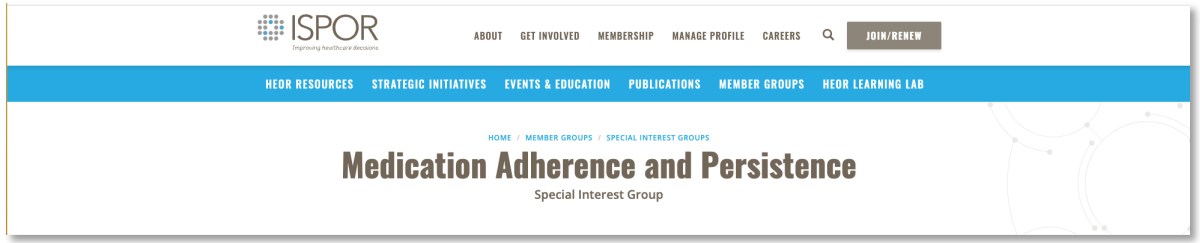
Medication Adherence

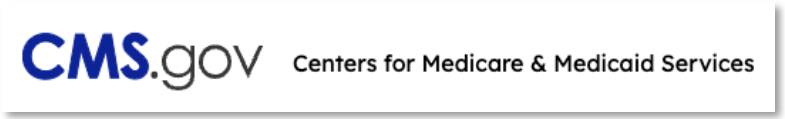
Terminology, Definitions, and Example Calculations

Amber Schilling, PharmD

Relevant Organizations for Standards in Medication Adherence

- International Society for Pharmacoeconomics and Outcomes Research (ISPOR)
  - Medication and Persistence Special Interest Group
- Pharmacy Quality Alliance (PQA)
- National Quality Forum (NQF)
- Centers for Medicare and Medicaid Services (CMS)





Primary vs Secondary Non-adherence

- Primary Non-adherence:
  - A prescription is written, but the patient does not fill the prescription
  - Can’t track in pharmacy claims data
- Secondary Non-adherence:
  - A prescription is written and the patient fills it at least once, but the patient does not continue to conform to the providers’ recommendations
  - Can track in pharmacy claims data

Terminology and Definitions

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VALUE IN HEALTH

Medication Compliance and Persistence: Terminology and Definitions

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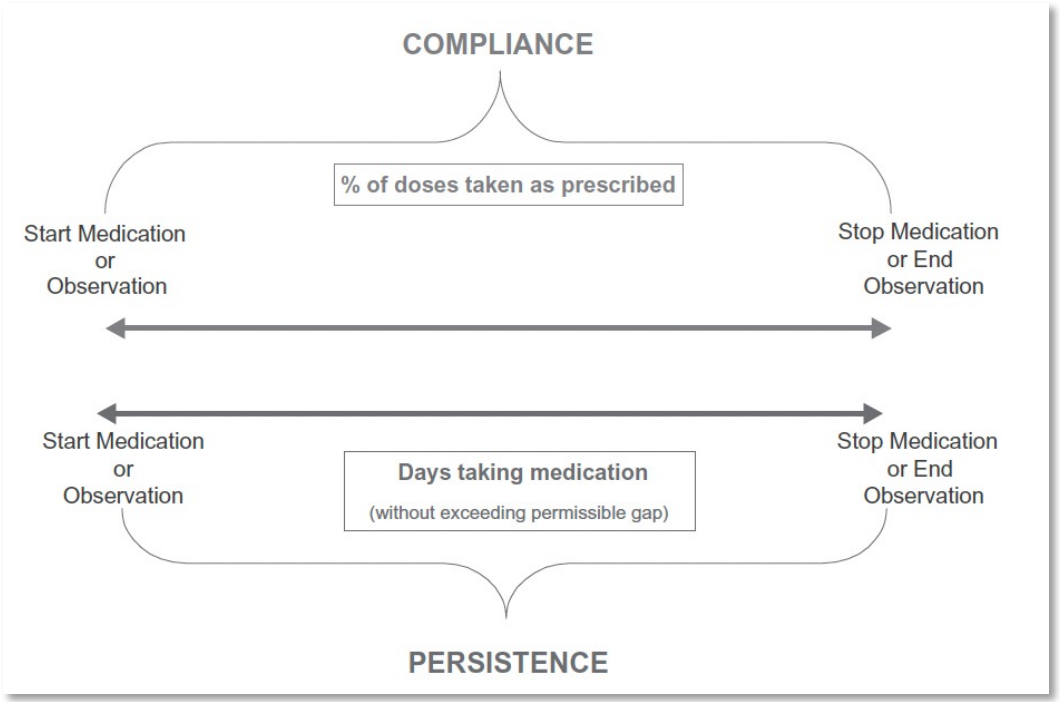
- Adherence (= Compliance)
  - Percent of doses taken as prescribed within a timeframe
  - Proxy measures
    - Medication Possession Ratio (MPR)
    - Proportion of Days Covered (PDC)
- Persistence
  - Length of time on therapy from initiation to discontinuation
  - Days taking medication without exceeding a permissible gap



Assessing Medication Adherence

Subjective

- Via patient self-report
- Morisky Medication Adherence Scale (MMAS)
  - 4-item version (MMAS-4)
  - 8-item version (MMAS-8)
- Medication Adherence Report Scale (MARS)
  - 5-item version (MARS-5)
  - 10-item version (MARS-10)

Objective

- Via claims data
- Proportion of Days Covered (PDC)
  - Research
  - CMS performance measures
  - Preferred by ISPOR, PQA, NQF
- Medication Possession Ratio (MPR)
  - Research

MPR and PDC

- There can be wide variability in how MPR and PDC are calculated
- But, in general:

  - MPR = $\frac{Sum\ of\ days\ \mathbf{supply}\ in\ time\ frame}{number\ of\ days\ in\ time\ frame}$

  - PDC = $\frac{Sum\ of\ days\ \mathbf{covered}\ in\ time\ frame}{number\ of\ days\ in\ time\ frame}$

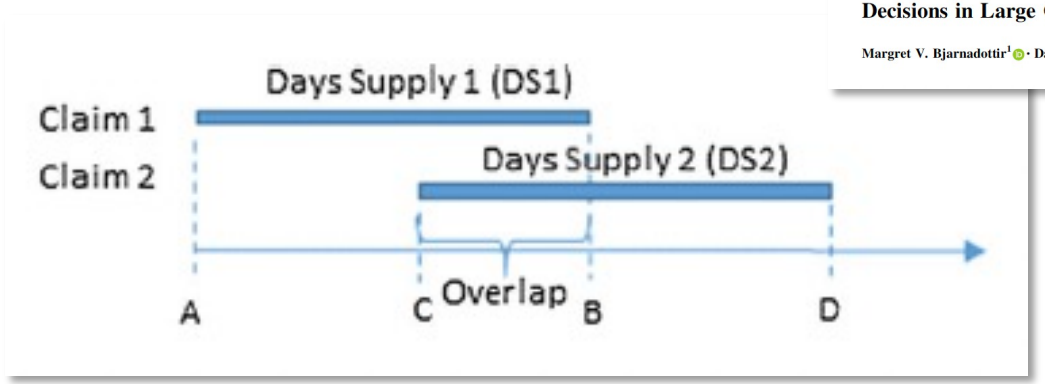
MPR and PDC

PharmacoEconomics (2018) 36:369–380
https://doi.org/10.1007/s40273-017-0597-y

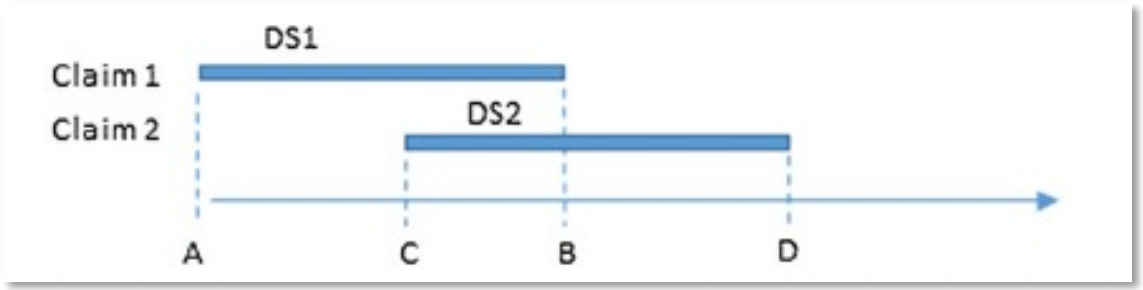
ORIGINAL RESEARCH ARTICLE

Sensitivity of the Medication Possession Ratio to Modelling Decisions in Large Claims Databases

