demographic} \beta_i x_i^D + \sum_{j}^{Conditions} \gamma_j x_j^C = Y$$

Where alpha is the intercept term in a linear regression model, beta/gamma represent the coefficients of regression, and the summation is over the age/sex and condition group binary indicators. The dependent variable, Y, is typically the total medical cost over the year contiguous to the experience year. Thus given the coefficients of this model ({alpha, M-25-29, Asthma, Fracture} → {0.2, 0.33, 0.35, 0.01}) we can calculate the risk score for patient A (0.2+0.33+0.25+0.01 = 0.79). A risk score of 0.79 indicates that patient A is expected to cost 21% less than an average risk over the next year.

Risk *adjustment* is the process of adjusting provider payments or insured premiums to reflect the health status of the members. Once risk scores are calculated using the process above, they can be averaged over a sub-population to produce a point estimate reflecting the risk of that population. This estimate can then be compared to other sub-populations of interest and for purposes of risk adjustment. As a heuristic rule, members with less than 6 months of experience are not scored as their experience is not considered credible, and the risk scores for others are weighted by months of membership in order to put more emphasis on members that had more experience. Comparisons are made by age/sex bins in order to mitigate differences due to demographic mix.

The table below shows a simplified revenue-neutral risk adjustment calculation.

Table 2 – A simplified risk adjustment calculation

	Member Months	Average Risk	Base Capitation	Adjusted Capitation
Plan A	500,000	1.03	$450.00	$463.50
Plan B	500,000	0.97	$450.00	$436.50
Total	1,000,000	1.00	$450.00	$450.00

APPENDIX B: ADVANCED ANALYTICS WITH WRA

The focus of the Wakely Risk Adjustment Model is appropriately on fairness, transparency, and accuracy - roughly in that order. There are other actuarial applications which demand an absolutely uncompromising focus on improving accuracy. The Wakely Risk Adjustment Model provides a great foundation to build advanced predictive modeling solutions. This section briefly describes the process that Wakely consultants have developed to evolve the WRA model further into a sophisticated predictive modeling application.

- Typical Risk Adjustment: A typical risk adjustment model looks like the formula below. This model is representative of the process behind capitation payment adjustments in Medicare Advantage, many state Medicaid programs and commercial plans. This model is also representative of the base WRA model. A grouping algorithm is used to create indicators for demographic and condition variables and then using linear regression the model is fitted to data to produce the coefficients. These coefficients in turn determine the individual-level risk scores.

$$\alpha + \sum_{i}^{Demographic(D)} \beta_i^D x_i^D + \sum_{j}^{Conditions(C)} \beta_j^C x_j^C = Y$$

- Avanced Risk Adjustment: Advanced risk adjustment modeling does no presuppose a set of variables or a modeling approach. It is a disciplined and rigorous investigation into producing the most accurate predictions possible, along with a sophisticated understanding of the reliability of such estimates using confidence intervals and calculating levels of statistical significance. This modeling builds on the traditional risk adjustment model and may be represented sybmolically as below.

$$f : \vec{X} \rightarrow Y$$

$$\left\{ \vec{x}_{Demographic}, \vec{x}_{Conditions}, \vec{x}_{Lifestyle}, \vec{x}_{Census}, \vec{x}_{Other} \right\} \in \vec{X}$$

