

DATA STANDARD	Hospital Readmission
DESCRIPTION	<p>Hospital readmission is defined as readmission to an acute care hospital following discharge from an acute care hospital within a specified period of time. Hospital readmission strives to capture anyone who receives care in an acute care hospital and then receives care again within an acute care hospital, recognizing that there are differences across healthcare systems and countries regarding the definition of acute care hospital admission and the time period between hospital admissions that constitutes a readmission.</p> <p>Hospital readmission may be evaluated in several ways including during a defined time period:</p> <ul style="list-style-type: none"> • hospital readmission: proportion of all live patient discharges from an acute care hospital that are followed by readmissions to an acute care hospital within a specified period of time after discharge • hospital readmission rate: number of hospital readmissions (as defined per pre-specified period of time after discharge) per time at risk
RATIONALE	<p>Hospitalization is common in individuals with end-stage kidney disease (ESKD) requiring maintenance dialysis, and is associated with lower quality of life, higher cost and higher mortality.¹ Therefore, hospitalization rates are an important indicator of patient morbidity and quality of life.¹ As an example, in the United States (US), maintenance dialysis patients on average are admitted to the hospital twice a year and spend an average of 11.2 days in the hospital per year¹. Measures of the frequency of hospitalization have the potential to help efforts to improve patient outcomes, control medical costs, and help facilities provide cost-effective health care.</p> <p>Similarly, hospital readmission rates are a marker of quality of care provided during the hospitalization and post-hospitalization periods.^{2,3,4,5} It has been argued that interventions to reduce rates of readmission may improve quality of care and reduce healthcare costs.^{3,4,5} Targeting individuals with ESKD for appropriate discharge and transition to outpatient care to reduce readmission has been characterized as an urgent healthcare priority.⁶</p>

The Kidney Health Initiative is a public-private partnership between the American Society of Nephrology, US Food and Drug Administration and over 100 companies and organizations in the kidney community. KHI leadership acknowledges and thanks the workgroup that developed these data standards to support research and development in kidney disease. To learn more about KHI or this project, please visit www.kidneyhealthinitiative.org.

DATA SOURCE(S)	Patient-level data
REQUIRED DATA ELEMENTS	<ul style="list-style-type: none"> • Date of acute care hospital admission(s) • Date of acute care hospital discharge(s) • Start date of individual's follow-up time: date within the study observation period at which the individual is discharged from an acute care hospital • End date of individual's follow-up time: Earliest of: (a) last date for the individual in the cohort OR (b) end date of defined observation period • Cause of end of follow-up (e.g., death, loss to follow-up, etc.) • Definition of time period after live hospital discharge where a subsequent hospitalization is defined as a readmission (e.g., 30 days) • Vital status at the time of hospital discharge (e.g., alive at discharge)
DERIVED DATA ELEMENTS	<ul style="list-style-type: none"> • Identification of index hospitalizations and readmission hospitalizations • Total number of hospital discharges where patient is alive at time of discharge • Total number of hospital readmissions • Time at risk: Time after hospital discharge during which patient at risk for readmission
CALCULATION METHOD	<p>Hospital readmissions (%) =</p> $\frac{\text{Total number of hospital readmission events}}{\text{Total number of hospital discharges}}$ <p>Hospital readmission rate (events per patient-time) =</p> $\frac{\text{Total number of hospital readmission events}}{\text{Total time at risk for all patients}}$ <p>The numerator and/or the denominator may be multiplied or divided by a factor to scale the rate to specific reporting units (e.g., if the time at risk is measured in days and the desired reporting unit is per 100 patient days, then the numerator needs to be multiplied by 100).</p> <p>The most common calculation for this measure is hospital readmissions. Hospital readmission rate is less common but is included to afford investigators multiple ways to characterize hospitalization</p>

Hospital Readmission

<p>EXCLUSIONS</p>	<ul style="list-style-type: none"> • Hospital admissions to non-acute facilities (e.g., rehabilitation centers, extended care facilities, long-term acute care hospitals, skilled nursing facilities) • Hospital readmissions to non-acute facilities (e.g., rehabilitation centers, extended care facilities, long-term acute care hospitals, skilled nursing facilities) • Emergency department visits
<p>ADDITIONAL DESIRABLE DATA ELEMENTS FOR COLLECTION</p>	<ul style="list-style-type: none"> • Demographics (age, sex, race, ethnicity) • Principal discharge diagnosis or condition that resulted in admission to the hospital AND hospital readmission. • Dialysis modality ascertained as modality preceding hospital admission AND readmission • Time since initiation of dialysis for ESKD <p>Other variables required for cohort description, subgroup analyses or model adjustments, such as primary cause of ESKD and comorbid conditions.</p>
<p>NOTES</p>	<ul style="list-style-type: none"> • Depending on the purpose of the study, researchers may want to focus on cause-specific hospitalizations and readmissions. • If cause of hospitalization/rehospitalization is relevant to the study, the researchers need to define if they will rely on primary diagnosis only, or if they will consider lower-level diagnoses (e.g., secondary diagnoses). • Depending on the purpose of the study, researchers may want to consider certain types of hospitalizations/rehospitalizations separately (e.g., elective access-related hospitalizations, hospitalizations <24 hours duration, etc.). • Because of variable definitions of observational stays across countries investigators may wish to consider observational stays separately from other hospitalizations and rehospitalizations. In the US, observational stays are considered outpatient care. • Depending on the nature of the study and data sources, investigators may wish to consider situations where a hospital stay overlaps with another, starts at the same day or shortly after a discharge from another one. In these situations, investigators may decide criteria for when they will consider these single or multiple hospital admission events (i.e., admission and readmission). In addition, investigators should consider the possibility of errors in admission or discharge dates. Furthermore, investigators need to consider how to handle hospital transfers (i.e., whether interhospital transfers should be considered an admission). • The Standardized Readmission Ratio (SRR) is designed to reflect readmission rates of patients per a given dialysis facility. Specifically, SRR is the number of hospital readmissions for all patients receiving maintenance dialysis at a specific dialysis facility relative to the number of

