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Chronic School Absenteeism of Children with Chronic Kidney Disease

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Abstract

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

Keywords

academic achievement; attendance; chronic illness

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 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 less than 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 intelligence quotient (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]

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The purpose of this study was to characterize chronic school absenteeism among United States children with mild to moderate CKD and to compare the prevalence with published norms among healthy American children. Additionally, 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 (NIDDK) Central Repositories. All participating sites in the CKiD study have local institutional review board (IRB) approval, and additional IRB approval was obtained from our institution for the current analyses using de-identified data. The study enrolls children between 1-16 years of age with mild to moderate CKD (glomerular filtration rate (GFR) of 30-90mL/min/1.73m^2) from >50 sites across the United States. A more complete description of the CKiD study design and protocol has been previously published.[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 criteria given that children <6 years of age are not routinely enrolled in school programs. A total of 608 children were included in the final analyses, after 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 versus 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 (WASI). Scores were reported on a numeric scale between 0-200. Mean WASI score is 100 (standard deviation 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 ≥60mL/min/1.73m^2 or <60mL/min/1.73m^2, based on the bedside Schwartz equation.[11] Type of CKD was categorized as glomerular or non-glomerular disease. Urologic data were collected from caregiver report to determine if the child had enuresis and/or required bladder catheterization. Determination of anemia and hyperphosphatemia were based on Kidney Disease Improving Global Outcomes (KDIGO) 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 KDIGO 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 were also 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 prior 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 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 to the proportion of children studied in NHANES with chronic absenteeism, a chi-square test was used. We estimated relative risks (RR) and 95% confidence intervals 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 factor 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.

Relative risks and 95% confidence intervals were also estimated to evaluate the relationship between chronic school absenteeism and the presence of acute illnesses (UTI, hospitalization and emergency department visits) during the prior 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 standard deviation 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 NHANES 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 CKD severity and chronic school absenteeism. Glomerular CKD was associated with more chronic school absenteeism than non-glomerular CKD (RR=1.6, 95% CI: 1.1-2.2).

The risk of chronic school absenteeism was higher 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% higher 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 higher 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 relative risk of 1.5 for enuresis (95% CI: 0.98-2.3) and an adjusted relative risk of 1.6 for bladder catheterization (95% CI: 0.84-3.2).

There was a strong relationship between higher 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 if 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 medication frequency increased beyond twice per day. Adjustment for frequency of medication administration had only a modest effect on the relationship between medication burden and chronic absenteeism.

A history of acute illness was also positively associated with chronic school absenteeism. Study participants with at least one UTI in the last year had an increased risk of chronic school absenteeism compared with those with no such infections. This relationship remained present after adjusting for a history of hospitalization in the last year, to account for any effect from hospitalization for diagnosis and/or treatment of the infection (RR = 2.5, 95% CI: 1.6-3.8). A history of hospitalization (any reason) within the last year was associated with a 4.1 times higher risk of chronic school absenteeism (95% CI: 2.9-5.8). Children with CKD who had one emergency room visit in the last year also demonstrated an increased risk of chronic school absenteeism (RR = 2.9, 95% CI: 1.7-4.9); the corresponding relative risk among children with >1 emergency room visit was 5.8 (95% CI: 3.8-8.7).

Discussion

Children with CKD were found to have a higher frequency of chronic school absenteeism than United States children in general. As pediatric providers we counsel families on the long term impacts of chronic illness, but influences on education are not commonly discussed.[15,16] Educational outcomes in adults with childhood-onset CKD are poor,[17] and chronic absenteeism is likely contributing to lower achievement. Additionally, school attendance is closely linked to social functioning in children, with school absenteeism potentially characterizing children with a lower quality of life.[3,5]

We identified several predictors of school absenteeism among children with CKD, including demographic, socioeconomic and disease-specific indicators. Although these exposures and characteristics are not necessarily modifiable or causal, they may permit the identification of relatively high-risk children. Conversely, higher maternal education was associated with a lower risk of chronic school absenteeism. The reduced risk associated with a higher level of maternal education is similar to the association of maternal education with other childhood health outcomes, and may serve as a surrogate indicator of socioeconomic status.