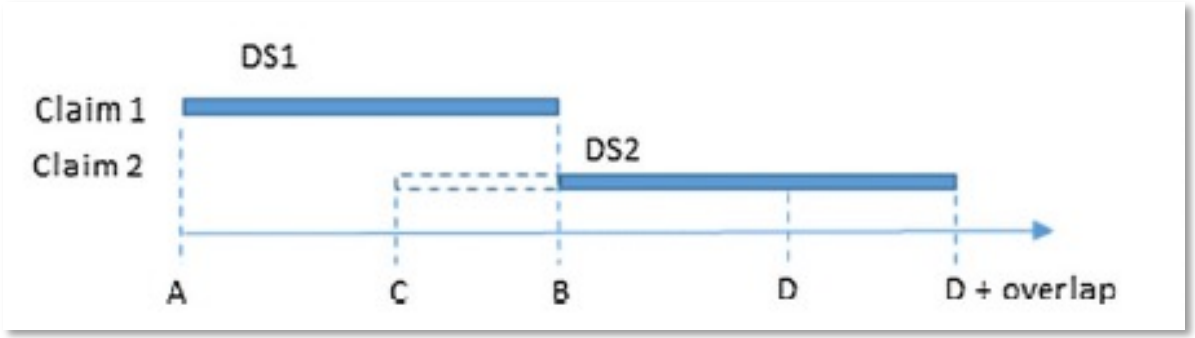
Margret V. Bjarnadottir[1] · David Czerwinski[2] · Eberechukwu Onukwugha[3]



MPR: Ignore Overlap
MPR = 80.9%



PDC: Append / Extend Days Supply
PDC = 78.6%



MPR and PDC

- Both the MPR and the PDC have pros and cons
  - Decision on which to use depends on several factors
    - Disease state (acute or chronic)
    - Type of medications (injectables vs orals)
    - Data available
- Can be dichotomized
  - For most medications:
    - Adherence = MPR or PDC >= 80%
  - Antiretrovirals (HIV drugs)
    - Adherence = PDC >= 90%

MPR and PDC Time Frame

$$\text{MPR} = \frac{Sum\ of\ days\ \textbf{supply}\ in\ time\ frame}{number\ of\ days\ in\ time\ frame}$$

$$\text{PDC} = \frac{Sum\ of\ days\ \textbf{covered}\ in\ time\ frame}{number\ of\ days\ in\ time\ frame}$$

- For patients taking medications for chronic disease:
  - The study period in PDC or MPR calculation (denominator) must be long enough to show a true impact
  - A study period < 3 prescription fills is unlikely to show a true adherence behavior pattern

Navigating the Wild West of Medication Adherence Reporting in Specialty Pharmacy

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SUMMARY

Estimating medication adherence through the use of pharmacy claims-based adherence calculations such as medication possession ratio (MPR) and proportion of days covered (PDC) plays a significant role in specialty pharmacy practice. Although MPR and PDC are frequently used in clinical practice, calculation methodologies vary, making meaningful comparisons of adherence rates difficult. In addition, MPR and PDC are increasingly used by insurance companies, pharmacies, accrediting bodies, and drug manufacturers to demonstrate quality differences or clinical benefit across the specialty pharmacy industry. Therefore, recognizing the source and effect of calculation variability is necessary to fully understand reported adherence results.

This article highlights the challenges in standardizing adherence methodologies, minimum methodology considerations that should be reported with MPR and PDC results, and key elements to consider when interpreting and applying adherence results. Further, recommendations are provided to promote a more consistent description of calculation methods and to aid pharmacies in adherence measure analysis, interpretation, and application to practice, with a focus on specialty pharmacy programs. A detailed description of methodology as outlined in this article must be provided to ensure reproducibility, external validation, and scientific rigor.

In the absence of standardization, specialty pharmacies should be prudent in their use of adherence calculations as a clinical benchmarking tool or comparative quality indicator with outside organizations. Furthermore, specialty pharmacies should consider using current adherence measure calculations to identify and provide targeted interventions to patients with potential adherence problems and strive to better demonstrate ties between adherence measures and direct clinical and cost outcomes.

J Manag Care Spec Pharm. 2019;25(10):1073-77

Current inconsistencies in adherence calculations severely limit the generalizability of the growing number of adherence studies. Research into calculation transparency has shown that fewer than 10% of publications on adherence named all parameters included in their investigations,[1] and the majority had unclear methodological assumptions leading to impossible reproducibility or incorporation into a common body of research.[2] The clinical, financial, and quality implications of medication adherence underscore the fundamental need to standardize and benchmark results. Here, we present considerations for calculating medication possession ratio (MPR) and proportion of days covered (PDC) and provide recommendations for describing calculation methodology and addressing common calculation challenges with an emphasis on their application to adherence with self-administered specialty medications.

The 2 most common methods to estimate medication adherence are MPR and PDC, but neither measure can confirm that medication was administered as prescribed; however, they can provide insight into how often a patient had medication available.[3,4] In addition to this basic flaw, other limitations exist and will be discussed in detail within 2 general categories: (1) challenges with standardization and methodology and (2) challenges with interpretation and utilization. These challenges and lack of standardization leads to confusion and an inability to compare study results.[5,6] Although some notable efforts to standardize adherence measures have been previously published,[7,8] no singular entity has presented a statement addressing all potential calculation challenges. Organizations such as the Pharmacy Quality Alliance and International Society of Pharmacoeconomics and Outcomes Research and accrediting bodies such as URAC have approached the idea of calculation standardization, but a consistent message has not emerged.[9]

Various studies have demonstrated that poor medication adherence may result in treatment failures, excessive health care costs, more frequent hospitalizations, and an increased risk of premature death in certain disease states.[10-14] Although this correlation may exist within individual studies, the lack of detailed methodology can bring into question whether the same results would be found if different calculation methods were used. Moreover, individual pharmacies may have comparatively smaller datasets in which adherence calculations may be inordinately sensitive to methodological differences. Despite these concerns, specialty pharmacies have increasing accountability for maintaining specific adherence standards.

Adherence metrics are increasingly being used to differentiate quality between pharmacies such as in direct and indirect remuneration fee calculations, payer network agreements, and accreditation standards. All of these can have considerable financial implications for specialty pharmacies and can leave pharmacies feeling like they are trying to navigate in a land of uncertainty without a guide to show them the way.[15]

Overview of Common Adherence Calculations

Although variability is common in MPR and PDC calculations, the general methods used to calculate MPR and PDC are typically described as the following[5,6,9,16,17]:

- MPR = (Sum of days supply in time frame) ÷ (number of days in time frame) × 100
- PDC = (Sum of days covered in time frame) ÷ (number of days in time frame) × 100

General Methods

Inclusion criteria often involve patients filling a certain number of designated prescriptions (e.g., ≥ 3 fills within the time frame) or patients having consistent payer plan enrollment. Adherence may be reported at the level of the patient, population, medication, or therapeutic class. Results are commonly presented as an average or as a proportion meeting a certain threshold (e.g., proportion of

"…the Wild West of Medication Adherence"

tial calculation challenges. Organizations such as the Pharmacy Quality Alliance and International Society of Pharmacoeconomics and Outcomes Research and accrediting bodies such as URAC have approached the idea of calculation standardization, but a consistent message has not emerged.[9]

