Prevalent Standardized Waitlist Ratio (PSWR) Measure Calculation Description

Table of Contents

Introduction

The *Prevalent Standardized Waitlist Ratio (PSWR) Measure Calculation Description* serves as a complementary document to the *Quality ID 512: Prevalent Standardized Waitlist Ratio (PSWR) Measure Specification Form* to aid in the calculation of the PSWR. These technical notes describe the statistical methods used to calculate the measure, including model details, and can be found on the following publicly available webpage: https://dialysisdata.org/content/MIPS. The model details have already been calculated by the measure developer and are provided to Merit-based Incentive Payment System (MIPS) eligible clinician groups calculating the measure.

Measure Description

The Prevalent Standardized Waitlist Ratio (PSWR) measures the number of dialysis patients in a practitioner group (inclusive of physicians and advanced practice providers) who are under the age of 75, and were listed on the kidney or kidney-pancreas transplant waitlist or received a living donor transplant.

The measure is defined as the ratio of the observed number of waitlist events in a practitioner group to the model-based expected number of waitlist events. Specifically, the numerator is the number of observed waitlist events in a practitioner group. The denominator is the number of expected waitlist events in a practitioner group. Here the expected waitlist events are calculated from a Cox model, adjusting for age, patient comorbidities, and other risk factors at the time of dialysis, and assuming the practitioner group-specific event rate equals the population average.

In this measure, each practitioner group is compared with an “average” group in the population of all practitioner groups. A PSWR lower than 1 indicates that the practitioner group’s observed waitlist rate is less than expected based on national rates. A PSWR greater than 1 indicates that the practitioner group has a rate of waitlist events higher than expected, based on patient characteristics and the national rates.

Numerator

The numerator is comprised of patients in the practitioner group’s denominator who are listed on the kidney or kidney-pancreas transplant waitlist or who received living donor transplants.

Denominator

The denominator for the PSWR is the expected number of waitlist or living donor transplant events in the practitioner group according to each patient's treatment history adjusted for age, incident and prevalent comorbidities, previous waitlist, previous transplant, dual Medicare-Medicaid eligibility, Area Deprivation Index (from patient's residence zip code) and transplant center characteristics, among patients under 75 years of age. The number of days at risk (time from the latest of (1) start or re-start of dialysis, (2) January 1, (3) entrance into the practitioner group, or (4) de-listing from kidney waitlist to the earliest of (1) being placed on the waitlist, (2) receiving a living donor transplant, (3) death, (4) exit from the practitioner group, or (5)

December 31) for each patient is used to calculate the expected waitlist or living donor transplant events. Patients can be included more than once in a period**.**

Patient characteristics included in the model as covariate variables are:

- Age at start
    - Age is specified in 5-year categories (0-4, 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74)
- Vintage
    - Vintage is calculated as years since date of first ESRD service, as of the start of a patient's time-at-risk, and specified as falling into one of four categories (<=1, >1 and <=2, >2 and <=3, >3).
- Previously placed on the kidney waitlist
- Previously received a kidney transplant
- Medicare-Medicaid dual eligibility
- Area Deprivation Index (ADI), based on patient residence zip code
- Transplant center characteristics, based on patient residence zip code
    - Weighted SRTR mortality ratio
    - Weighted SRTR transplant ratio
- Comorbidities at ESRD incidence (from CMS Medical Evidence Form 2728 Box 16):
    - Heart disease (congestive heart failure, atherosclerotic heart disease and other cardiac disease)
    - Cerebrovascular disease, CVA, TIA
    - Peripheral vascular disease
    - Chronic obstructive pulmonary disease
    - Inability to ambulate
    - Inability to transfer
    - Malignant neoplasm, cancer
    - Drug dependence
    - Tobacco use
    - Diabetes (primary cause of ESRD, non-primary cause)
- A set of prevalent comorbidities based on presence of a relevant diagnosis, or relevant Medicare inpatient or outpatient claim from the prior calendar year in the following 64 categories (see Sheet "ICD10 codes" in Files *PSWR_ModelInfo.xlsx*):

- Diabetes without complications
- Diabetes with complications
- Malnutrition / Cachexia
- Pancytopenia
- Opioid Dependance
- Epilepsy
- Bipolar Disorder
- Major depressive affective disorder
- Myocardial Infarction
- Coronary Atherosclerosis
- Pulmonary Heart Disease
- Cardiomyopathy
- Paroxysmal Tachycardia
- Atrial fibrillation
- Atrial flutter
- Acute Cerebrovascular Disease
- Peripheral and Visceral Atherosclerosis
- Venous Thromboembolism
- Chronic Obstructive Pulmonary Disease
- Aspiration Pneumonitis
- Respiratory Failure
- Cirrhosis of Liver
- Other Liver Disease
- Chronic Skin Ulcer
- Rheumatoid Arthritis
- Gangrene
- Below knee amputation status
- Above knee amputation status
- Long-term (current) use of insulin

Patient Exclusions

Patient are excluded from this calculation if any of the following are true:

- Patients who were at age 75 or older on their start date
- Patients who do not have a submitted bill for a dialysis monthly capitation payment
- Patients admitted to a skilled nursing facility during the period of evaluation
- Patients in hospice in the year before or during the period of evaluation
- Patients with a diagnosis for dementia in the year before or during the period of evaluation

These exclusions represent conditions for which transplant waitlist candidacy is highly unlikely and which can be identified readily with available data. Patients were also excluded if waitlisted or transplanted prior to initiation of first dialysis.

