# Chronic School Absenteeism of Children with Chronic Kidney Disease

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We evaluated the frequency of chronic school absenteeism (≥18 missed school days per year) among children with mild-to-moderate chronic kidney disease. Chronic absenteeism was present in 17.3% of children with chronic kidney disease, compared with 2.7% of children in the US National Health and Nutrition Examination Survey. (J Pediatr 2018;■■:■■-■■).

School attendance is associated with academic success.[1] Early detection of children at high risk of frequent school absenteeism may allow for interventions to increase the likelihood of school completion.[2] Children with chronic illness have an increased risk of absenteeism and lower academic achievement compared with children in general.[3,4] School attendance in chronically ill children is associated with disease severity, disease control, physical limitations, psychological factors, and parental perception of their child's health.[5]

School absenteeism is not well described in the pediatric chronic kidney disease (CKD) population. Pediatric CKD has unique impacts on growth and development that potentially may affect school attendance beyond what is seen in other chronic diseases. Up to 25% of children <5 years of age with CKD have developmental delays,[6] and children with CKD are more likely to have lower academic achievement scores and lower IQ scores than their siblings.[7] Children with CKD-associated urologic abnormalities often have bowel/bladder incontinence and may require bladder catheterization, which can be challenging for school-aged children.[8,9]

The purpose of this study was to characterize chronic school absenteeism among children in the US with mild-to-moderate CKD and to compare the prevalence with published norms among healthy American children. In addition, we sought to identify predictors of chronic school absenteeism in children with CKD, recognizing that identification of these factors is an important first step in developing interventions to address barriers to school attendance.

## Methods

This study is an analysis of baseline data obtained from children participating in the Chronic Kidney Disease in Children (CKiD) multicenter cohort study, with data supplied by the National Institutes of Diabetes and Digestive and Kidney Diseases Central Repositories. All participating sites in the CKiD study have local institutional review board approval, and additional institutional review board approval was obtained from

our institution for the current analyses using deidentified data. The study enrolls children between 1 and 16 years of age with mild-to-moderate CKD (glomerular filtration rate [GFR] of 30-90 mL/min/1.73 m$^2$) from >50 sites across the US. A more complete description of the CKiD study design and protocol has been published previously.[10] The present study was limited to children ≥6 years of age at the time of study enrollment (n = 667). Age <6 years was an exclusion criterion, given that children <6 years of age are not enrolled routinely in school programs. A total of 608 children were included in the final analyses, after the exclusion of 28 children who did not attend school outside their home and 31 children with missing school absenteeism data.

### Exposures

Exposure variables were selected from the baseline CKiD study visit to account for both demographic and clinical characteristics that could potentially influence absenteeism. Age was categorized as <11 years, 11-14 years, and >14 years of age to approximate elementary, middle, and high school. Type of insurance (private vs public) and maternal education (high school or less, some college, or college graduate) were included as socioeconomic indicators. IQ was calculated from the Wechsler Abbreviated Scale of Intelligence. Scores were reported on a numeric scale between 0 and 200. The mean Wechsler Abbreviated Scale of Intelligence score is 100 (SD 15 points).

CKD-specific factors including estimated glomerular filtration rate (eGFR), type of CKD, and urologic complications were evaluated. Severity of CKD was defined by an eGFR ≥60 mL/min/1.73 m$^2$ or <60 mL/min/1.73 m$^2$, based on the bedside Schwartz equation.[11] Type of CKD was categorized as glomerular or nonglomerular disease. Urologic data were collected from the caregiver report to determine whether the child

| CKD | Chronic kidney disease |
|---|---|
| CKiD | Chronic Kidney Disease in Children |
| eGFR | Estimated glomerular filtration rate |
| GFR | Glomerular filtration rate |
| RR | Relative risk |
| UTI | Urinary tract infection |

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had enuresis and/or required bladder catheterization. Determination of anemia and hyperphosphatemia was based on Kidney Disease Improving Global Outcomes age-specific guidelines.[12,13] Hypertension was determined based on caregiver report. Height z-scores of −2 or less were used to identify short stature, in accordance with the Kidney Disease Improving Global Outcomes definition of short stature.[13] The number of medications taken by each participant was used to assess medication burden. Medication burden was categorized as 1-4 medications, 5-9 medications, and ≥10 medications. We also evaluated the association between frequency of medication administration and school absenteeism. To capture the impact of acute illnesses on school absenteeism, data on urinary tract infection (UTI), hospitalizations, and emergency department visits in the last year also were collected. These data were based on parental/caregiver report and were evaluated in a separate analysis, given the ambiguous temporality with respect to school absenteeism during the previous year.

