

Food Insecurity During COVID-19 in Children with End-Stage Kidney Disease: A Pilot Study

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Research Article

Keywords: Coronavirus disease 2019, Food insecurity, Kidney disease, End-stage renal disease, Nutritional status.

Posted Date: March 30th, 2022

DOI: <https://doi.org/10.21203/rs.3.rs-910466/v1>

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Abstract

Background

Food insecurity, an important social determinant of health among children, has become more common during the COVID-19 pandemic. Children with chronic diseases including end-stage kidney disease (ESKD) are at higher risk of food insecurity due to their complex care needs, medication burden, and dietary restrictions. No data exists describing food insecurity prevalence in pediatric ESKD patients during the COVID-19 pandemic.

Methods

Food insecurity was assessed among families of children (age 0-18 years) with ESKD on chronic dialysis at two pediatric academic medical centers. Families were screened in April 2020 using the Hunger Vital Sign, a validated 2-question screening tool. We assessed impact of COVID-19 on food insecurity. We compared serum phosphorus “pre-COVID” (January/February 2020) to “during COVID” (April/May 2020).

Results

A total of 29 families enrolled in this study. 62% (18/29) of children with ESKD lived in food insecure households, and of those, 72% (13/18) reported that COVID-19 had worsened their food insecurity status. During the COVID-19 pandemic, food insecure patients experienced greater rise in their serum phosphorus levels ($p=0.03$) and decreased likelihood of having adequate phosphorus control ($p=0.03$).

Conclusion

Food insecurity was common among children with ESKD on chronic dialysis during the COVID-19 pandemic. Children with food insecurity had a greater increase in their phosphorus levels during the pandemic than did food secure children. Further exploration into how food resources such as an onsite food pantry impacts food insecurity and phosphorus control in children with ESKD is essential.

Background

Food insecurity (FI) is defined as limited or uncertain availability of nutritionally adequate and safe foods, or limited ability to acquire such food in socially acceptable ways [1]. Fourteen million households in the United States were food insecure in 2019, with 20% of American children living in food insecure households [1]. FI is an important social determinant of health and is more common in children with chronic diseases [2, 3]. Pediatric FI impacts a higher proportion of children with kidney disease, occurring in 35% of children seen in a general nephrology clinic and 65% of children with end-stage kidney disease (ESKD) [4, 5]. In children with ESKD, FI is associated with increased healthcare utilization and decreased

quality of life [4, 5]. FI in children with kidney disease is also associated with higher phosphorus levels, as phosphorus content is often higher in low-cost shelf-stable processed foods [4].

During the COVID-19 pandemic, rates of FI have increased. Estimates suggest that during the height of the pandemic, FI rates tripled [6]. However, the impact of the pandemic on FI in children with chronic disease, such as kidney disease, is unknown. Evaluating the impact of the COVID-19 pandemic on food insecurity rates in children with chronic disease is paramount as a first step in connecting families to necessary community resources. In this study, we assessed the prevalence of FI among pediatric patients with ESKD during COVID-19. We hypothesized that the rates of FI in children with ESKD would be high during the COVID-19 pandemic, and that FI would correlate with worsening control of serum phosphorus, which may reflect quantity and quality of available food.

Methods

We performed a pilot cohort study of pediatric patients with ESKD undergoing chronic hemodialysis (HD) or peritoneal dialysis (PD) during the COVID-19 pandemic at two institutions: Riley Hospital for Children at Indiana University (Indianapolis, Indiana) and Seattle Children's Hospital (Seattle, Washington). Patients and families at both sites were screened for FI in April 2020 using the Hunger Vital Sign screen [7]. The Hunger Vital sign is a two-question tool validated in a variety of clinical settings, including the outpatient nephrology clinic and dialysis unit [4, 5, 7]. All families were screened using a paper copy of the Hunger Vital sign tool [5]. Families were included regardless of primary language and certified medical interpreters were utilized for all families where English was not their primary language. Families were identified as food insecure if they answered affirmatively to either of the two statements: 1) *Within the past 12 months we worried whether our food would run out before we got money to buy more* and 2) *Within the past 12 months the food we bought just didn't last and we didn't have money to get more* [7]. If participants responded no to both Hunger Vital Sign questions, they were considered food secure.