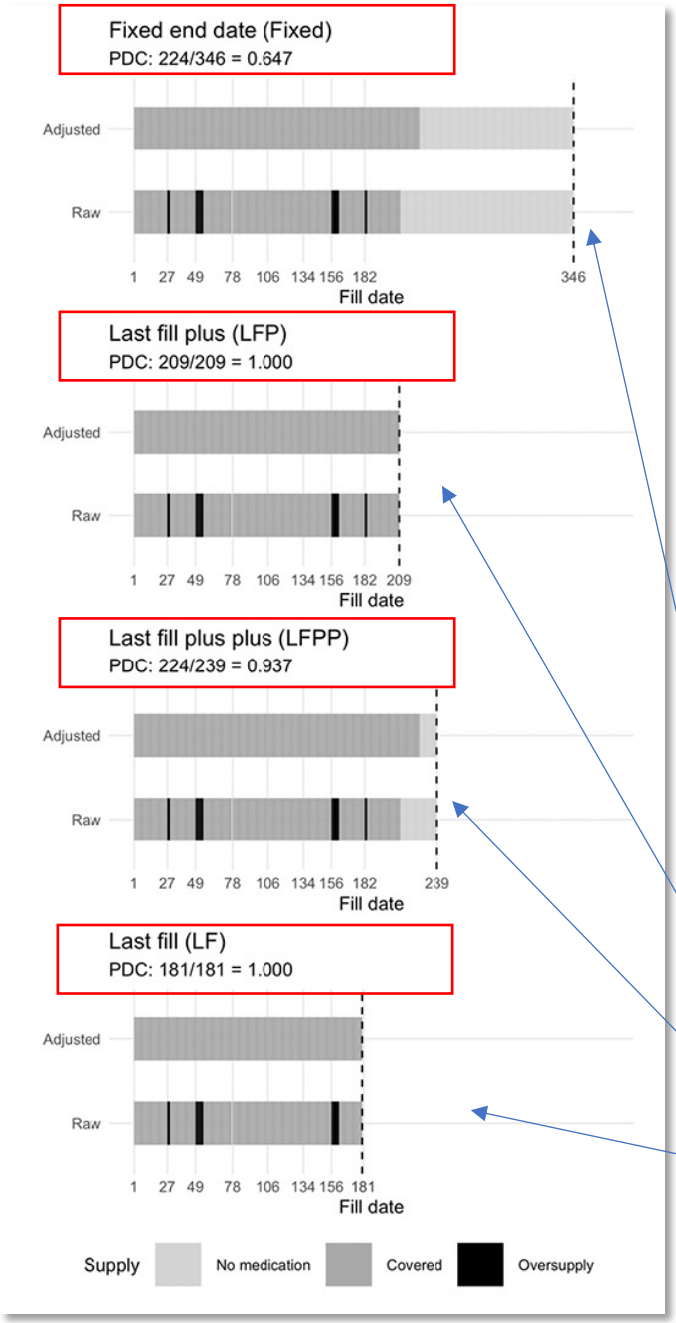


Figure 2.
Case study of a single patient's adherence profile detailing the calculation of PDC based on different end date rules. The "Raw" bar indicates the medication adherence supply diary, where grey bars indicate normal supply ("Covered"), black bars indicate a surplus of medication (caused by an early fill, "Oversupply"), while the light grey bars indicate days where the patient is not covered by medication (gap days, "No medication"). The "Adjusted" bar represents the supply diary after the oversupply has been shifted forward in time according the rules for calculating PDC. Conceptually, the black bars can be thought to slide forward in time until a gap in medication occurs, then the excess supply provides coverage for otherwise uncovered days. Here we present supply diaries for the same patient data according to four different end date rules: Fixed end date (Fixed), Last fill plus (LFP), Last fill plus plus (LFPP), and Last fill (LF). This patient was lost to follow-up, and hence the last fill date is before the end of the study period, thus the observation window is more variable than a patient who was followed through to the end. PDC calculations are displayed above each plot. Note that last fill and last fill plus methods arrive at the same PDC result, but with different lengths of the observation window.

End of Observation Window (Denominator)	Notes
Fixed End Date Use the same end of study period for all patients	Recommended by the PQA Most conservative approach
Select the earlier occurrence of: • Study End Date • Date the Last Fill Is Exhausted	May bias estimates of PDC high Assumes all discontinuations were medically advised (i.e., no one was non-adherent after their last fill)
Select the earlier occurrence of: • Study End Date • Date the Last Fill is Exhausted **Plus 30 days**	Allows for the possibility that people were non-adherence after their last fill, but caps this gap at 30 days
Use the last fill as study end	Disregards the decision of a censoring rule altogether

PDC value will vary depending on the end date utilized!

MPR, Variable Follow-Up Time Depending on Date of Last Rx and Including Days Covered by Last Fill

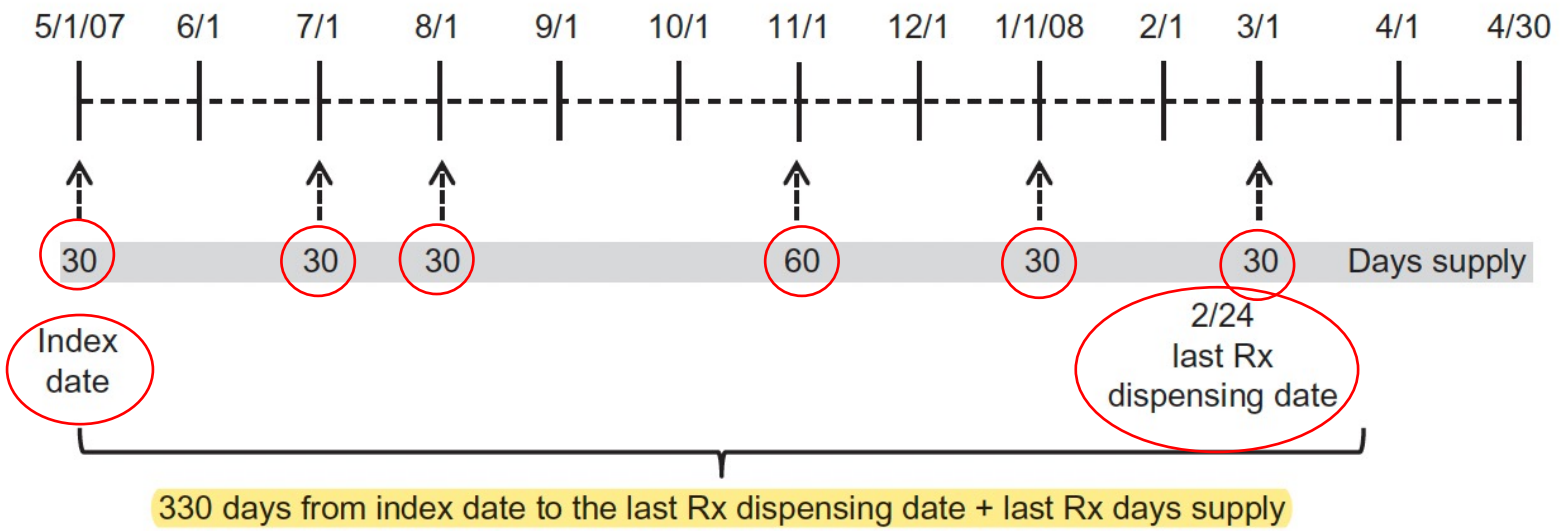
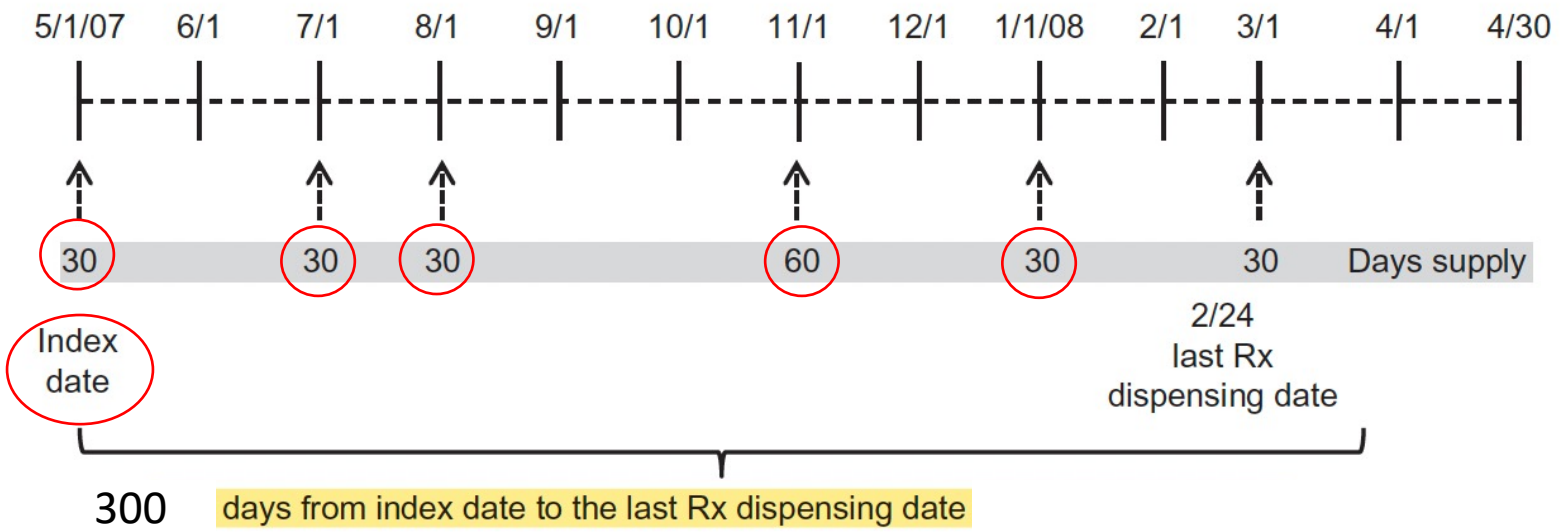


Figure 1 Illustration of prescription dispensing for calculating variable MPR.
Abbreviation: MPR, medication possession ratios.

