Data Standard	Hospital Admission
Alternate Name(s)	
Description	Hospital admission is defined as admission to an acute care hospital. Hospital admission strives to capture anyone who receives care in an acute care hospital recognizing that there are differences across healthcare systems and countries regarding the definition of acute care hospital admission. Hospital admission may be evaluated in several ways including: • hospital admission (or discharge) rate: number of hospital admissions (or discharges) per unit time at risk • hospital days rate: number of hospital days per unit time at risk
Rationale	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.[1,2] As an example, in the United States (US), maintenance dialysis patients on average are admitted to the hospital approximately twice a year and spend an average of 11.2 days in the hospital per year.[1] 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.
Data Source(s)	Patient-level data
Required Data Elements	• 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 or report's observation period at which the patient joins the cohort. • End date of individual's follow-up time: Earliest of: (a) last date for the patient in the cohort (e.g., for loss of follow up), OR (b) end date of the study's observation period. • Cause of end of follow up (e.g., censored for transplant, loss to follow-up, death, etc.)
Derived Data Elements	• Hospitalizations: number of unique hospital admissions. • Hospital days: number of days in the hospital, which is defined as the date of hospital discharge (DOD) minus the date of hospital admission (DOA).[3] Please note when DOD = DOA, some organizations designate hospital days = 1, others designate hospital days = 0, and others designate hospital days = 0.5.[4]

	- Cumulative hospital days: the sum of hospital days - Time at risk: Time during which the patient is at risk for hospitalization. Please note, investigators should decide whether the at-risk time for a hospital admission excludes time periods of hospitalization. Investigators may choose a similar or alternative approach for at-risk time when calculating the hospital days rate.
Calculation Method	1. Hospital admission (or discharge) rate* = unique hospital admissions (or discharges) divided by the patient time at risk (e.g., per patient-year or per 100 patient-months) 2. Hospital days rate* = total number of hospital days divided by patient time at risk (e.g., per patient-year or per 100 patient-months) * The numerator &/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).
Exclusions	- Hospital admissions to non-acute facilities, e.g., rehabilitation centers, extended care facilities, long-term acute care hospitals, skilled nursing facilities - Emergency department visits that do not result in a hospitalization
Additional Desirable Data Elements for Collection	- Demographics (age, sex, race, ethnicity) - Principal discharge diagnosis or condition that resulted in admission to the hospital - Dialysis modality ascertained as modality immediately preceding hospital admission - Time since dialysis initiation for ESKD - Reason for end of follow-up (death, loss to follow-up, transplant, recovery of kidney function, etc.) - Other variables required for cohort description, subgroup analyses or model adjustments, such as primary cause of ESKD and comorbid conditions.
Notes	- Depending on the purpose of the study, researchers may want to focus on cause-specific hospitalizations. - Consideration should be given to what constitutes an acute care hospital. This may vary by state and country. - If cause of hospitalization 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 (i.e., secondary diagnoses). - Depending on the purpose of the study, researchers may want to consider certain types of hospitalizations separately (e.g., elective access-related hospitalizations, hospitalizations <24 hours in duration, observation stays, etc.). - 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. • The Standardized Hospitalization Ratio (SHR) is designed to reflect hospitalization rates relative to a national standard. Specifically, SHR is the number of hospital admissions for all patients receiving maintenance dialysis at a specific dialysis facility relative to the number of hospital admissions 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.[5] • Consideration should be made for hospitalizations 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 and death. Third, in the US, researchers should pay close attention to the capture of hospitalization 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 of dialysis separately. • Depending on patients' insurance and venues of care, consideration should be given to soliciting hospitalization data directly from patients and their dialysis facilities. • 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 hospitals but not classified as an admission. • While the time at risk is defined as the end date of follow-up minus the start date of follow-up, researchers should consider approaches for calculating time at risk as outlined above. • Researchers will need to consider additional data elements necessary for adjustments such as demographics and comorbid conditions. • Capture of hospitalization may depend on data sources (e.g., administrative data vs. primary data collection). • "Same date" hospitalizations (i.e., where DOD = DOA) can be counted in two different ways. Unfortunately, there does not seem to be a universal standard. Most US States and European countries assign a LOS of 1 when DOA=DOD[4]. However, this practice is not universally followed. For the NIS dataset, AHRQ H-CUP assigns a LOS of 0 when DOA=DOD.[3]

Example Measure Calculation	Hospitalization Rate:
	    Total number of hospitalization events = 30 events
	
	    Total time at risk = 5460 days

	Hospitalization rate $= \frac{30 \times 365}{5460}$ = 2 events per patient-year
	Hospital Days:
	     Total number of hospital days = 200 days
	     Total time at risk = 5260 days
	
	Hospital days $= \frac{200 \times 365}{5260}$ = 14 days per patient-year

Acronyms	DOA: Date of Admission DOD: Date of Discharge CMS: Centers for Medicare and Medicaid Services LOS: Length of Stay SHR: Standardized Hospitalization Ratio

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. Centers for Medicare & Medicaid Services Center for Clinical Standards and Quality. CMS ESRD Measures Manual for the 2018 Performance Period / 2020 Payment Year. https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/ESRDQIP/Downloads/ESRD-Manual-v30.pdf. Accessed February 5, 2021.

3. HCUP NIS Description of Data Elements. Healthcare Cost and Utilization Project (HCUP). September 2008. Agency for Healthcare Research and Quality, Rockville, MD. AHRQ Healthcare Cost and Utilization Project (H-CUP) https://www.hcup-us.ahrq.gov/db/vars/los/nisnote.jsp. Accessed February 5, 2021.

4. World Health Organization (WHO) – European Health Information Gateway https://gateway.euro.who.int/en/indicators/hfa_540-6100-average-length-of-stay-all-hospitals/. 2019. Accessed February 5, 2021.

5. 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.