There was no association between chronic school absenteeism and eGFR, possibly because eGFR may not fully capture the overall burden of disease. Some of the factors associated with chronic school absenteeism that we identified are related to disease control (such as medication burden) and/or the occurrence of acute illnesses. These findings are similar to studies in other chronic disease populations, such as children with asthma and lupus, where school absenteeism has been associated with poor disease control.[18,19] Asthma literature suggests the association between absenteeism and the intensity of disease management may be useful not only to identify children at risk for school failure, but to identify children with sub-optimal disease control based on the number of missed school days.[18,20]

If causal, the association between medication burden and chronic school absenteeism suggests a potentially modifiable exposure. Medication burden is not only a surrogate of disease severity; it likely is an indicator of relatively poor disease control as well. Previous studies have shown that complex pill regimens are associated with lower levels of medication adherence.[21,22] Regardless of the mechanism driving the association between medication burden and absenteeism, it can be used as an identifier of patients at particularly high risk for chronic school absenteeism.

This study of school absenteeism in the chronic kidney disease population provides insight into the scope of the problem among patients with CKD. Although the frequency of chronic school absenteeism is striking in the CKD population, these findings are likely an underestimate. The method of outcome ascertainment in this study likely underrepresents the true burden of chronic illness on school attendance, as it does not capture partial missed days for clinic appointments and does not account for time out of the classroom for school nurse visits, medication administration or catheterization. Future study should target longitudinal assessment of absenteeism in children with CKD to avoid the temporality issues raised by this cross-sectional assessment.

Healthcare providers may have a limited view of patients' lives outside of the hospital or clinic setting. Asking about school attendance provides insight into how children and families are coping with chronic illness and is something many patients and caregivers want to discuss.[15] Enhanced communication between educators and clinicians could allow for a shared understanding of how to support children with complex health care needs.[23-25] Health care providers also need to better understand school resources and parental concerns regarding the school's ability to recognize and manage a medical issue during the school day.[20] As healthcare teams, we need to understand barriers to school attendance in order to develop appropriate targeted interventions to help children attend school and succeed in the classroom.

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Abbreviations

CKD	chronic kidney disease
CKiD	chronic kidney disease in children study
NHANES	National Health and Nutrition Examination Survey
RR	relative risk
CI	confidence interval
NIDDK	National Institutes of Diabetes and Digestive and Kidney Diseases
GFR	glomerular filtration rate
KDIGO	Kidney Disease Improving Global Outcomes
UTI	urinary tract infection

IQ	intelligence quotient

Table 1

Demographic and clinical characteristics of children with chronic kidney disease, by chronic school absenteeism (≥18 days missed) status in the previous year

	Missed School Days			
	≥18 (N=105)		<18 (N=503)	
	n[a]	(%)	n[a]	(%)
Age (years)				
<11	40	(19.4)	166	(80.6)
11-14	36	(16.7)	180	(83.3)
>14	29	(15.6)	157	(84.4)
Gender				
Female	51	(21.2)	179	(77.8)
Male	54	(14.3)	324	(85.7)
Insurance				
Private	50	(13.4)	324	(86.6)
Public	51	(25.5)	149	(74.5)
Race/Ethnicity				
Caucasian/Non-Hispanic	57	(16.6)	286	(83.4)
Caucasian/Hispanic	7	(11.7)	53	(88.3)
African-American	19	(17.0)	93	(83.0)
Other	22	(24.7)	67	(75.3)
Maternal Education				
High School or Less	48	(21.0)	181	(79.0)
Some College	33	(20.1)	131	(79.9)
College Graduate	22	(10.9)	179	(89.1)
eGFR (mL/min/1.73m^2)				
≥60	43	(19.8)	174	(80.2)
<60	62	(15.9)	329	(84.1)
CKD Etiology				
Non-Glomerular	61	(14.7)	354	(85.3)
Glomerular	44	(22.8)	149	(77.2)
Anemia				
No	66	(14.6)	386	(85.4)
Yes	37	(25.7)	107	(74.3)
Hyperphosphatemia[c]				
No	43	(16.3)	220	(83.7)
Yes	10	(25.0)	30	(75.0)
Short stature				
No	88	(16.1)	460	(83.9)
Yes	17	(28.3)	43	(71.7)
Hypertension				