We additionally assessed the impact of the COVID-19 pandemic on food security status with the following statement: *Because of the COVID Pandemic, access to food has been more challenging than it normally is*. Food insecure families were referred to both short-term resources within the hospital, and connected with community-based resources to establish long-term supports. Of note, families with FI at Seattle Children's Hospital had access to an on-site food pantry with ESKD appropriate foods, beginning in 2018, as previously described [4, 5]. Additionally, FI screening results from Seattle Children's Hospital were compared prior FI prevalence data in previously published cohort of dialysis patients [4]. No prior FI prevalence data was available at Riley Hospital for Children.

We collected data on serum phosphorus levels as a surrogate marker of access to and intake of food as phosphorus is often elevated in lower-cost, higher-processed shelf-stable foods [4]. We defined goal range serum phosphorus levels using laboratory age-based norms which mirror the KDIGO targets for normal phosphorus in children with ESKD [8]. We compared relevant clinical parameters "pre-COVID"

(January/February 2020) to “during COVID” (April/May 2020) for each subject to assess changes over time during the COVID pandemic.

We summarized categorical variables by number and percentage, and continuous variables by mean and standard deviation. Comparisons between categorical and continuous variables were performed using Chi square testing and Kruskal-Wallis rank sum, respectively. Statistical analyses were performed using STATA/SE 17.0 (StataCorp, College Station, Texas) and figures using Prism (Graphpad, San Diego, California). This study was approved by Institutional Review Boards at both Indiana University School of Medicine/Riley Hospital for Children and University of Washington/Seattle Children’s Hospital and performed in accordance with the Declaration of Helsinki. At Seattle Children’s Hospital, written consent was obtained from all parents or guardians and assent in patients aged 13 and older. At Riley Hospital for Children this study was deemed non-human research/exempt and consent was not required nor obtained.

Results

A total of 29 families enrolled in this study (**Supplemental Table 1**). The majority of patients were on hemodialysis (86%), as at the time of the study Riley Hospital for Children only assessed FI in their hemodialysis patients. Eighteen children (62%) with ESKD were food insecure. At Seattle Children’s Hospital, which had previously performed FI screening, and where dialysis patients had access to an on-site food pantry, FI rates were significantly lower during COVID-19 (40%) than in 2019 in a different clinical cohort of dialysis patients (64%, $p=0.03$). A higher percentage of study participants at Riley Hospital for Children were food insecure during the COVID-19 pandemic compared to Seattle Children’s Hospital (86% versus 40%, $p=0.01$) (Figure 1, **Panel A**). Among food insecure families, 13 (72%) reported that the COVID-19 pandemic had worsened their FI. There were no significant differences between demographic characteristics between food secure and food insecure participants (**Supplemental Table 1**).

Children with ESKD who lived in food insecure households had a greater change in their serum phosphorus during COVID-19 than did food secure participants. Among children with FI, there was a median increase of 1.1mg/dL [IQR -0.2, 2.4] in serum phosphorus compared to a median change of 0 mg/dL [IQR -2, 2] in the food secure group ($p=0.03$, Figure 1, **Panel B**). While not statistically significant, the median increase in serum phosphorus among food insecure children at Riley Hospital for Children was larger (1.1 mg/dL) than at Seattle Children’s Hospital (0.55 mg/dL). During COVID-19, food insecure patients were also less likely to have a serum phosphorus within goal range (decreasing from 50% before COVID-19 to 11% during COVID-19, $p=0.03$). Among food secure children, there was no observed change in percentage with phosphorous values within goal range. (**Supplemental Table 1**)

Discussion

The majority of children with ESKD on chronic dialysis participating in this study lived in food insecure households, and a majority of food insecure families reported worsening of their food insecurity due to

the COVID-19 pandemic. We also found that children with FI had increasing serum phosphorus levels during the COVID-19 pandemic.

Children with ESKD may be at higher risk of FI given their frequent healthcare utilization and high medical expenditures. These risk factors may be exacerbated in the setting of a global pandemic [9]. Our finding of increasing serum phosphorus levels during COVID-19 may reflect the impact of increasingly limited access to appropriately low-phosphorous food options during the initial wave of the pandemic. Specifically, a diet higher in processed and shelf-stable foods, which are more readily accessible and affordable, is likely to be higher in phosphorous content [10]. However, other pandemic related factors may have also influenced

phosphorous levels as children not eating school lunches, restaurants were closed, and families were spending more time indoors and isolating.[9] There are too many variables that impact phosphorous intake to draw a conclusion from this finding.