$$MPR = \frac{All\ Days\ Supply\ (including\ last\ fill)}{Elapsed\ Days, inclusive\ of\ days\ covered\ by\ last\ fill} = \frac{30+30+30+60+30+30}{(Feb24{,}2008\ -May1{,}2007+1)+(30days)} = \frac{210}{299+1+30} = \frac{210}{330} = 0.636$$

MPR, Variable Follow-Up Time Depending on Date of Last Rx and Excluding Days Covered by Last Fill



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$$MPR = \frac{All\ Days\ Supply\ (excluding\ last\ fill)}{Elapsed\ Days, excluding\ days\ covered\ by\ last\ fill} = \frac{30+30+30+60+30}{(Feb24{,}2008 - May1{,}2007)} = \frac{180}{(299+1)} = \frac{180}{300} = 0.600$$

MPR, Fixed Follow-Up Time (365 days)

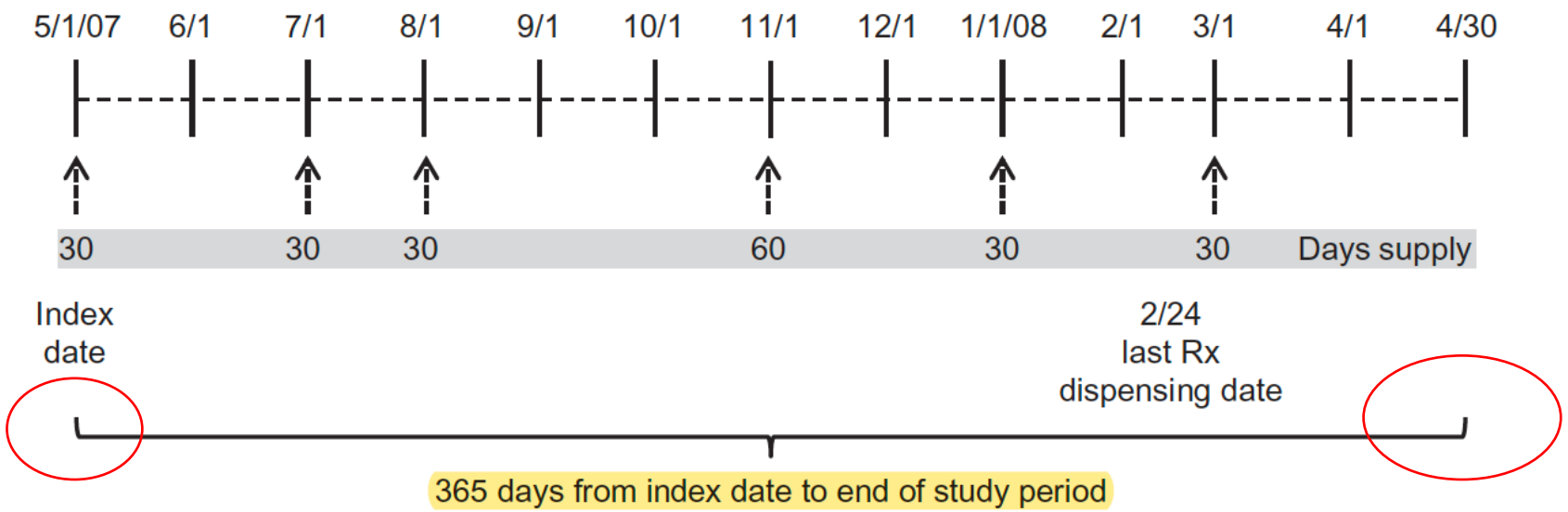


Figure 2 Illustration of prescription dispensing for calculating fixed MPR.
Abbreviation: MPR, medication possession ratios.

$$MPR = \frac{All\ Days\ Supply}{365\ Days\ Observation\ Period} = \frac{30+30+30+60+30+30}{365} = \frac{210}{365} = 0.575$$

MPR and PDC

$$\frac{proxy\ for\ number\ of\ compliant\ days}{number\ of\ days\ in\ the\ measurement\ period}$$

	MPR	PDC
Information it Provides	How often a patient had medication available Provides evidence for receiving a drug	
Assumptions	Medication picked up from the pharmacy is taken by the patient as prescribed	
Ratio	$\frac{Total\ Days\ Supply\ Dispensed\ for\ Drug}{Days\ of\ FollowUp}$	$\frac{Total\ Days\ Drug\ is\ Available}{Days\ of\ FollowUp}$
Explanation of Numerator	Total ”Days Supply” from all medication records within the follow-up period Quantity of medication that is in a patient’s possession for consumption over an observed period of time	Total “Days Covered,” denoting the availability of the prescribed daily dose for each day in the follow-up period Available supply for each individual day in the follow up period
Each Day in the Denominator	Each day in the denominator may have more than 1 days supply if there are overlaps, which can cause the MPR to exceed 100%	Each day in the denominator has a maximum of 1 days supply, which prevents PDC from exceeding 100%
Overlaps / Early Fills	Ignored Days Supply is simply summed across the measurement period, even if overlap occurs (days when patients refill their medication before the previous prescription runs out) Overlapping days supply is assumed to be used sequentially instead of taking more medication on the same day	Adjusts for early fills by shifting the overlapping supply forward in time to the day when the previous fill runs out Prevents over-counting days supply in situations like switching between medications Avoids double counting days when 2 refills overlap

MPR and PDC

$$\frac{proxy\ for\ number\ of\ compliant\ days}{number\ of\ days\ in\ the\ measurement\ period}$$

	MPR	PDC
Complexity	Easy to understand; easy to program (Excel can be used)	Requires a much more complex calculation using arrays (SAS is typically required)
Estimation	May overestimate adherence (overlaps not accounted for)	May underestimate adherence (more conservative)
Preferences	Still very much a part of the medication adherence literature	Preferred by a variety of entities (ISPOR, PQA, NQF, CMS, etc.)
Use	Single medications, Injectables Example: • In Multiple Sclerosis, counting days supply for injectable drugs used to treat MS makes sense because patients do not typically use 2 injections at the same time	Multiple medications, switching medications, therapeutic duplication Example: • In HTN, counting days an anti-hypertensive is on hand rather than days supply makes sense because patients often use multiple drugs at the same time and switch therapies to maintain blood pressure control
Limitations	Insensitive to changes in patient behavior over time and circumstances • A patient that receives the drug irregularly may have the same adherence estimates as a patient that steadily received the drug in the same time interval, yet the real differences in dosing behavior may result in a totally different patient prognosis Dichotomous classifications that come out of PDC and MPR calculations (above a specified threshold, e.g., PDC >80%) may not adequately differentiate between clinically significant adherence behaviors • PDC of 79% is labeled nonadherent; PDC 81% is considered adherent; however, the probability of therapeutic success is likely to be similar	

2023 Medicare-Medicaid Plan Performance Data Technical Notes

Updated – March 2023

CMS (Medicare Part D) evaluates medication adherence for diabetes, HTN, and cholesterol

- Measure: PDC
  - Adherence defined as PDC >=80% at the end of the measurement period
  - Based entirely on prescription claims processed at the pharmacy under Part D benefit
- Calculations made for classes of drugs instead of individual rx's
- Measure D08: Medication Adherence for Diabetes Medications (MAD)
  - Examples: glimepiride, glipizide, metformin, pioglitazone
  - (non-insulin therapies)
- Measure D09: Medication Adherence for HTN (RAAS antagonists) (MAH)
  - Examples: benazepril, lisinopril, valsartan/HCTZ, ramipril
- Measure D10: Medication Adherence for Cholesterol (Statins) (MAC)
  - Examples: atorvastatin, pravastatin, simvastatin

2023
Medicare-Medicaid Plan
Performance Data
Technical Notes

Updated – March 2023

Example 1: Non-Overlapping Fills of Two Different Drugs

In this example, a beneficiary fills Benazepril and Captopril, two drugs in the RAS antagonist hypertension target drug class. The covered days do not overlap, meaning the beneficiary filled the Captopril prescription after the days' supply for the Benazepril medication ended.