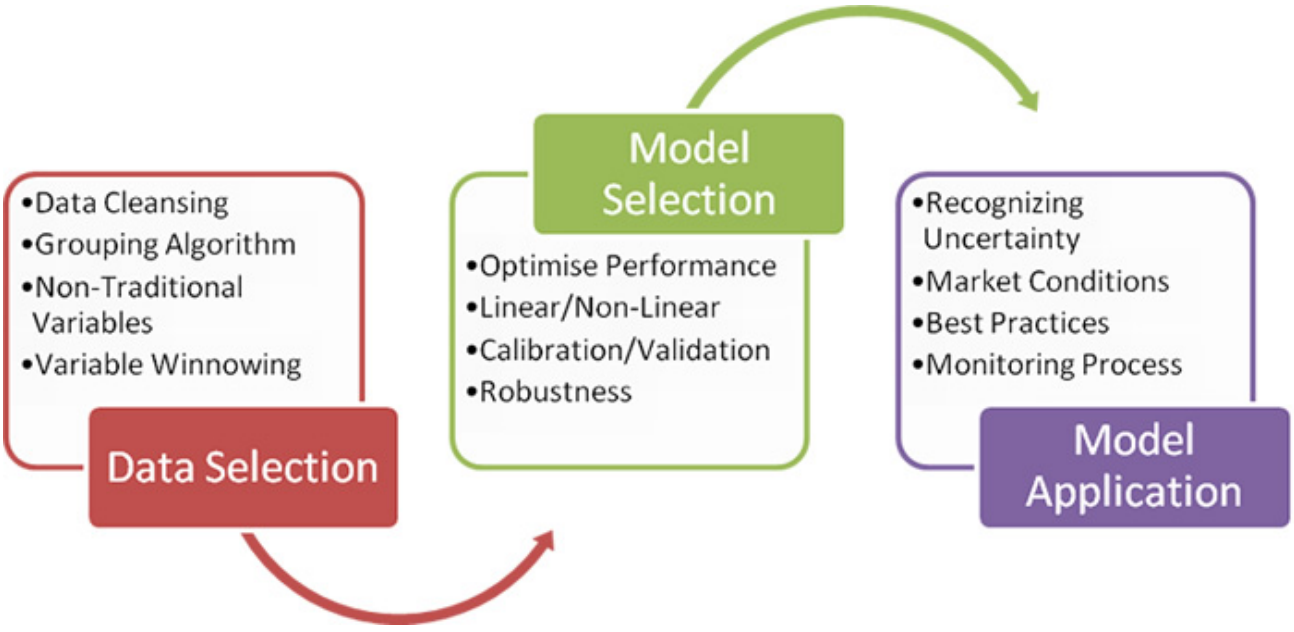
$$Y \Rightarrow \left\{ y_a, y_b \right\}, \Pr(y_a < Y < y_b) = 1 - \alpha$$

- Prior Cost & Utilization: While prior cost and utilization statistics have been shown to substantially improve accuracy, they are inappropriate for use in a typical risk adjustment application as they provide incentives to reward costlier treatment or over-utilization. However there are certain applications where such incentives do not exist, and as such these variables can add tremendously to the predictive power of the application. The open-source and flexible framework of the WRA model allows for easy addition of these variables. At Wakely, consultants have studied the various sub-categorizations of prior cost and use and have identified combinations that optimize performance.

- Recognition of Uncertainty: this represents cutting edge research. Performance metrics such as R-Square only partially describe a measurement of risk score. The expression of uncertainty has long been a key missing piece of the puzzle. Developing confidence intervals around risk scores and testing group-mean risk scores for statistical significance allows for a scientific basis for comparing the risk of two groups and adjusting this comparison for uncertainty inherent in future estimates. This information can also be used to reduce year-over-year volatility in risk score estimates of small groups.

- Non-Traditional Variables: identifying variables that add predictive power beyond traditional risk adjustment variables is a very important question, especially given changes in the healthcare system emerging over the next few years. Traditional variables comprise elements such as demographic information, diagnosis codes and national drug codes. Non-Traditional variables such as income, geography, lifestyle variables, behavioral information, and various formulations of uncommon utilization statistics can provide additional predictive accuracy. The design framework of the WRA model allows for non-traditional variables, if available, to easily be included in the development of risk coefficients.

- Advanced Modeling: Typical risk adjustment models utilize a simple linear regression model for reasons explained at the beginning of this section. Even the more sophisticated models appear beholden to a certain approach (i.e. using only a decision tree model or a Neural Network model). One needs to free themselves from a particular approach, software or process - and to realize optimal performance via applying and measuring performance over different classes of algorithms. This amount of computation is usually not feasible, but recent advancements in processing and development of frameworks such as the Algorithm Comparison Engine allow this type of model selection to be achieved efficiently.