Additionally, we report lower rates of FI at Seattle Children's Hospital compared to Riley Hospital for Children, as well a lower rate of FI than that reported in a previous FI study at Seattle Children's among a different clinical cohort of ESKD patients [4]. We speculate that these differences may potentially reflect the positive impact of earlier adoption of FI screening and the availability of an on-site food pantry at Seattle Children's Hospital, the establishment of which preceded the COVID-19 pandemic. Conversely, no on-site food pantry was available at Riley Hospital for Children during the time of this study. Similar to what has been reported in other patient populations, availability of an on-site food pantry may have decreased barriers to accessing food for families with FI [9, 11, 12]. While no baseline data on FI rates at Riley Hospital for Children is available, we speculate that the lower rates at Seattle Children's despite the COVID-19 pandemic may reflect the previous work and resources available to this population, particularly the presence of an on-site food pantry.

Both FI and COVID-19 are known to disproportionately affect racial minorities, and structural racism is an important underpinning of these disparities.[13] While we did not observe differences in the prevalence of FI by race, this may have been due to small sample size. A recent cross-sectional study of national data found that during the COVID-19 pandemic, FI did not significantly differ between racial groups, but racial minorities were significantly less confident about their food security compared to white participants.[14]

Food insecurity is an essential social determinant of health that has been tied to higher rates of chronic disease and poorer health outcomes [15]. These concerns are exacerbated by a global pandemic that has highlighted disparities and further strained already-limited social resources. Increased rates of unemployment and poverty, two strong drivers of FI, increased worldwide following the COVID-19 pandemic [16]. Other factors which may contribute to high FI prevalence during COVID-19 include school closures and virtual learning resulting in the loss of SNAP subsidized meals.[17, 18]

This study has several limitations. First, patients and families may have reasons not to disclose FI, thus leading to an underestimate of FI prevalence. Enlisting the help of a social worker or other dialysis team

member with good rapport with families may help them to feel more comfortable in disclosing FI.[19] Further, owing to the relative rarity of pediatric ESKD, the sample size is limited. Additionally, we do not have available data on the prevalence of FI at Riley Hospital for Children prior to the COVID-19 pandemic, limiting longitudinal comparisons among part of the cohort. Despite these limitations, our study highlights the frequency and importance of FI among children with ESKD.

Conclusion

Our findings support the implementation of routine assessment of FI in all children with ESKD, especially during periods of high community stress, such as the COVID-19 pandemic. Identification of FI through frequent screening, and subsequently developing targeted interventions such as access to on-site food banks with diet-appropriate foods, offers the possibility of improving outcomes for these children. Future studies need to evaluate the clinical outcomes of these interventions.

Abbreviations

COVID-19: Coronavirus 2019

ESKD: End-Stage Kidney Disease

FI: Food Insecurity

FSGS: Focal Segmental Glomerulosclerosis

HD: Hemodialysis

IQR: Inter-Quartile Range

KDIGO: Kidney Disease Improving Global Outcomes

PD: Peritoneal Dialysis

SD: Standard Deviation

SNAP: Supplemental Nutrition Assistance Program

Declarations

Ethics approval and consent to participate: This study was approved by Institutional Review Boards at both Indiana University School of Medicine/Riley Hospital for Children and University of Washington/Seattle Children's Hospital. At Seattle Children's Hospital, written consent was obtained from all parents or guardians and assent in patients aged 13 and older. At Riley Hospital for Children this study was deemed non-human research/exempt and consent was not required nor obtained.

Consent to publish: Not required by Institutional Review Board.

Availability of data and material: The authors confirm that all data generated or analysed during this study are included in this published article.

Competing Interests: The authors have no conflicts of interest relevant to this article to disclose.