15 + 16 + 15 + 13 + 15 + 16 = 90 days in the measurement period

Measurement Period

1/1-1/15 = 15 days
1/16-1/31 = 16 days
2/1-2/15 = 15 days
2/16-2/28 = 13 days
3/1-3/15 = 15 days
3/16-3/31 = 16 days

Table C-1: No Adjustment

Drug	January		February		March	
	1/1/2021	1/16/2021	2/1/2021	2/16/2021	3/1/2021	3/16/2021
Benazepril	15	16	15	13		
Captopril					15	16

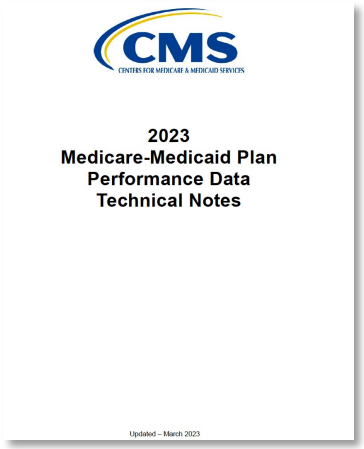
$$PDC = \frac{days\ covered\ with\ drug}{days\ in\ the\ measurement\ period} = \frac{90}{90} = 1$$

Covered Days

In possession of:

15 days of medication
16 days of medication
15 days of medication
13 days of medication
15 days of medication
16 days of medication

15 + 16 + 15 + 13 + 15 + 16 = 90 days "covered" with an ACEI (anti-hypertensive)



Example 2: Overlapping Fills of the Same Generic Ingredient across Single and Combination Products

In this example, a beneficiary fills a drug with the same target generic ingredient prior to the end of the days' supply of the first fill. In rows one and two, there is an overlap between a single and combination drug product, both containing Lisinopril. For this scenario, the overlapping days are shifted because the combination drug product includes the targeted generic ingredient. An adjustment is made to the PDC to account for the overlap in days covered.

Table C-2: Before Overlap Adjustment

Drug	January		February		March	
	1/1/2021	1/16/2021	2/1/2021	2/16/2021	3/1/2021	3/16/2021
Lisinopril	15	16				
Lisinopril & HCTZ		16	15			

Assuming the patient stops taking the first drug when they get the fill for the new drug: 15 + 16 + 15 = 46 days

$$PDC(unadjusted) = \frac{days\ covered\ with\ drug}{days\ in\ the\ measurement\ period} = \frac{46}{90} = 0.51 \rightarrow 51\%$$

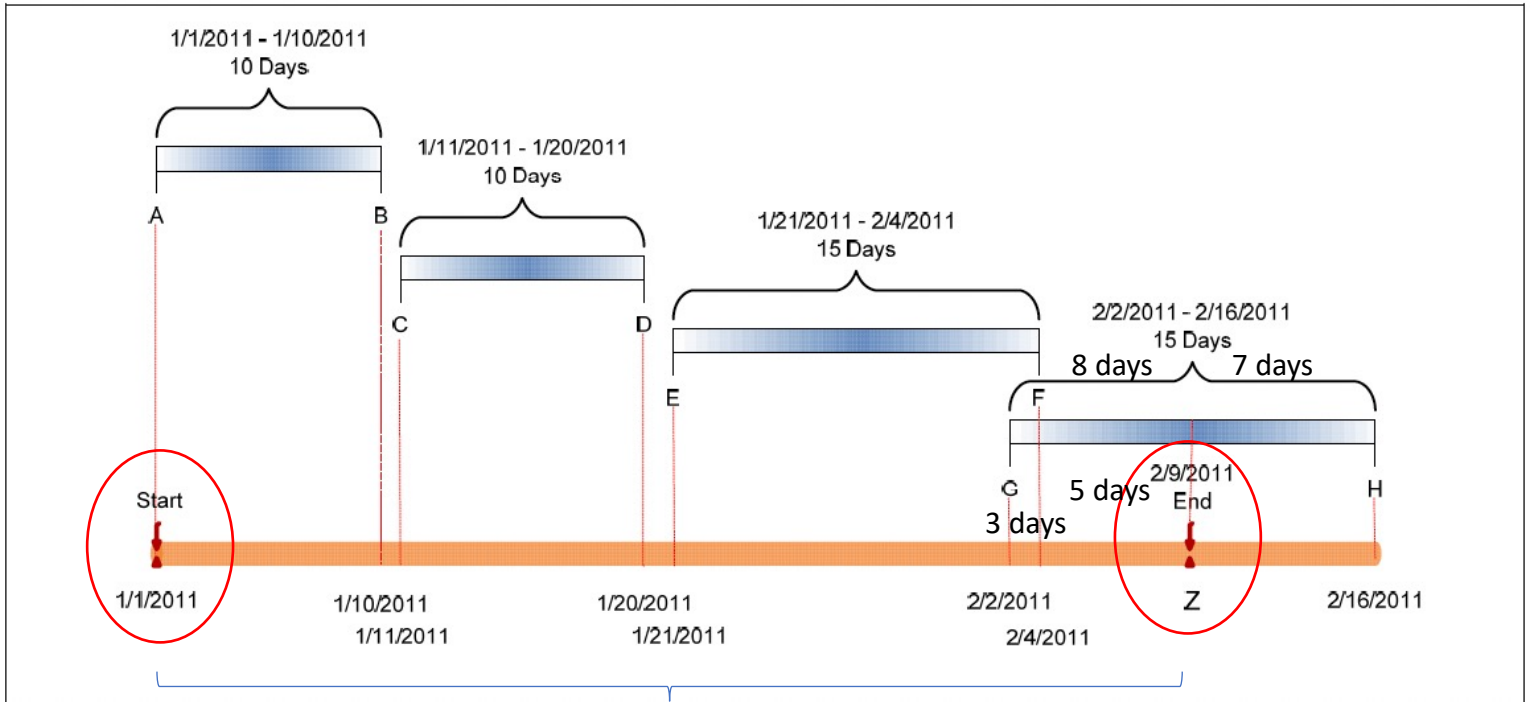
Table C-3: After Overlap Adjustment

Drug	January		February		March	
	1/1/2021	1/16/2021	2/1/2021	2/16/2021	3/1/2021	3/16/2021
Lisinopril	15	16				
Lisinopril & HCTZ			15	13	3	

Counts all the days when an anti-hypertensive was available; spreads out / accounts for the overlap

$$PDC(adjusted) = \frac{days\ covered\ with\ drug}{days\ in\ the\ measurement\ period} = \frac{62}{90} = 0.69 \rightarrow 69\%$$

Figure 1 Comparison between Medication Possession Ratio and Proportion Days Covered