APPENDIX C: DIAGNOSIS & PHARMACY COMBINED MAPPING

The following tables (I & II) show the variables that are selected from the diagnosis and pharmacy indicators of the WRA model in order to develop a combined model.

Table I – WRA (Diagnosis-Based) Categories Picked for Combination Model (65 Categories)

WRA Category Description	WRA #
Arthropathies	WRA1
Bone/Joint/Muscle Infections/Necrosis	WRA2
Central Nervous System (H)	WRA3
Central Nervous System (L)	WRA4
Cerebral Palsy, Hemorrhage and Other Paralytic Syndromes	WRA5
Chronic Ulcer of Skin, Except Decubitus	WRA7
Circulatory/Cardiovascular (H)	WRA8
Circulatory/Cardiovascular (L)	WRA9
Circulatory/Cardiovascular (M)	WRA10
Cirrhosis of Liver	WRA11
Congestive Heart Failure	WRA12
Cystic Fibrosis	WRA13
Diabetes with Renal or Other Specified Manifestation	WRA15
Dialysis Status	WRA17
Diseases of the Blood (H)	WRA18
Diseases of the Blood (L)	WRA19
Diseases of the Blood (M)	WRA20
Diseases of the Blood (VH)	WRA21
Diseases of the Genitourinary System	WRA23
Disorders of Immunity	WRA24
Disorders of the Eye & Adnexa	WRA25
Dorsopathies (H)	WRA26
Dorsopathies (L)	WRA27
Drug/Alcohol Psychosis or Dependence	WRA28
Endocrine, Metabolic, and Immunity Disorders (H)	WRA29
Endocrine, Metabolic, and Immunity Disorders (L)	WRA30
End-Stage Liver Disease	WRA31
Fracture/Dislocation	WRA33
Gastrointestinal/Infectious/Parasitic (H)	WRA34
Inflammatory Bowel Disease	WRA38
Lymphatic, Head and Neck, Brain, and Other Major Cancers (H)	WRA41
Lymphatic, Head and Neck, Brain, and Other Major Cancers (L)	WRA42
Lymphatic, Head and Neck, Brain, and Other Major Cancers (M)	WRA43
Major Complications of Medical Care and Trauma	WRA44
Major Depressive, Bipolar, and Paranoid Disorders	WRA45
Mental Disorders (H)	WRA47
Mental Disorders (L)	WRA48

WRA Category Description	WRA #
Metastatic Cancer and Acute Leukemia	WRA49
Multiple Sclerosis	WRA50
Neoplasm of Bone, Connective Tissue, Skin, & Breast (H)	WRA52
Neoplasm of Bone, Connective Tissue, Skin, & Breast (L)	WRA53
Neoplasm of Digestive/Peritoneum	WRA54
Osteoarthrosis	WRA56
Other Infectious & Parasitic Diseases (H)	WRA60
Other Infectious & Parasitic Diseases (L)	WRA61
Other Musculoskeletal System & Connective Tissue	WRA62
Other Neoplasm	WRA64
Other Pulmonary/Respiratory	WRA65
Other Rare	WRA66
Polyneuropathy	WRA69
Pregnancy (Incomplete)	WRA70
Pregnancy Related	WRA71
Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	WRA72
Protein-Calorie Malnutrition	WRA73
Pulmonary/Respiratory (H)	WRA74
Pulmonary/Respiratory (L)	WRA75
Pulmonary/Respiratory (M)	WRA76
Quadriplegia, Other Extensive Paralysis	WRA77
Renal Failure (H)	WRA78
Renal Failure (M)	WRA80
Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	WRA82
Septicemia/Shock	WRA85
Skin & Subcutaneous Tissue (H)	WRA86
Vascular Disease	WRA88
Very Severe Neoplasm / Cancer	WRA90

Table II – WRX (Pharmacy-Based) Categories Picked for Combination Model (35 Categories)

WRX Category Description	WRX #
Anti-coagulants	WRX3
Asthma/COPD (High)	WRX5
Asthma/COPD (Medium)	WRX7
Attention Deficit	WRX8
Cardiac (High)	WRX10
Cardiac (Medium)	WRX12
Cystic Fibrosis	WRX14
Depression / Anxiety	WRX15
Diabetes	WRX16
ESRD / Renal	WRX19
Folate Deficiency	WRX20