Funding: This study was supported in part by the NIH T32DK997662 (MS, RM). The funding sources for this study had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

Authors' contributions: MC and MS conceptualized and designed this study, collected data and performed data analysis, drafted the initial manuscript, and reviewed and revised the manuscript. RM, AW, and NP contributed to data collection and analysis, drafted sections of the manuscript, and critically revised the manuscript. SH provided oversight, and reviewed and revised the manuscript. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

Acknowledgments: We would like to thank Kelly Fisher, Emily Pao, Elizabeth Winstanley, Jamie Olsen, Marion Wilson (Seattle Children's Hospital) and Molly Jackson, Courtney Conner, R.N., Ashley Thomas, Shannon Stewart, Justice Cornelius, Shannon Anderson, Danielle Lowden, Suzanne Hedrick, Naomi Rivera, Laura Ruhe, Erica McNary, Susan Campbell, and Kari McCarty (Indiana University School of Medicine) for assistance with this project. The authors would like to thank Samantha Wallace (Department of Pediatrics, Indiana University School of Medicine) for help with technical editing and proofreading of the manuscript.

References

1. Coleman-Jensen A, Rabbitt M.P, Gregory C., & Singh A. (2019). Household Food Security in the United States in 2018. Department of Agriculture, Service ER; AP-079: 2918.
2. Lalji R., Francis A., Wong G. et al (2020). Disparities in end-stage kidney disease care for children: a global survey. *Kidney Int* 98(3):527-532.
3. O'Malley J.A., Klett B.M., Klein M.D., Inman N., Beck A.F. (2017). Revealing the Prevalence and Consequences of Food Insecurity in Children with Epilepsy. *J Community Health* 42(6):1213-1219.
4. Starr M.C., Wightman A., Munshi R., Li A., Hingorani S. (2019). Association of Food Insecurity and Acute Health Care Utilization in Children With End-Stage Kidney Disease. *JAMA Pediatr* 173(11):1097-1099.
5. Starr M.C., Fisher K., Thompson K., Thurber-Smith K., Hingorani S. (2018). A pilot investigation of food insecurity among children seen in an outpatient pediatric nephrology clinic. *Prev Med Rep* 10:113-116.

6. The COVID-19 crisis has already left too many children hungry in America
[<https://www.brookings.edu/blog/up-front/2020/05/06/the-covid-19-crisis-has-already-left-too-many-children-hungry-in-america/>]
7. Hager E.R., Quigg A.M., Black M.M. et al. (2010). Development and validity of a 2-item screen to identify families at risk for food insecurity. *Pediatrics* 126(1):e26-32.
8. KDIGO Group. (2018) KDIGO 2017 Clinical Practice Guideline Update for the Diagnosis, Evaluation, Prevention, and Treatment of Chronic Kidney Disease-Mineral and Bone Disorder (CKD-MBD). *Kidney Int Suppl* 7(1):1-59.
9. Akseer N., Kandru G., Keats E.C., Bhutta Z.A. (2020). COVID-19 pandemic and mitigation strategies: implications for maternal and child health and nutrition. *Am J Clin Nutr* 112(2):251-256.
10. Crews D.C., Kuczmarski M.F., Grubbs V. et al. (2014). Effect of food insecurity on chronic kidney disease in lower-income Americans. *Am J Nephrol* 39(1):27-35.
11. Cullen D., Abel D., Attridge M., Fein J.A. (2020). Exploring the Gap: Food Insecurity and Resource Engagement. *Acad Pediatr*.
12. Bazerghi C., McKay F.H., Dunn M. (2016) The Role of Food Banks in Addressing Food Insecurity: A Systematic Review. *J Community Health* 41(4):732-740.
13. Hanson A.E., Hains D.S., Schwaderer A.L., Starr M.C. (2020). Variation in COVID-19 Diagnosis by Zip Code and Race and Ethnicity in Indiana. *Front Public Health* 8:593861.
14. Morales D.X., Morales S.A., Beltran T.F. (2020) Racial/Ethnic Disparities in Household Food Insecurity During the COVID-19 Pandemic: a Nationally Representative Study. *J Racial Ethn Health Disparities* 1-15.
15. Cook J.T., Frank D.A., Berkowitz C et al. (2004). Food insecurity is associated with adverse health outcomes among human infants and toddlers. *J Nutr* 134(6):1432-1438.
16. Niles M.T., Bertmann F., Belarmino E.H., Wentworth T., Biehl E., Neff R. (2020). The Early Food Insecurity Impacts of COVID-19. *Nutrients* 12(7).
17. Li A., Harries M., Ross L.F. (2020) Reopening K-12 Schools in the Era of COVID-19: Review of State-level Guidance Addressing Equity Concerns. *J Pediatr*.
18. Bruce J.S., De La Cruz M.M., Lundberg K., Vesom N., Aguayo J., Merrell S.B. (2019). Combating Child Summer Food Insecurity: Examination of a Community-Based Mobile Meal Program. *J Community Health* 44(5):1009-1018.
19. Barnidge E., LaBarge G., Krupsky K., Arthur J. (2017) Screening for Food Insecurity in Pediatric Clinical Settings: Opportunities and Barriers. *J Community Health* 42(1):51-57.

