Steps to Calculate a Medical Expenditure Risk Score

April 1, 2022

The Health Care Authority uses a Medicaid clients' medical expenditure risk score as one of many criteria for eligibility for health home services. The methodology is periodically updated for code changes, but this is the version used currently (April, 2022). There are 9 steps to calculating a clients' risk score.

Step 1. Collect Paid Claims and Health Plan Encounter Data
Step 2. Group ICD10 Diagnosis Codes into CDPS Risk Categories
Step 3. Group National Drug Codes (NDCs) into MRx Risk Categories
Step 4. Remove Duplicate Risk Categories
Step 5. Select the Highest CDPS Risk Category within a Disease Group
Step 6. Determine Age/Gender Category
Step 7. Apply Risk Weights
Step 8. Sum Risk Weights to Obtain the Risk Score
Step 9. Interpreting the Risk Score

Step 1. Collect Paid Claims and Health Plan Encounter Data

The first step in calculating a risk score is to obtain a set of paid fee-for-service claims and managed care encounters for a client. For children (age <18) we use all paid claims and encounters within the last 24 months. For adults (age 18+) we use all paid claims and encounters within the last 15 months.

The claims and encounters include the International Classification of Diseases, Tenth Revision (ICD 10) diagnosis codes and National Drug Codes (NDCs) submitted by health care providers. These will be used in step 2 to match to a set of risk categories. We use two risk category crosswalks developed by University of California, San Diego; 1. Chronic Illness and Disability Payment System (CDPS) which assigns ICD 10 codes to CDPS risk categories and 2. Medicaid Rx (MRx) which assigns National Drug Codes to MRx risk categories.

Step 2. Group ICD9/10 Diagnosis Codes into CDPS Risk Categories

We currently use 58 CDPS risk categories (Table 1a), used by permission from University of California, San Diego. To group ICD 10 codes into the CDPS risk categories we use the version 6.5 ICD 10 to CDPS crosswalk, which is available for a licensing fee from University of California, San Diego - http://cdps.ucsd.edu/. We modified the 6.5 ICD 10 to CDPS crosswalk as shown in Table 1b. Each of the ICD 10 codes is assigned to one risk category. Note that if an ICD 10 code is not listed in the crosswalk, then it does not map to a risk category that is used in the calculation of the medical expenditure risk score.

TABLE 1A

Titles of Chronic Illness and Disability Payment System Risk Categories

CARVH	Cardiovascular, very high
CARM	Cardiovascular, medium
CARL	Cardiovascular, low
CAREL	Cardiovascular, extra low
PSYH	Psychiatric, high
PSYM	Psychiatric, medium
PSYML	Psychiatric, medium low
PSYL	Psychiatric, low
SKCM	Skeletal, medium
SKCL	Skeletal, low
SKCVL	Skeletal, very low
CNSH	Central Nervous System, high
CNSM	Central Nervous System, medium
CNSL	Central Nervous System, low
PULVH	Pulmonary, very high
PULH	Pulmonary, high
PULM	Pulmonary, medium
PULL	Pulmonary, low
GIH	Gastro, high
GIM	Gastro, medium
GIL	Gastro, low
DIA1H	Diabetes, type 1 high
DIA1M	Diabetes, type 1 medium
DIA2M	Diabetes, type 2 medium
DIA2L	Diabetes, type 2 low
SKNH	Skin, high
SKNL	Skin, low
SKNVL	Skin, very low
RENEH	Renal, extra high
RENVH	Renal, very high
RENM	Renal, medium
RENL	Renal, low
SUBL	Substance abuse, low
SUBVL	Substance abuse, very low
CANVH	Cancer, very high
CANH	Cancer, high
CANM	Cancer, medium
CANL	Cancer, low
DDM	Developmental Disability, medium
DDL	Developmental Disability, low
GENEL	Genital, extra low
METH	Metabolic, high
METM	Metabolic, medium
METVL	Metabolic, very low
PRGCMP	Pregnancy, complete

PRGINC	Pregnancy, incomplete
EYEL	Eye, low
EYEVL	Eye, very low
CERL	Cerebrovascular, low
AIDSH	AIDS, high
INFH	Infectious, high
HIVM	HIV, medium
INFM	Infectious, medium
INFL	Infectious, low
HEMEH	Hematological, extra high
HEMVH	Hematological, very high
HEMM	Hematological, medium
HEML	Hematological, low