WRX Category Description	WRX #
Gastric Acid Disorder	WRX21
Glaucoma	WRX22
Growth Hormone	WRX24
Hemophilia/von Willebrands	WRX25
HIV	WRX28
Hyperlipidemia	WRX29
Infections, high	WRX30
Insomnia	WRX34
Insulin Analogue (Chemical/Ingredient)	WRX35
Liver Disease	WRX39
Malignancies	WRX40
Multiple Sclerosis / Paralysis	WRX42
Nausea	WRX43
Neurogenic bladder	WRX44
Pain	WRX47
Parkinsons / Tremor	WRX48
Prenatal care	WRX49
Psychotic Illness / Bipolar	WRX51
Quinolone Antimicrobial	WRX52
Recombinant Human Interferon beta, Recombinant Proteins	WRX53
Replacement solution	WRX54
Seizure disorders	WRX55
Serotonin-3 Receptor Antagonist	WRX56
Transplant	WRX58

APPENDIX D: DEMOGRAPHIC CATEGORIES

The following table shows the demographic breakdowns of the Wakely Risk Assessment Model. The WRA model reporting tool reports condition prevalence and risk for each of these breakdowns.

WRA Category	Description
F1	Female, 00-01
F2	Female, 02-09
F3	Female, 10-18
F4	Female, 19-24
F5	Female, 25-29
F6	Female, 30-34
F7	Female, 35-39
F8	Female, 40-44
F9	Female, 45-49
F10	Female, 50-54
F11	Female, 55-59
F12	Female, 60-65
F13	Female, 65+
M1	Male, 00-01
M2	Male, 02-09
M3	Male, 10-18
M4	Male, 19-24
M5	Male, 25-29
M6	Male, 30-34
M7	Male, 35-39
M8	Male, 40-44
M9	Male, 45-49
M10	Male, 50-54
M11	Male, 55-59
M12	Male, 60-65
M13	Male, 65+

APPENDIX E: DIAGNOSTIC CODE REMOVAL

The following SQL logic identifies diagnostic codes consistent with how the weights were developed for the WRA model {CPTID=CPT Code, REV=Revenue code}.

```
DIAGNOSTIC_EXCL=CASE WHEN CPTID IN
('36415','G0027','G0252','G0328','S0820','S2120','S3905','S9024') OR
                          CPTID BETWEEN '70000' AND '76999' OR
                          CPTID BETWEEN '77051' AND '77084' OR
                          CPTID BETWEEN '78000' AND '78999' OR
                          CPTID BETWEEN '80000' AND '89999' OR
                          CPTID BETWEEN '99000' AND '99002' OR
                          CPTID BETWEEN 'G0101' AND 'G0107' OR
                          CPTID BETWEEN 'G0117' AND 'G0124' OR
                          CPTID BETWEEN 'G0130' AND 'G0148' OR
                          CPTID BETWEEN 'G0202' AND 'G0235' OR
                          CPTID BETWEEN 'G0306' AND 'G0307' OR
                          CPTID BETWEEN 'G0330' AND 'G0331' OR
                          CPTID BETWEEN 'G0430' AND 'G0431' OR
                          CPTID BETWEEN 'P2028' AND 'P7001' OR
                          CPTID BETWEEN 'P9603' AND 'P9615' OR
                          CPTID BETWEEN 'Q0091' AND 'Q0115' OR
                          CPTID BETWEEN 'R0070' AND 'R0076' OR
                          CPTID BETWEEN 'S3600' AND 'S3900' OR
                          CPTID BETWEEN 'S8001' AND 'S8093' THEN 1
                     WHEN REV IN ('0343','0349') OR
                          LEFT(REV,3) IN ('035','040','060','030') OR
                          REV BETWEEN '0310' AND '0341' THEN 1
                     ELSE 0
                     END
```

APPENDIX F: GETTING STARTED WITH WRA

The WRA quick start guide is reproduced below and also shipped with the distributable file.