Calculation of the PSWR

In order to calculate the PSWR, you will need (1) information on your patients events (transfer in date, first date of ESRD, waitlist date, living donor transplant date, transfer out date, and/or death date) in order to calculate the number of days at risk, (2) information on your patients' characteristics that are described above (age, time on dialysis, incident and prevalent comorbidities, previously placed on the kidney transplant waitlist, previously received a kidney transplant, Medicare dual eligibility status (i.e. whether the patient has both Medicare and Medicaid coverage), and zip code) which can be found on the CMS Medical Evidence Form 2728, and (3) to download the *PSWR_ModelInfo.*xlsx spreadsheet. Note that when a patient has fewer than 6 months of Medicare coverage in the prior year, all prevalent comorbidity variables are set to 0. With this information you will be able to do the mathematical calculation for each patient as described above.

The *PSWR_ModelInfo.*xlsx spreadsheet includes the following information: **Model Coefficients**, **Baseline Cumulative Hazard**, **Txp Center & ADI by Zip Code,** and **ICD10 Codes**. For the purposes of this document, each reference to these model details sheets will be described in **bold** text. A calculation example is provided.

The **Model Coefficients** sheet details the PSWR model coefficients' parameter, variable type, and estimate. For example, the "Cancer" parameter is listed as "Categorical (0 versus 1)" with an estimate of -0.2996(rounded).

The **Baseline Cumulative Hazard** sheet provides a hazard value for each day at risk in a year, numbered 0 to 365.

The **Txp Center & ADI by Zip Code** sheet provides the values for the two transplant center effects, Weighted SRTR mortality ratio and Weighted SRTR transplant ratio, as well as Area Deprivation Index ADI by Zip code. For example, Zip Code "00601" uses the

following values (rounded): a Weighted SRTR mortality ratio of 1.07847, a Weighted SRTR transplant ratio of 0.97104, and an ADI of 8.5499.

The **ICD10 Codes** sheet provides the Clinical Classifications Software (CCS) group as well as ICD10 codes and descriptions. For example, "candidal esophagitis" has a CCS Grouper of "1" and ICD10 code of "B3781".

As an example, we calculate the PSWR for a hypothetical practitioner group that treated 12 patients. Patients #2 and #7 were placed on the waitlist during the time period. Patient #12 received a living donor transplant. Table 1 describes the patients and their history of treatment. Characteristics are omitted for 8 patients for space.

For this practitioner group:

Step 1: Calculate days at risk. Days at risk is calculated as the time between the latest of (1) start or re-start of dialysis, (2) January 1, (3) entrance into the practitioner group, or (4) de-listed from kidney waitlist to the earliest of (1) being placed on the waitlist, (2) receiving a living donor transplant, (3) death, (4) exit from the practitioner group, or (5) December 31 for each patient's time period.

Table 1. Description of 4 patients at a hypothetical practitioner group for the FYSWR calculation

Patient *i*	Start date	End date (event)	Days at risk	Characteristics*
#1	1/1/2024 (Jan 1st)	12/31/2024 (Dec 31st)	365	Age=73; vintage=7 years; previous waitlist; comorbidities in 2728: Cancer, Tobacco use; CCS groupers: 73 (Rheumatoid Arthritis); Medicare dual eligibility; zip code=49727.
#2a	5/23/2024 (start of dialysis)	10/11/2024 (waitlisted)	141	Age=48; vintage=0 years; comorbidities in 2728: none; CCS groupers: none; zip code=49727
#2b	11/31/2024 (delisted from waitlist)	12/22/2024 (exit from practitioner group)	52	Age=48; vintage=0.4 years; comorbidities in 2728: none; CCS groupers: none; zip code=49727
#3	7/5/2024 (entrance to practitioner group)	11/28/2024 (death)	146	Age=64; vintage=4 years; previous transplant; comorbidities in 2728: diabetes non-primary cause, drug use, inability to ambulate; CCS groupers: diabetes with complications, below knee amputation, long-term use of insulin; zip code=49762
#4 - #11	*(omitted)*	*(omitted)*	*(omitted)*	*(omitted)*

Patient *i*	Start date	End date (event)	Days at risk	Characteristics*
#12	8/16/2024 (entrance to practitioner group)	12/5/2024 (transplant)	111	Age=67; vintage=1.5 years; comorbidities in 2728: Heart Disease; less than 6 months medicare coverage in prior year (all CCS grouper variables set to 0); CCS groupers: Pulmonary Heart Disease; zip code=49712.

*Comorbidities and Medicare dual eligibility are coded as "1" if present, otherwise "0" for not present or unknown; Unknown zip codes are referred to row "unknown" for the corresponding transplant center effects and ADI in the Excel file.