TABLE 1B

CDPS modifications

Change from AIDSH to INFH

- ICD10 Codes: A31.2, A81.2, B45.0-B45.9, C46.0-C46. 9

Change from HIVM to INFH

- ICD10 Codes: Z16.10-Z16.39

Step 3. Group National Drug Codes (NDCs) into Medicaid Rx Risk Categories

We currently use 45 Medicaid Rx risk categories (Table 2 below), used by permission from University of California, San Diego. To group NDC codes into the Medicaid Rx risk categories we use the version 6.5 NDC to Medicaid Rx crosswalk, which is available for a licensing fee from University of California, San Diego - http://cdps.ucsd.edu/. Each NDC is assigned to one risk category. Note that if an NDC code is not listed in the crosswalk, then it does not map to a risk category that is used in the calculation of the risk score.

TABLE 2

Titles of Medicaid Rx Risk Categories

MRx	MRx1	Alcoholism
	MRx2	Alzheimer's
	MRx3	Anti-coagulants
	MRx4	Asthma/COPD
	MRx5	Attention Deficit
	MRx6	Burns
	MRx7	Cardiac
	MRx8	Cystic Fibrosis
	MRx9	Depression / Anxiety
	MRx10	Diabetes
	MRx11	EENT

MRx12	ESRD / Renal
MRx13	Folate Deficiency
MRx14	CMV Retinitis
MRx15	Gastric Acid Disorder
MRx16	Glaucoma
MRx17	Gout
MRx18	Growth Hormone
MRx19	Hemophilia/von Willebrand
MRx20	Hepatitis
MRx21	Herpes
MRx22	HIV
MRx23	Hyperlipidemia
MRx24	Infections, high
MRx25	Infections, medium
MRx26	Infections, low
MRx27	Inflammatory /Autoimmune
MRx28	Insomnia
MRx29	Iron Deficiency
MRx30	Irrigating solution
MRx31	Liver Disease
MRx32	Malignancies
MRx33	Multiple Sclerosis / Paralysis
MRx34	Nausea
MRx35	Neurogenic bladder
MRx36	Osteoporosis / Paget's
MRx37	Pain
MRx38	Parkinson's / Tremor
MRx39	Prenatal care
MRx40	Psychotic Illness / Bipolar
MRx41	Replacement solution
MRx42	Seizure disorders
MRx43	Thyroid Disorder
MRx44	Transplant
MRx45	Tuberculosis

Step 4. Remove Duplicate Risk Categories

After mapping all diagnosis and drug codes to the risk categories, we eliminate duplicates of each client's risk categories so that there is only one occurrence of any risk category for each client.

Step 5. Select the Highest CDPS Risk Category within a Disease Group

CDPS risk categories are organized into risk category groups of different intensity levels. The highest risk category in each group is used in the calculation of the risk score; the lower level risk categories are eliminated from further calculations. The risk category groups are listed in Table 3 below.

TABLE 3

Chronic Disease Payment System Risk Category Groups

Group Description	**Risk Categories** (Ordered Highest to Lowest Intensity)
AIDS/HIV and Infection	AIDSH, INFH, HIVM, INFM, INFL
Cancer	CANVH, CANH, CANM, CANL
Cardiovascular	CARVH, CARM, CARL, CAREL
Central Nervous System	CNSH, CNSM, CNSL
Diabetes	DIA1H, DIA1M, DIA2M, DIA2L
Developmental Disability	DDM, DDL
Eye	EYEL, EYEVL
Gastrointestinal	GIH, GIM, GIL
Hematological	HEMEH, HEMVH, HEMM, HEML
Metabolic	METH, METM, METVL
Pregnancy	PRGCMP, PRGINC
Psychiatric	PSYH, PSYM, PSYML, PSYL
Substance Abuse	SUBL, SUBVL
Pulmonary	PULVH, PULH, PULM, PULL
Renal	RENEH, RENVH, RENM, RENL
Skeletal	SKCM, SKCL, SKCVL
Skin	SKNH, SKNL, SKNVL

Step 6. Determine Age/Gender Category

For each client we select the appropriate age/gender category. The eleven categories are listed in Table 4 below. Note that the categories for ages below 5 and above 65 are gender neutral.