	Missed School Days			
	≥18 (N=105)		<18 (N=503)	
	n[a]	(%)	n[a]	(%)
No	42	(14.2)	254	(85.8)
Yes	62	(20.3)	244	(79.7)
Enuresis[b]				
No	42	(12.5)	294	(87.5)
Yes	26	(23.2)	86	(76.8)
Catheterization[b]				
No	45	(12.4)	319	(87.6)
Yes	23	(26.1)	65	(73.9)
Medication Burden[d]				
1 to 4	39	(11.2)	310	(88.8)
5 to 9	47	(25.7)	136	(74.3)
≥ 10	16	(47.1)	18	(52.9)
Intelligence Quotient				
Mean (SD)	94.5	(14.4)	97.4	(15.9)

CKD = Chronic kidney disease, eGFR = Estimated glomerular filtration rate, UTI = Urinary tract infection, SD = standard deviation

All variables have <5% missing data unless otherwise noted

[a]Numbers may not add up to total due to missing data

[b]Variable has 24% missing data in chronic absenteeism group and 35% missing data in group without chronic absenteeism

[c]50% missing data in each group

[d]Pill burden represents number of unique medications reported by participant/caregiver; 2.9% missing data in group with chronic school absenteeism, 7.8% missing data in group without chronic school absenteeism

Table 2

Crude and adjusted associations between demographic and clinical characteristics and chronic school absenteeism

	Crude RR	95% CI	Adjusted RR	95% CI
Age (years)				
<11	1.0	Reference	-	-
11-14	0.86	0.57-1.3	-	-
>14	0.80	0.52-1.2	-	-
Gender				
Female	1.0	Reference	-	-
Male	0.65	0.46-0.91	-	-
Insurance[a]				
Private	1.0	Reference	1.0	Reference
Public	1.9	1.3-2.7	1.7	1.2-2.4
Race/Ethnicity				
Caucasian/Non-Hispanic	1.0	Reference	-	-
Caucasian/Hispanic	0.70	0.34-1.5	-	-
African American	1.02	0.64-1.6	-	-
Other	1.5	0.96-2.3	-	-
Maternal Education				
High school or less	1.0	Reference	-	-
Some college	0.96	0.65-1.4	-	-
College graduate	0.52	0.33-0.83	-	-
eGFR (mL/min/1.73m^2)				
≥60	1.0	Reference	-	-
<60	0.80	0.56 – 1.1	-	-
CKD Etiology				
Non-Glomerular	1.0	Reference	-	-
Glomerular	1.6	1.1-2.2	-	-
Anemia[b]				
No	1.0	Reference	1.0	Reference
Yes	1.8	1.2-2.5	1.6	1.1-2.3
Hyperphosphatemia				
No	1.0	Reference	-	-
Yes	1.5	0.84-2.8	-	-
Short Stature[b]				
No	1.0	Reference	1.0	Reference
Yes	1.8	1.1-2.8	1.5	0.99-2.4
Hypertension				
No	1.0	Reference	-	-
Yes	1.4	1.0-2.0	-	-
Enuresis				

	Crude RR	95% CI	Adjusted RR	95% CI
No	1.0	Reference	-	-
Yes	1.6	1.0-2.4	-	-
Catheterization[c]				
No	1.0	Reference	1.0	Reference
Yes	1.9	1.2-3.0	2.2	1.4-3.7
Medication Burden				
1 to 4	1.0	Reference	-	-
5 to 9	2.3	1.6-3.4	-	-
≥ 10	4.2	2.6-6.7	-	-

RR = relative risk, CI = confidence interval, eGFR = estimated glomerular filtration rate, CKD = chronic kidney disease

[a]Adjusted for maternal education

[b]Adjusted for insurance carrier

[c]Adjusted for type/etiology of kidney disease (glomerular v. non-glomerular)