Step 2: For each patient period, calculate the linear prediction using the **Model Coefficients** table in the *PSWR_ModelInfo.xlsx* Excel file located at https://dialysisdata.org/content/MIPS. Table 2 shows these details for the example. Note the calculations can be affected by rounding. For this calculation example, we show only four decimal places for ease of display.

Table 2. Calculation of the linear prediction for each patient period

Patient *i*	Linear prediction calculation	Resulting linear prediction
#1	(Age74=1)*(-0.9144)+(vintage4=1)*(0.0)+(previous waitlist=1)*(0.1892)+(cancer=1)*(-0.3214)+(tobacco use=1)*(-0.6167)+(at least 1 incident comorb=1)*(0.0386)+(dual eligibility=1)*(-0.3062)+(ADI=7.3248)*(-0.0750)+(mort ratio=0.8332)*(0.3202)+(tx ratio=0.9930)*(0.0369)+(Rheumatoid Arthritis=1)*(0.2158)	-1.96
#2a	(Age49=1)*(0.7408)+(vintage1=1)*(1.2584)+(ADI=7.3248)*(-0.0750)+(mort ratio=0.8332)*(0.3202)+(tx ratio=0.9930)*(0.0369)	1.75
#2b	(Age49=1)*(0.7408)+(vintage1=1)*(1.2584)+(ADI=7.3248)*(-0.0750)+(mort ratio=0.8332)*(0.3202)+(tx ratio=0.9930)*(0.0369)	1.75
#3	(Age64=1)*(0.2407)+(vintage4=1)*(0.0)+(previous tx=1)*(0.5562)+(inability to ambulate=1)*(-0.9678)+(drug use=1)*(-0.8298)+(diabetes, non-primary=1)*(-0.1889)+(at least 1 incident comorb=1)*(0.0386)+(ADI=8.1310)*(-0.0750)+(mort ratio=1.1924)*(0.3202)+(tx ratio=1.5151)*(0.0369)+(diab w/ complications=1)*(0.1924)+(below knee amputation=1)*(-0.5347)+(long term insulin=1)*(0.0109)	-1.65
#4 - #11	*(omitted)*	*(omitted)*
#12	(Age69=1)*(0.0)+(vintage2=1)*(1.0481)+(heart disease=1)*(-0.0851)+(at least one incident comorb=1)*(0.0386)+(ADI=5.9805)*(-0.0750)+(mort ratio=0.91134)*(0.3202)+(tx ratio=1.0496)*(0.0369)+(<6 months medicare coverage prior year=1)*(0.0536)	0.94

Step 3: Use the Excel file to find the baseline cumulative hazard, by finding the corresponding hazard value given the number of days at risk in the patient period. Table 3 shows these details for the example. Again, note the baseline cumulative hazard values are shown to four decimal places in this example.

Table 3. Baseline cumulative hazard values for each patient

Patient i	Days at risk	Baseline cumulative hazard
#1	365	0.0342
#2a	141	0.1385
#2b	52	0.0049
#3	146	0.0145
#4 - #11	*(omitted)*	*(omitted)*
#12	111	0.0108

Step 4: Using the linear prediction and baseline cumulative hazard in Tables 2 and 3, compute the expected number of waitlists for each of these patients by calculating the exponentiation of the linear prediction and multiplying by the baseline cumulative hazard.

The expected number of waitlists of a patient is calculated as:

$$Expected\ number\ of\ waitlists = \exp(Linear\ prediction) * (Baseline\ cumulative\ hazard)$$

Tables 4 shows the calculation of the expected number of waitlists for each patient.

Table 4. Calculation of the expected number of waitlists for each patient

Patient *i*	Linear prediction	exp(linear prediction)	Baseline cumulative hazard	Expected number of waitlist events
#1	-1.96	0.1407	0.0342	0.0048
#2a	1.75	5.7717	0.0138	0.0799
#2b	1.75	5.7717	0.0049	0.0283
#3	-1.65	0.1911	0.0145	0.0028
#4 - #11	*(omitted)*	*(omitted)*	*(omitted)*	*(omitted)*

Patient *i*	Linear prediction	exp(linear prediction)	Baseline cumulative hazard	Expected number of waitlist events
#12	0.94	0.0108	0.0108	0.0275

Step 5: Calculate the total expected number of waitlists by adding each patient's expected number of waitlists for all the patients from Table 4:

$$Total\ expected\ number\ of\ waitlists_{\square} = 0.0048 + 0.0799 + 0.0283 + 0.0028 + \cdots + 0.0275$$

Step 6: Finally, calculate PSWR by dividing the total number of observed events (waitlists or living donor transplants) by the total number of expected waitlists. Since there were 2 patients that were placed on the kidney transplant waitlist and 1 patient that received a living donor transplant, the sum of observed events is 3 for this practitioner group. The sum of the expected events is 0.5371.

$$PSWR = \frac{Sum\ observed\ waitlists_{\square}}{Sum\ expected\ waitlists_{\square}}$$

$$= \frac{2+1}{0.0048 + 0.0799 + 0.0283 + 0.0028 + \cdots + 0.0275} = \frac{3}{0.5371} = \mathbf{5.59}$$