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- hospital readmissions for all patients at a given dialysis facility that would be expected based on overall national rates and the characteristics of the patients at that facility. Further instructions on its calculation and required data elements are available within CMS guidance.⁷
- Consideration should be made for hospitalizations/rehospitalizations during the first 90 days of ESKD treatment with dialysis. First, this period includes some patients who may recover kidney function. Second, this period is also considered a high-risk period as there are unusually high rates of hospitalization/rehospitalization and death. Third, in the US, researchers should pay close attention to the capture of hospitalization/rehospitalization data since this period may mark a transition in insurance status (e.g., receipt of Medicare coverage). For these reasons, researchers may want to study the first 90 days separately.
 - Depending on patient's insurance and venues of care, consideration could be given to soliciting hospitalization/rehospitalization data directly from patients and their dialysis facilities. The data collection approach, and the associated limitations, should be carefully considered by investigators in their study design.
 - A patient may be receiving care within an acute care hospital, but the indication for ongoing hospitalization is for long-term care, rehabilitation or other non-acute conditions. In order to be consistent with the exclusions of the measure, these types of admissions should be considered for exclusion.
 - Researchers, especially in the US, may also need to consider whether to include or exclude "observation stays" in their calculation or not. Some patients may be physically in acute care hospital but not classified as an admission.
 - Researchers will need to consider additional data elements necessary for adjustments such as demographics and comorbid conditions.
 - There are many considerations for the post-discharge observation period. There is substantial variability in how this period is defined by research studies and regulatory bodies. Many use the 30 days following discharge from the index hospitalization.
 - Censoring is an important consideration. During the post-discharge observation period, there are multiple possibilities: alive, no readmission; died, no readmission; readmitted to acute care hospital, live discharge from readmission; readmitted to acute care hospital, death during readmission; readmitted to non-acute care hospital; etc. Researchers will need to consider how to handle these various possibilities.
 - Cause and duration of index hospitalizations may affect the risk of readmission. These need to be considered particularly when comparing readmissions between different groups or trends over time.
 - When there are multiple hospitalizations for a patient within the study observation period, researchers should decide the approach to classification of index and readmission hospitalizations and whether a single hospitalization can, at times, be classified as both a readmission and index hospitalization.

<p>NOTES (Cont'd)</p>	<ul style="list-style-type: none"> Planned versus unplanned admissions should be considered, and investigators should decide and specify how planned readmissions will be examined. Start date of individual's follow-up time (date within the study observation period at which the patient joins the cohort) and end date of individual's follow-up time are important matters for investigators to determine in their study design. The examination of hospital readmission requires many methodologic decisions. A number of references are available to assist investigators in identifying key considerations.
<p>EXAMPLE MEASURE CALCULATION</p>	<p>Readmission Proportion or Percent: Number of index hospital discharges = 500 hospital discharges Post-discharge follow-up period: 30 days Number of hospital readmission events = 50 readmissions $\text{Hospital Readmissions} = \frac{50}{500} = 10\%$</p> <p>Readmission Rate: Total patient-at-risk-time = 200 patient-years Hospital readmission events = 50 events $\text{Hospital readmission rate} = \frac{50 \text{ events}}{200 \text{ patient-years}} = 0.25 \text{ events per patient-year}$</p>
<p>ACRONYMS</p>	<p>SRR: Standardized Readmission Ratio CMS: Centers for Medicare and Medicaid Services</p>
<p>SYNONYMS</p>	<p>Rehospitalization is synonymous with Readmission</p>

REFERENCES

1. United States Renal Data System. 2019 USRDS Annual Data Report: Epidemiology of kidney disease in the United States. National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD, 2019. <https://www.usrds.org/annual-data-report/>. Accessed February 5, 2021.
2. James, Julia. Medicare Hospital Readmissions Reduction Program. November 12, 2013. <https://www.healthaffairs.org/doi/10.1377/hpb20131112.646839/full/>. Accessed February 5, 2021.
3. Erickson, K. F., et al. Physician visits and 30-day hospital readmissions in patients receiving hemodialysis. J Am Soc Nephrol. 2014. 25(9): 2079-2087.
4. Jencks, S. F., et al. Rehospitalizations among patients in the Medicare fee-for-service program. N Engl J Med 2009. 360(14):1418-1428.
5. Erickson, K. F., et al. "Hemodialysis Hospitalizations and Readmissions: The Effects of Payment Reform." Am J Kidney Dis 2017.69(2): 237-246.
6. Wingard, R. L., et al. Right Return. Partnering to reduce the high rate of hospital readmission for dialysis-dependent patients. Nephrol News Issues 2012. 26(3): 20-22.
7. University of Michigan Kidney Epidemiology and Cost Center. Report for the Standardized Hospitalization Ratio. June 23, 2016. www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/ESRDQIP/Downloads/SHR-Methodology-Report.pdf. Accessed February 5, 2021.

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