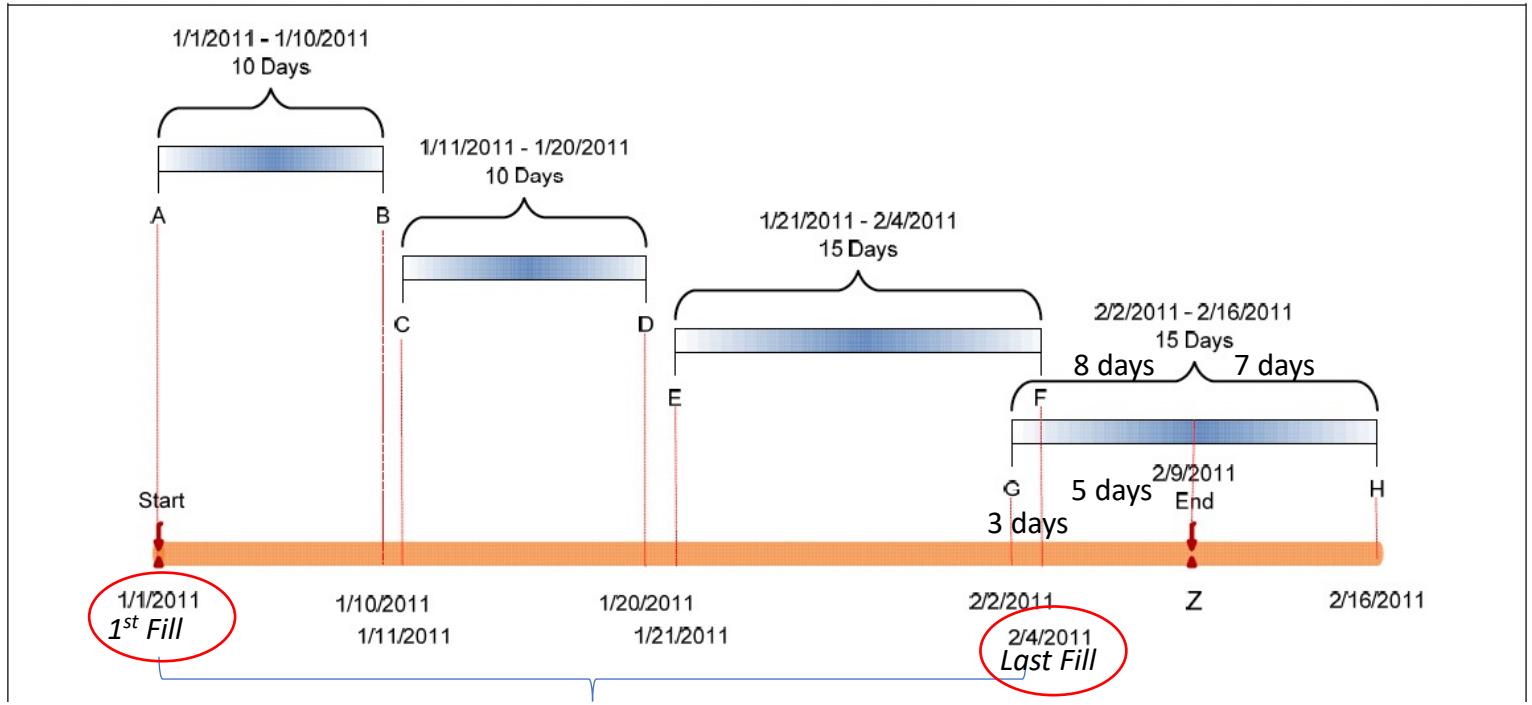


Observation Period = (2/9/11 – 1/1/11) + 1 = 40 days

Chu et al

Type of Follow-Up (Observation Period)	MPR	PDC
Fixed Follow-Up Observation Period (Denominator) is fixed for all patients Appropriate for Patients who are expected to remain on long-term therapy (diabtes, HTN, etc.); would not be appropriate for acute treatements such as antibiotics, pain meds, or corticosteroids)	$\frac{All\ Days\ Supply\ in\ Observation\ Period}{Length\ of\ Observation\ Period} =$ $\frac{AB + CD + EF + GZ}{Days\ in\ AZ} =$ $\frac{10 + 10 + 15 + 8}{40} =$ $\frac{43}{40} = 1.075$	$\frac{All\ Days\ Covered\ in\ Observation\ Period}{Length\ of\ Observation\ Period} =$ $\frac{AB + CD + EG + GZ}{Days\ in\ AZ} =$ $\frac{10 + 10 + (15 - 3) + 8}{40} =$ $\frac{40}{40} = 1$

Figure 1 Comparison between Medication Possession Ratio and Proportion Days Covered

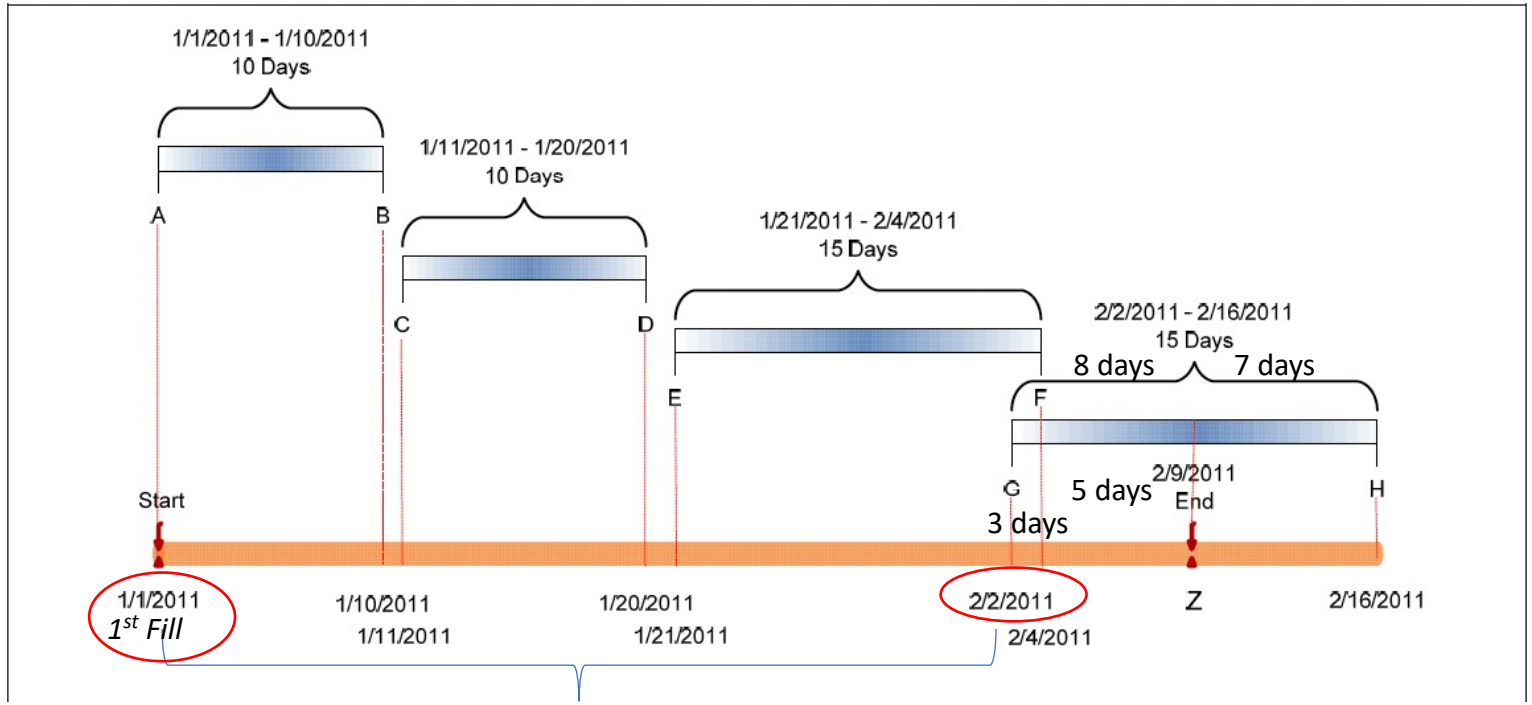


Elapsed Time = (2/4/11 – 1/1/11) + 1 = 35 days

Chu et al

Type of Follow-Up (Observation Period)	MPR	PDC
Variable Based on Elapsed Time Between Fills, Inclusive of Last Fill	$\frac{All\ Days\ \textbf{Supply}\ in\ Observation\ Period}{(Elapsed\ Time) + Days\ Supply\ of\ Last\ Rx} =$ $\frac{AB + CD + EF + GH}{(Last\ Rx\ Date\ - First\ Rx\ Date + 1) + Last\ Rx\ Days\ Supply} =$ $\frac{10 + 10 + 15 + 15}{(Feb4 - Jan1 + 1) + (5 + 7)} =$ $\frac{50}{47} = 1.063$	$\frac{All\ Days\ \textbf{Covered}\ in\ Observation\ Period}{(Elapsed\ Time) + Days\ Supply\ of\ Last\ Rx} =$ $\frac{AB + CD + EG + GH}{(Last\ Rx\ Date\ - First\ Rx\ Date + 1) + Last\ Rx\ Days\ Supply} =$ $\frac{10 + 10 + (15 - 3) + 15}{(Feb4 - Jan1 + 1) + (5 + 7)} =$ $\frac{47}{47} = 1.00$

Figure 1 Comparison between Medication Possession Ratio and Proportion Days Covered



Chu et al

Elapsed Time Excl Last Fill = (2/2/11 – 1/1/11) - 1 = 32 days

Type of Follow-Up (Observation Period)	MPR	PDC
Variable Based on Elapsed Time Between Fills, Exclusive of Last Fill	$\frac{All\ Days\ \mathbf{Supply}\ in\ Observation\ Period}{(Elapsed\ Time, excl\ last\ fill)} =$ $\frac{(Total\ Rx\ Days\ of\ Supply)\ -(Days\ of\ Supply\ of\ Last\ Rx)}{(Last\ Rx\ Date\ -First\ Rx\ Date-1)} =$ $\frac{(AB+CD+EG)-(1)}{Feb\ 2-Jan1\ -1}$ $\frac{(10+10+12)-(1)}{32}=\frac{32}{32}=1.00$	$\frac{All\ Days\ \mathbf{Covered}\ in\ Observation\ Period}{(Elapsed\ Time, excl\ last\ fill)} =$ $\frac{(Total\ Days\ Drug\ Available)\ -(Days\ Supply\ of\ Last\ Rx)}{(Last\ Rx\ Date\ -First\ Fx\ Date\ -1)}$ $\frac{(AB+CD+EG)-(1)}{(Last\ Rx\ Date\ -First\ Rx\ Date-1)} =$ $\frac{(10+10+12)-(1)}{32}=\frac{32}{32}=1.00$

MARS-10

- Patient is asked to circle the answer that describes their behavior or attitude towards their medication ***during the past week***.