### Outcome

School attendance in the CKiD study was based on caregiver/parent recall, by asking "During the past school year, approximately how many days has (*name of child*) missed from school because of not feeling well?" The answer was recorded as the number of days missed. Children were categorized as "chronically absent" if ≥18 days of school were missed in the last year. This decision was made to align with other published school absenteeism data.[14]

### Statistical Analyses

Stata, version 12.0 (StataCorp LLC, College Station, Texas) was used for all analyses. The proportion of children with ≥18 days of school missed in the last year was reported. To compare the proportion of children with CKD and chronic school absenteeism with the proportion of children studied in National Health and Nutrition Examination Survey with chronic absenteeism, a $\chi^2$ test was used. We estimated relative risks (RRs) and 95% confidence intervals (CIs) to evaluate which variables were predictive of chronic school absenteeism in our CKD study population. Because our primary focus was prediction, not etiology, our main analyses assessed the relationship of each demographic and clinical factors to chronic school absenteeism. We also evaluated potential confounding by all demographic and clinical variables. Only those variables that individually changed our risk estimate by at least 10% were accounted for with Mantel–Haenszel adjustment. Where confounding was present, both crude and adjusted risk estimates were reported.

RRs and 95% CIs also were estimated to evaluate the relationship between chronic school absenteeism and the presence of acute illnesses (UTI, hospitalization, and emergency department visits) during the previous year. The timing of days missed relative to the exposures was not available, so we were unable to determine whether a given day of absenteeism occurred during the illness or hospitalization. Despite this limitation, we adjusted for the occurrence of hospitalization in one analysis of the association between the occurrence of UTIs and

chronic absenteeism. Mean IQ scores and SD were calculated for each absenteeism group.

## Results

The overall prevalence of chronic school absenteeism among children with CKD was 17.3% (n = 105), in contrast to 2.7% of children in the National Health and Nutrition Examination Survey population (RR 6.2, 95% CI 4.6-8.4). Characteristics of children with CKD in whom chronic absenteeism was and was not present are presented in **Table I**.

Univariate analyses of the associations between demographic and CKD-specific variables and chronic school absenteeism are presented in **Table II**. Neither age nor race/ethnicity was related to chronic school absenteeism. Boys experienced less chronic absenteeism than girls (RR 0.65, 95% CI 0.46-0.91). Among children with CKD whose mother obtained a college degree, the risk of chronic school absenteeism was 0.52 times that of children whose mother obtained a high school degree or less (95% CI 0.33-0.83). Mean IQ score in the chronic absenteeism group was 94.5 (95% CI 91.2-97.7) and 97.4 (95% CI 95.9-99.0) in the group without chronic school absenteeism. There was little association between severity of CKD and chronic school absenteeism. Glomerular CKD was associated with more chronic school absenteeism than nonglomerular CKD (RR 1.6, 95% CI 1.1-2.2).

The risk of chronic school absenteeism was greater among participants with urologic issues, specifically enuresis or the need for bladder catheterization. Both variables had a substantial amount of missing data (24% among the chronic absenteeism group, 35% among children without chronic absenteeism). The risk of chronic absenteeism was 60% greater among participants with documented enuresis (95% CI 1.0-2.4). When adjusted for type of CKD, the risk of chronic school absenteeism was 2.2 times greater among children requiring bladder catheterization (95% CI 1.4-3.7). Given the elevated risk of UTI in children with enuresis or bladder catheterization, we repeated this analysis with adjustment for the presence of UTI in the last year. This adjustment attenuated both risk estimates, with an adjusted RR of 1.5 for enuresis (95% CI 0.98-2.3) and an adjusted RR of 1.6 for bladder catheterization (95% CI 0.84-3.2).

There was a strong relationship between greater medication burden and chronic school absenteeism. When compared with a baseline category of 1-4 medications, children requiring 5-9 medications had 2.3 times the risk of chronic school absenteeism (95% CI 1.6-3.4), and children requiring ≥10 medications had 4.2 times the risk (95% CI 2.6-6.7). To evaluate whether medication burden was a marker of disease severity, the relationship between medication burden and chronic school absenteeism was adjusted for GFR category, but this did not appreciably alter risk estimates. Children requiring medication administration at least twice per day were 2.6 times as likely to be chronically absent from school compared with those requiring once per day dosing (95% CI 2.4-5.1). There was no stepwise increase in absenteeism as