TABLE 4

Age/Gender Categories

Age <1
Age 1 to 4
Age 5 to 14, Male
Age 5 to 14, Female
Age 15 to 24, Male
Age 15 to 24, Female
Age 25 to 44, Male
Age 25 to 44, Female
Age 45 to 64, Male
Age 45 to 64, Female
Age 65+

Step 7. Apply Risk Weights

In the next step we assign each risk category and age/gender category a weight. These weights come from one of two models. Either the set of weights from the children's model is used (if the client is less than 18), or the set of weights from adult model is used (if the client is 18 or older). The full sets of weights for both models are provided in Table 5: Risk Score Weights.

In each model there are three types of weights.

1. **Age/Gender** – Weights that correspond to the age/gender category of a client
2. **CDPS** – Weights that correspond to 58 of the CDPS risk categories
3. **MRx** – Weights that correspond to 45 of the MRx risk categories

TABLE 5

Risk Score Weights

Category Type	Category	Description	Weights for Children Age <18	Weights for Adults Age 18+
Age/Gender	Age <1	Clients of age less than 1	0.91261	0.00000
	Age 1 to 4	Clients age 1 to 4	0.31764	0.00000
	Age 5 to 14, Male	Male clients age 5 to 14	0.25834	0.00000
	Age 5 to 14, Female	Female clients age 5 to 14	0.26338	0.00000
	Age 15 to 24, Male	Male clients age 15 to 24	0.25662	-0.01629
	Age 15 to 24, Female	Female clients age 15 to 24	0.29685	0.03640
	Age 25 to 44, Male	Male clients age 25 to 44	0.00000	0.04374
	Age 25 to 44, Female	Female clients age 25 to 44	0.00000	0.06923
	Age 45 to 64, Male	Male clients age 45 to 64	0.00000	0.13321
	Age 45 to 64, Female	Female clients age 45 to 64	0.00000	0.06841
	Age 65+	Clients age 65 and older	0.00000	-0.05623
CDPS	CARVH	Cardiovascular, very high	0.84325	2.86702
	CARM	Cardiovascular, medium	0.33428	0.73492
	CARL	Cardiovascular, low	0.12835	0.24620
	CAREL	Cardiovascular, extra low	0.04307	0.06225
	PSYH	Psychiatric, high	0.40351	0.27085
	PSYM	Psychiatric, medium	0.23892	0.00000
	PSYML	Psychiatric, medium low	0.13796	0.00000
	PSYL	Psychiatric, low	0.07675	0.00000
	SKCM	Skeletal, medium	0.21071	0.42212
	SKCL	Skeletal, low	0.08343	0.15467
	SKCVL	Skeletal, very low	0.06244	0.06773
	CNSH	Central Nervous System, high	0.80483	0.78090
	CNSM	Central Nervous System, medium	0.31945	0.40886
	CNSL	Central Nervous System, low	0.15106	0.18261
	PULVH	Pulmonary, very high	1.14056	4.01723
	PULH	Pulmonary, high	0.34356	0.39309
	PULM	Pulmonary, medium	0.35587	0.31774
	PULL	Pulmonary, low	0.11315	0.13017
	GIH	Gastro, high	0.65934	1.34924
	GIM	Gastro, medium	0.24699	0.24372
	GIL	Gastro, low	0.09767	0.05104
	DIA1H	Diabetes, type 1 high	0.27018	1.04302
	DIA1M	Diabetes, type 1 medium	0.27018	0.23620
	DIA2M	Diabetes, type 2 medium	0.13647	0.17581
	DIA2L	Diabetes, type 2 low	0.13647	0.09635
	SKNH	Skin, high	0.56322	0.37981
	SKNL	Skin, low	0.23664	0.45155
	SKNVL	Skin, very low	0.05697	0.02119
	RENEH	Renal, extra high	1.80489	3.41999
	RENVH	Renal, very high	0.59311	0.69251
	RENM	Renal, medium	0.28630	0.92846
	RENL	Renal, low	0.21048	0.17220