Figures

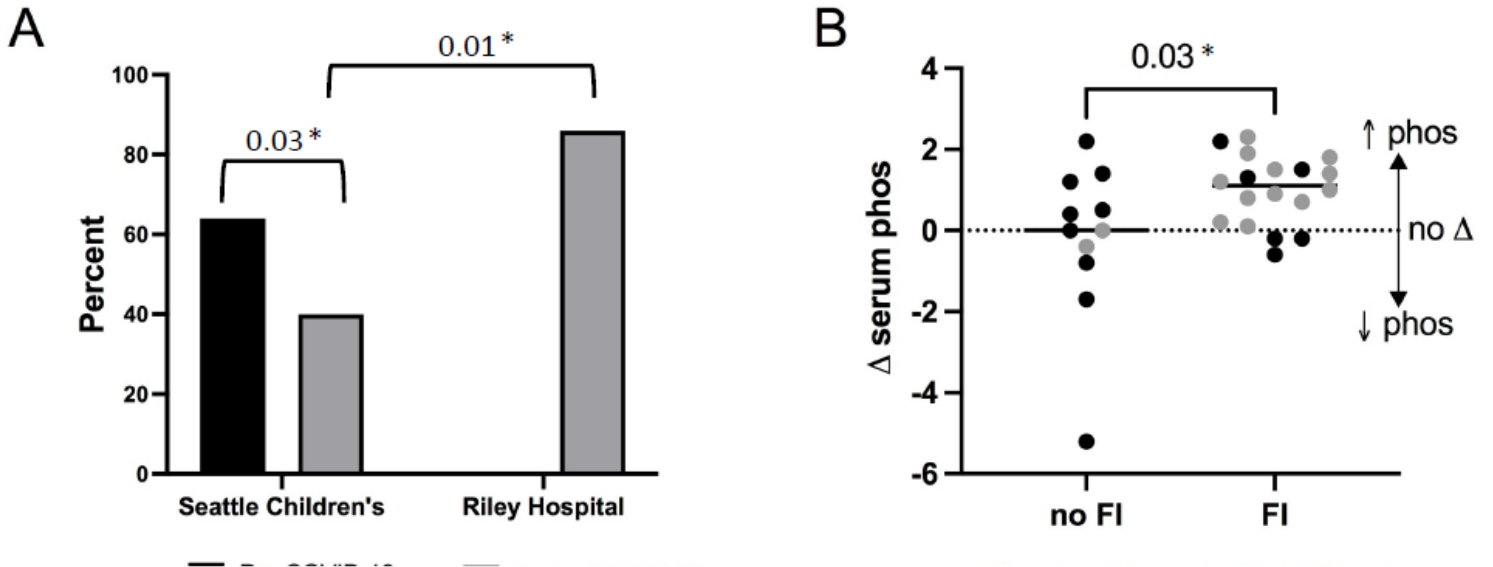


Figure 1

A) Prevalence of food insecurity at Seattle Children’s Hospital and Riley Hospital for Children; 2019 pre-pandemic food insecurity prevalence at Seattle Children’s is included for context (note that no similar pre-COVID pandemic data available for Riley Hospital for Children). B) Change in serum phosphorus (expressed as Δ serum phosphorus, in mg/dL) from before COVID-19 (January/February 2020) to during COVID-19 (April/May 2020) comparing those without food insecurity (no FI) to those with food insecurity (FI).

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [SupplementalTable.docx](#)