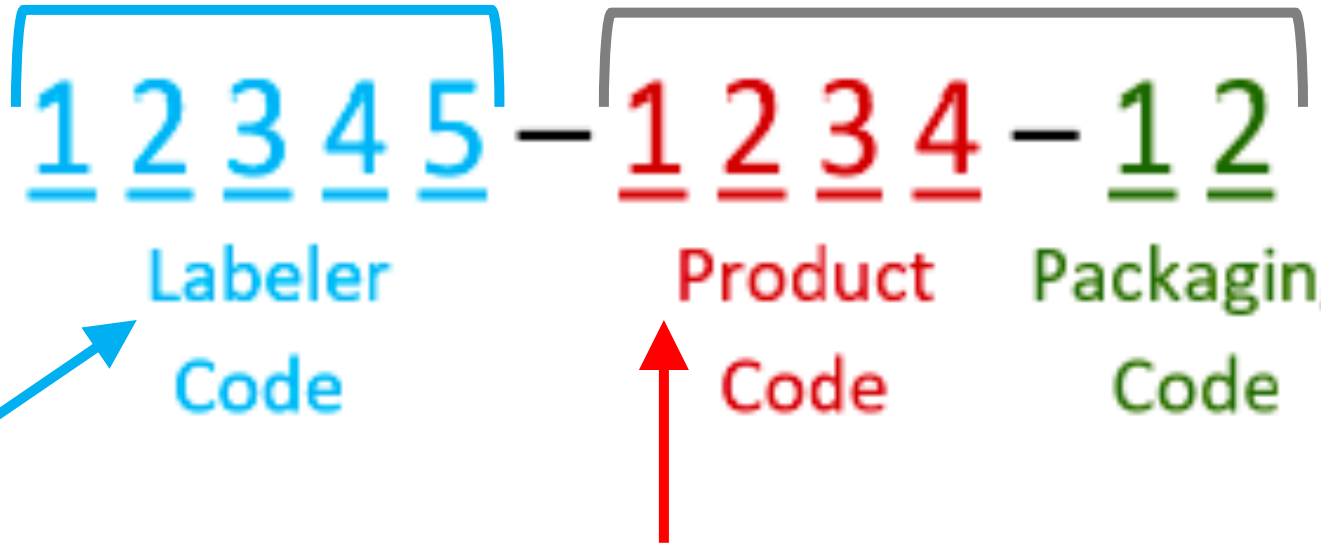
	Question	Answer
1	Do you ever forget to take your medication?	Yes / No
2	Are you careless at times about taking your medication?	Yes / No
3	When you feel better, do you sometimes stop taking your medication?	Yes / No
4	Sometimes if you feel worse when you take the medication, do you stop taking it?	Yes / No
5	I take my medication only when I am sick	Yes / No
6	It is unnatural for my mind and body to be controlled by medication	Yes / No
7	My thoughts are clearer on medication	Yes / No
8	By staying on medication, I can prevent getting sick.	Yes / No
9	I feel weird, like a 'zombie' on medication	Yes / No
10	Medication makes me feel tired and sluggish	Yes / No

The same drug molecule or active ingredient can be associated with many different NDC numbers

National Drug Code (NDC)

Assigned by the FDA

Assigned by the manufacturer or distributor

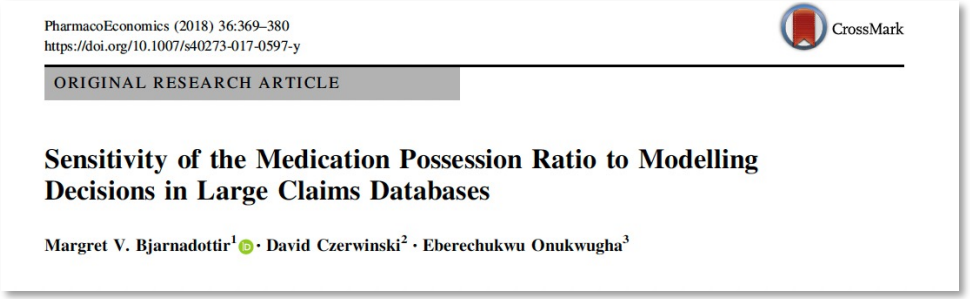


Manufacturer's Code
Identifies who manufactures, repacks, re-labels, or distributes the drug product

Identifies the drug, strength, dosage form, and formulation (specific to the firm that manufacturers the drug product)

Identifies the number of product units in the drug product (package size)
Also may indicate the type of packaging used

MPR and Overlapping Prescriptions


PharmacoEconomics (2018) 36:369–380
https://doi.org/10.1007/s40273-017-0597-y

ORIGINAL RESEARCH ARTICLE

Sensitivity of the Medication Possession Ratio to Modelling Decisions in Large Claims Databases

Margret V. Bjarnadottir[1] · David Czerwinski[2] · Eberechukwu Onukwugha[3]

- Can be treated in multiple ways (Bjarnadottir et al, 2018)
  - Approach 1: Ignore any overlap
    - Simply sum up the days' supply of all prescriptions within a study period, regardless of any overlap
    - Round MPRs >1 and <1.5 down to 1 (common approach)
    - Eliminate MPRs >=1.5 (large MPRs may indicate data problems)
  - Approach 2: Merge the overlapping prescriptions
    - Underlying assumption: the early fill was due to a starting a new medication and stopping an old one ("replacement")
  - Approach 3: Append / extend the coverage period to account for overlapping supply
    - Underlying assumption: overlap was caused by an early refill
  - Combination of 2 and 3
    - Overlaps of durations longer than a specified threshold are merged (approach 2)
    - Overlaps of durations shorter than a specified threshold are appended (approach 3)
    - Ex: overlap threshold of 7 days (Laliberte et al, 2013)
    - Assumptions: longer overlaps are due to replacements (e.g., started 1 medication for a few days but stopped if adverse effects and started a new one), but smaller overlaps are due to early refills (waiting until a few days before needing more of the same medication but still filling early)

2023 Medicare-Medicaid Plan Performance Data Technical Notes

Updated – March 2023

Measure: D08 - Medication Adherence for Diabetes Medications

Title	Description
Label for Data:	Taking Diabetes Medication as Directed
Description:	Percent of members with a prescription for diabetes medication who fill their prescription often enough to cover 80% or more of the time they are supposed to be taking the medication. One of the most important ways people with diabetes can manage their health is by taking their medication as directed. The MMP, the doctor, and the member can work together to find ways to do this. ("Diabetes medication" means a *biguanide drug,* a *sulfonylurea drug,* a *thiazolidinedione drug*, a *DPP-4 inhibitor,* a *GLP-1 receptor agonist,* a *meglitinide drug,* or an *SGLT2 inhibitor*. Members who take insulin are not included.)
Metric:	This measure is defined as the percent of Medicare Part D beneficiaries 18 years and older who adhere to their prescribed drug therapy across classes of diabetes medications: biguanides, sulfonylureas, thiazolidinediones, DiPeptidyl Peptidase (DPP)-4 Inhibitors, GLP-1 receptor agonists, meglitinides, and sodium glucose cotransporter 2 (SGLT2) inhibitors. This percentage is calculated as the number of member-years of enrolled beneficiaries 18 years and older with a proportion of days covered (PDC) at 80 percent or higher across the classes of diabetes medications during the measurement period (numerator) divided by the number of member-years of enrolled beneficiaries 18 years and older with at least two fills of diabetes medication(s) on unique dates of service during the measurement period (denominator). The PDC is the percent of days in the measurement period "covered" by prescription claims for the same medication or another in its therapeutic category. Beneficiaries are only included in the measure calculation if the first fill of their diabetes medication occurs at least 91 days before the end of the enrollment period. The Medication Adherence measure is adapted from the Medication Adherence-Proportion of Days Covered measure that was developed and endorsed by the Pharmacy Quality Alliance (PQA). See the medication list for this measure. The Medication Adherence rate is calculated using the National Drug Code (NDC) list maintained by the PQA.
Primary Data Source:	Prescription Drug Event (PDE) data

The PDC calculation is adjusted for overlapping prescriptions for the same drug which is defined by the active ingredient at the generic name level using the NDC list maintained by PQA. The calculation also adjusts for Part D beneficiaries' stays in inpatient (IP) settings, and stays in skilled nursing facilities (SNFs). The discharge date is included as an adjustment for IP/SNF stays. Please see Attachment C: Medication Adherence Measure Calculations for more information about these calculation adjustments.