WRA Quick Start Guide

The following notes are intended to get a user up and running quickly with the WRA model. Please see the WRA White Paper (available on Wramodel.com) for more details regarding this model[20].

The Package:

1. **Wakely Risk Assessment Model V101.zip**
2. Unzip the package. Note the location it has been unzipped to. There are a few SQL lines of code that will need to be changed to the location of the unzipped files.

SQL Install:

1. If you do not currently have a SQL installation, you can download and install Microsoft SQL Express (this free version from Microsoft supports up to 10 Gigs databases[21])
   http://www.microsoft.com/sqlserver/en/us/editions/express.aspx

Setting Up a Workspace

1. Set up a database on SQL for the running of the model. The code uses a database titled WRA_Model. We recommend you use the same name, however if you would like to re-name it, then there are highlighted places in SQL code where you would need to edit the code to point to the right database.
2. There are a number of text files that ship with the WRA model. These need to be imported into SQL in order to begin using the model. You can either use your own import process, or there is code provided with the WRA model for quick importing into the database (described below).
   a. Open the SQL query WRA Model-Setup.sql.
   b. In the SQL query WRA Model-Setup.sql change the location of the .txt files in the SQL code. This is going to be the location where the package was unzipped. The SQL lines that need to be changed are: 241, 251, 261, and 271. In addition, for the practice exercise the following location will need to be changed on lines 334, 344, and 354. An easy way to change the paths is to navigate to the file location using windows explorer and copy and paste the path to the file in the code.
   c. Run the SQL query WRA Model-Setup.sql to create the database, create behind the scene tables, and load the data into those tables.

[20] Use of this model is subject to the terms and conditions stated on Wramodel.com.com
[21] While claim databases can easily exceed 10 gigs, the limited-field/grouped-down files needed to run the WRA model are fairly small even for a large number of individuals

Your First WRA Risk Scoring Exercise

Note: The practice exercise data (for 100 individuals) was simulated through randomized ages, genders, codes, etc. The data is not real and not a reflection of real data. Do not use the data for any other purpose other than learning how to run the SQL code and format the input files.

1. Open the SQL query WRA Model-Inputs v101.sql
2. Choose one of the following.
    a. The code is currently setup to run the practice exercise. Meaning the tables that were imported we feed the creation of the tables: INP_ELIG, INP_DX, and IND_RX. All that is needed is to run the code.
    b. If you would like to create the tables INP_ELIG, INP_DX, and IND_RX from your own data modify the SQL query WRA Model-Inputs v101.sql. Each field is described in the code. Be sure to specify the table the data is coming from.
3. Run the code to create the input tables.
4. Open the SQL query WRA Model-Grouping v101.sql and run the code.
    a. Using the user input section at the top of this code, you can select which version of the weights to apply (to the resulting member-level table with diagnosis and pharmacy markers). The options include (i) prospective/concurrent, (ii) type of data used[22], and (iii) include recognition of censored risk. The model automatically applies the correct weight by 1-12 months of eligibility. The model uses demographic only weights for members with no eligibility (i.e. new members).
5. **Four outputs will be created and displayed in the SQL window**

Using the Reporting Tool

1. Open the excel file Wakely Risk Assessment Model V101 – Reporting Tool.xlsx
2. Navigate to the DATA tab.
3. The data tab is where the four SQL outputs will be pasted.
    a. First Displayed Table (WRA Categories) will be pasted starting in column M[23]
    b. Second Displayed Table (WRA Diagnostics) will be pasted starting in column B
    c. Third Displayed Table (WRX Categories) will be pasted starting in column RE
    d. Fourth Displayed Table (WRA Demographics) will be pasted starting in column ADC

Navigate to the Results Detail tab in the model for the Results[24].

[22] Age-Sex (AS) only, AS and Diagnosis, AS and Pharmacy, AS diagnosis and pharmacy
[23] Be careful about either copying 'with headers' from SQL and pasting into row 2, or else pasting starting row 3. In order to navigate across these very wide tables in excel quickly, you can use CTRL+Arrow keys in row 1.
[24] A discussion of the results tab is included in the WRA white paper (available on Wramodel.com.com).