Category Type	Category	Description	Weights for Children Age <18	Weights for Adults Age 18+
	SUBL	Substance abuse, low	0.15170	0.16104
	SUBVL	Substance abuse, very low	0.01794	0.08784
	CANVH	Cancer, very high	1.19700	2.80074
	CANH	Cancer, high	0.51985	0.97173
	CANM	Cancer, medium	0.22164	0.38022
	CANL	Cancer, low	0.10350	0.22625
	DDM	Developmental Disability, medium	0.50073	0.27818
	DDL	Developmental Disability, low	0.19696	0.05913
	GENEL	Genital, extra low	0.00790	0.01121
	METH	Metabolic, high	0.47167	0.47226
	METM	Metabolic, medium	0.26297	0.11310
	METVL	Metabolic, very low	0.11546	0.18678
	PRGCMP	Pregnancy, complete	0.00244	0.00000
	PRGINC	Pregnancy, incomplete	0.12631	0.51636
	EYEL	Eye, low	0.09919	0.13271
	EYEVL	Eye, very low	0.02835	0.00000
	CERL	Cerebrovascular, low	0.14294	0.00000
	AIDSH	AIDS, high	0.70597	0.47361
	INFH	Infectious, high	0.70597	0.79689
	HIVM	HIV, medium	0.26129	0.07937
	INFM	Infectious, medium	0.26129	0.79689
	INFL	Infectious, low	0.07784	0.05617
	HEMEH	Hematological, extra high	5.37808	12.71981
	HEMVH	Hematological, very high	0.72873	3.08836
	HEMM	Hematological, medium	0.37824	0.63211
	HEML	Hematological, low	0.18676	0.25601
MRx	MRx1	Alcoholism	0.05982	0.01924
	MRx2	Alzheimers	0.00000	0.08112
	MRx3	Anti-coagulants	0.34428	0.13523
	MRx4	Asthma/COPD	0.08758	0.05751
	MRx5	Attention Deficit	0.00000	0.00779
	MRx6	Burns	0.16633	0.00000
	MRx7	Cardiac	0.09060	0.06425
	MRx8	Cystic Fibrosis	0.50399	0.37265
	MRx9	Depression / Anxiety	0.06743	0.09436
	MRx10	Diabetes	0.15190	0.17046
	MRx11	EENT	0.00000	0.00072
	MRx12	ESRD / Renal	1.24598	1.20707
	MRx13	Folate Deficiency	0.17973	0.11899
	MRx14	CMV Retinitis	0.37762	0.00000
	MRx15	Gastric Acid Disorder	0.10082	0.15470
	MRx16	Glaucoma	0.04221	0.12971
	MRx17	Gout	0.00000	0.00000
	MRx18	Growth Hormone	0.97410	1.59521
	MRx19	Hemophilia/von Willebrands	13.56192	89.14461

Category Type	Category	Description	Weights for Children Age <18	Weights for Adults Age 18+
	MRx20	Hepatitis	0.03018	0.00000
	MRx21	Herpes	0.03480	0.01725
	MRx22	HIV	0.65537	1.01178
	MRx23	Hyperlipidemia	0.00000	0.03791
	MRx24	Infections, high	1.38405	1.51663
	MRx25	Infections, medium	0.07462	0.06192
	MRx26	Infections, low	0.00000	0.00918
	MRx27	Inflammatory /Autoimmune	0.08075	0.20046
	MRx28	Insomnia	0.07093	0.06437
	MRx29	Iron Deficiency	0.13306	0.15054
	MRx30	Irrigating solution	0.87573	0.16387
	MRx31	Liver Disease	0.45314	0.22681
	MRx32	Malignancies	0.36859	0.44200
	MRx33	Multiple Sclerosis / Paralysis	0.03450	0.04353
	MRx34	Nausea	0.18219	0.17120
	MRx35	Neurogenic bladder	0.15282	0.07675
	MRx36	Osteoporosis / Pagets	0.00000	0.00000
	MRx37	Pain	0.02950	0.04151
	MRx38	Parkinsons / Tremor	0.17163	0.06257
	MRx39	Prenatal care	0.00000	0.13192
	MRx40	Psychotic Illness / Bipolar	0.22819	0.20274
	MRx41	Replacement solution	0.58622	1.49405
	MRx42	Seizure disorders	0.23997	0.19837
	MRx43	Thyroid Disorder	0.03948	0.06326
	MRx44	Transplant	0.37388	0.05810
	MRx45	Tuberculosis	0.20006	0.00000

Step 8. Sum Risk Weights to Obtain the Risk Score

After obtaining the weights that correspond to a client's age/gender category and set of risk categories, the final step is to sum the values of all of the weights. This sum will give you the risk score for a client.

Step 9. Interpreting the Risk Score

The risk score represents a ratio of expected future costs of a specific client divided by the expected future cost of the average client from a reference population. In the case of adults, a risk score of 1.50 means that the client is expected to incur future medical expenditures that are 50% higher than the future medical expenditures of the average Washington client with SSI disabled coverage.