2023 Medicare-Medicaid Plan Performance Data Technical Notes

Updated – March 2023

Measure: D09 - Medication Adherence for Hypertension (RAS antagonists)

Title	Description
Label for Data:	Taking Blood Pressure Medication as Directed
Description:	Percent of members with a prescription for a blood pressure medication who fill their prescription often enough to cover 80% or more of the time they are supposed to be taking the medication. One of the most important ways people with high blood pressure can manage their health is by taking medication as directed. The MMP, the doctor, and the member can work together to do this. ("Blood pressure medication" means an *ACEI (angiotensin converting enzyme inhibitor)*, an *ARB (angiotensin receptor blocker),* or a *direct renin inhibitor* drug.)
Metric:	This measure is defined as the percent of Medicare Part D beneficiaries 18 years and older who adhere to their prescribed drug therapy for renin angiotensin system (RAS) antagonists: angiotensin converting enzyme inhibitor (ACEI), angiotensin receptor blocker (ARB), or direct renin inhibitor medications. This percentage is calculated as the number of member-years of enrolled beneficiaries 18 years and older with a proportion of days covered (PDC) at 80 percent or higher for RAS antagonist medications during the measurement period (numerator) divided by the number of member-years of enrolled beneficiaries 18 years and older with at least two RAS antagonist medication fills on unique dates of service during the measurement period (denominator). The PDC is the percent of days in the measurement period "covered" by prescription claims for the same medication or another in its therapeutic category. Beneficiaries are only included in the measure calculation if the first fill of their RAS antagonist medication occurs at least 91 days before the end of the enrollment period. The Part D Medication Adherence measure is adapted from the Medication Adherence-Proportion of Days Covered measure that was developed and endorsed by the Pharmacy Quality Alliance (PQA). See the medication list for this measure. The Part D Medication Adherence rate is calculated using the National Drug Code (NDC) list maintained by the PQA.
Primary Data Source:	Prescription Drug Event (PDE) data

The PDC calculation is adjusted for overlapping prescriptions for the same drug which is defined by the active ingredient at the generic name level using the NDC list maintained by PQA. The calculation also adjusts for Part D beneficiaries' stays in inpatient (IP) settings, and stays in skilled nursing facilities (SNFs). The discharge date is included as an adjustment for IP/SNF stays. Please see Attachment C: Medication Adherence Measure Calculations for more information about these calculation adjustments.

2023 Medicare-Medicaid Plan Performance Data Technical Notes

Updated – March 2023

Measure: D10 - Medication Adherence for Cholesterol (Statins)

Title	Description
Label for Data:	Taking Cholesterol Medication as Directed
Description:	Percent of members with a prescription for a cholesterol medication (a *statin drug*) who fill their prescription often enough to cover 80% or more of the time they are supposed to be taking the medication. One of the most important ways people with high cholesterol can manage their health is by taking medication as directed. The MMP, the doctor, and the member can work together to do this.
Metric:	This measure is defined as the percent of Medicare Part D beneficiaries 18 years and older who adhere to their prescribed drug therapy for statin cholesterol medications. This percentage is calculated as the number of member-years of enrolled beneficiaries 18 years and older with a proportion of days covered (PDC) at 80 percent or higher for statin cholesterol medication(s) during the measurement period (numerator) divided by the number of member-years of enrolled beneficiaries 18 years and older with at least two statin cholesterol medication fills on unique dates of service during the measurement period (denominator). The PDC is the percent of days in the measurement period "covered" by prescription claims for the same medication or another in the therapeutic category. Beneficiaries are only included in the measure calculation if the first fill of their statin medication occurs at least 91 days before the end of the enrollment period. The Medication Adherence measure is adapted from the Medication Adherence-Proportion of Days Covered measure that was developed and endorsed by the Pharmacy Quality Alliance (PQA). See the medication list for this measure. The Medication Adherence rate is calculated using the National Drug Code (NDC) list maintained by the PQA.
Primary Data Source:	Prescription Drug Event (PDE) data

The PDC calculation is adjusted for overlapping prescriptions for the same drug which is defined by the active ingredient at the generic name level using the NDC list maintained by PQA. The calculation also adjusts for Part D beneficiaries' stays in inpatient (IP) settings, and stays in skilled nursing facilities (SNFs). The discharge date is included as an adjustment for IP/SNF stays. Please see Attachment C: Medication Adherence Measure Calculations for more information about these calculation adjustments.

2023 Medicare-Medicaid Plan Performance Data Technical Notes

Updated – March 2023

Attachment C: Medication Adherence Measure Calculations

Part D sponsors currently have access to monthly Patient Safety Reports via the Patient Safety Analysis Web Portal to compare their performance to overall rates and monitor their progress in improving the Part D patient safety measures over time. Sponsors may use the website to view and download the reports for performance monitoring.

Report User Guides are available on the Patient Safety Analysis Web Portal under Help Documents and provide detailed information about the measure calculations and reports. The following information is an excerpt from the Adherence Measures Report Guide (Appendices A and B) and illustrates the days covered calculation and the modification for inpatient stays and skilled nursing facility stays.

Proportion of Days Covered Calculation

In calculating the Proportion of Days Covered (PDC), we first count the number of days the patient was "covered" by at least one drug in the target drug class. The number of days is based on the prescription fill date and days' supply. PDC is calculated by dividing the number of covered days by the number of days in the measurement period. Both of these numbers may be adjusted for IP/SNF stays, as described in the 'Days Covered Modification for Inpatient Stays and Skilled Nursing Facility Stays' section that follows.

Note: CMS uses **days supply dispensed** and **refill dates** to determine the number of days the member **had medication on hand**

Determining the end of the observation window for PDC

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Statistical considerations for medication adherence research

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ORIGINAL REPORT

Estimating time-varying drug adherence using electronic records: extending the proportion of days covered (PDC) method

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ABSTRACT

KEY POINTS

- To date, measures of drug adherence have almost exclusively been applied for a fixed time interval, and without considering changes over time. Yet time varying differences in drug adherence may have real effects on patient prognosis.
- We demonstrate a method to measure time varying drug adherence, which better distinguishes an irregularly dosing patient from a stably dosing patient, and which is less likely to produce biassed estimates.
- The time varying PDC method may improve longitudinal and time-to-event studies that associate adherence with a clinical outcome, or (intervention) studies that seek to describe changes in adherence over time.

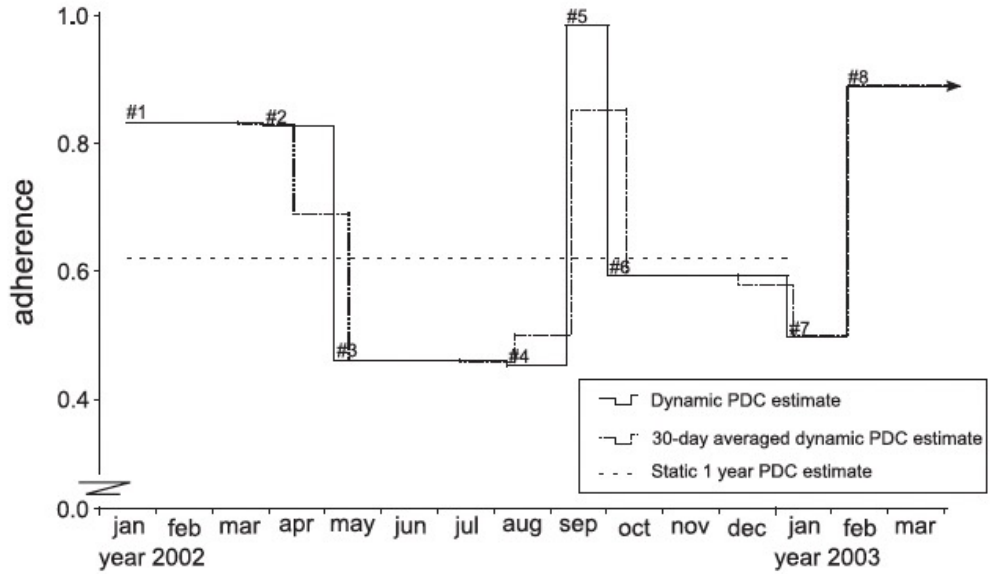

Figure 3. Comparisons of time-varying versus time-constant PDC estimates of drug adherence from a patient with irregular dosing behaviour. Each interval is represented by a horizontal line and labelled by # and its number. Interval #8 continues beyond the displayed range

Choice of Follow-Up Times (Kozma et al, 2013)

- Fixed vs Variable
  - Fixed is appropriate for chronic medical conditions in which patients are expected to remain on long-term therapy (HTN, diabetes, etc.)
  - Variable is appropriate for acute medical conditions (infections treated with antibiotics, acute pain, use of corticosteroids)
  - Using variable follow-up times provides adherence information only for the period of time when subjects are receiving drugs; does not provide information on those subjects who stop or interrupt therapy.

- Including days supply of last prescription in Variable Follow-Up Times
  - Used in studies to make an MRP value possible when there is only 1 prescription for a subject
  - However, this practice potentially inflates the MPR for patients with a single prescription because these subjects will always have an MPR of 1.0 (i.e., days supply = elapse days = 1.0)
  - This is obvious when shown for 1 study subject, but less noticeable when these subjects are embedded in a cohort. It will end up overestimating the average level of adherence for the group.

Medication Adherence

Terminology, Definitions, and Example Calculations

Amber Schilling, PharmD