Early-Life Course Socioeconomic Factors and Chronic Kidney Disease

Patrick D. Brophy, David A. Shoham, The CKD Life Course Group, Jennifer R. Charlton, J. Bryan Carmody, Kimberly J. Reidy, Lyndsay Harshman, Jeffrey Segar, and David Askenazi

Kidney failure or ESRD affects approximately 650,000 Americans, whereas the number with earlier stages of CKD is much higher. Although CKD and ESRD are usually associated with adulthood, it is likely that the initial stages of CKD begin early in life. Many of these pathways are associated with low birth weight and disadvantaged socioeconomic status (SES) in childhood, translating childhood risk into later-life CKD and kidney failure. Social factors are thought to be fundamental causes of disease. Although the relationship between adult SES and CKD has been well established, the role of early childhood SES for CKD risk remains obscure. This review provides a rationale for examining the association between early-life SES and CKD. By collecting data on early-life SES and CKD, the interaction with other periods in the life course could also be studied, allowing for examination of whether SES trajectories (eg, poverty followed by affluence) or cumulative burden (eg, poverty at multiple time points) are more relevant to lifetime CKD risk.

© 2015 by the National Kidney Foundation, Inc. All rights reserved.

Key Words: Chronic kidney disease, Socioeconomic status, Health disparities, Life course, Epidemiology

Introduction

Kidney failure or ESRD affects approximately 650,000 Americans, whereas the number with earlier stages of CKD is much higher.[1] The health-related costs of ESRD exceed 28 billion dollars per year, adding economic burden to the human toll from this disease.[2-4] Although CKD and ESRD are usually associated with adulthood, it is likely that the initial stages of CKD begin early in life.[2-4] Infants and children who develop CKD are at significant risk for associated health problems beyond those directly attributable to kidney disease as they have not completed their physiological or intellectual maturity.[4] The risk factors and natural history for CKD progression in infants and children are not well understood.[4] Currently, North American and European investigators are monitoring childhood cohorts of patients with CKD to better understand the natural progression and treatment of CKD and to identify significant risk factors for patients at risk for developing progressive CKD.[4-7] This review focuses on the early-life determinants of CKD, with an emphasis on pathophysiological mechanisms. Many of these pathways are associated with low birth weight and disadvantaged socioeconomic status (SES) in childhood, translating childhood risk into later-life CKD and kidney failure.

Social factors are thought to be "fundamental causes" of disease because they constrain health-promoting behaviors and access to resources.[8] Social class and SES may be defined in a number of manners including education, income, occupation, and composite measures such as neighborhood disadvantage.[9] The importance of SES in the initiation and progression of CKD has been noted in several populations including the United States,[10] Canada,[11] and Australia,[12] although socioeconomically disadvantaged groups in the United States may be at greater risk than those in other developed countries.[13] Although numerous studies have examined the association between adult SES and CKD,[14-24] few have examined the contribution of early-life socioeconomic determinants of CKD.[25,26] Nevertheless, given extant pathophysiological evidence, it is likely that socioeconomic determinants begin to influence kidney health and disease during gestation.

The life-course perspective essentially reflects the study of long-term protective and risk factor effects of physical and social exposures from gestation through to adult life, which may be applied to kidney disease. It incorporates studies based on cross-generational and individual biological, behavioral, psychosocial, and environmental determinants.[27] Three life course models have been proposed as general paradigms for how socioeconomic factors may influence development and adult disease: (1) the critical periods model, which emphasizes particular time points, such as early childhood, as most important in disease development; (2) the trajectory model, which posits that early and later life factors interact with one another to confer disease risk; and (3) the cumulative model, whereby all periods in the life course contribute to disease development and progression.[28]

From Pediatric Nephrology, University of Iowa Children's Hospital; Department of Public Health Sciences, Loyola University Chicago, Maywood, IL; Division of Nephrology, Department of Pediatrics, University of Virginia, Charlottesville, VA; Pediatric Nephrology, Montefiore Medical Center, Albert Einstein College of Medicine, Bronx, NY; Pediatrics, University of Iowa Children's Hospital, Iowa City, IA; Neonatology, University of Iowa Children's Hospital, Iowa City, IA; Department of Pediatric Nephrology, University of Alabama at Birmingham, Birmingham, AL; and the Department of Public Health Sciences, Stritch School of Medicine, Loyola University Chicago, Maywood, IL.

An earlier version of this manuscript was presented at the Life Course Research Network meeting in Washington, DC, in February 2013.

Financial Disclosure: The authors declare that they have no relevant financial interests.

Address correspondence to Patrick Brophy, MD, Pediatric Nephrology, University of Iowa Children's Hospital. E-mail: patrick-brophy@uiowa.edu

© 2015 by the National Kidney Foundation, Inc. All rights reserved.

1548-5595/$36.00

http://dx.doi.org/10.1053/j.ackd.2014.06.006

The evidence supporting these 3 life course SES paradigms has been explored by Shoham and colleagues in previous work,[25,26] where support was strongest for a cumulative model. We know of no other studies employing a life course SES perspective on adult CKD. Because the socioeconomic context of childhood for CKD has been understudied, we shall focus in this article on gestation and childhood factors using a critical period model.

The CKD framework as defined by the Kidney Disease Outcomes Quality Initiative provides evidence (or best practice)-based management paradigms but does little to provide insight into the underlying determinants of development or progression of CKD.[29] Given the already significant costs CKD care portends on our health-care system and society, there is a real need to step back and reframe the paradigm as to how we investigate the life course determinants of this chronic disease. In particular, we need a better understanding of the ways in which social structure, preventative care, and health management operate once the disease course has been established. Clear comprehension of these determinants lends itself to the improvement of population health, attenuation of health disparities, and overall cost reduction in health-care expenditure. Although our emphasis is on pathophysiology and early life as a critical period, we highlight mechanisms that are likely to be socially determined and may help explain SES and racial disparities in the United States but have not been studied in socioeconomic context. We begin with the earliest stage of life, summarizing gestational determinants of CKD; then, we shall describe infancy and early childhood determinants.

CLINICAL SUMMARY

- Adverse socioeconomic status in adulthood is associated with adult chronic kidney disease.
- There is substantial pathophysiological evidence that gestation and early life is important for kidney health, as factors such as low birth weight are associated with reduced nephron number.
- Early life socioeconomic conditions that are associated with gestational and birth factors may set the stage for later life kidney disease; more research is required regarding the influence of early life on later CKD.
- Kidney disease may also appear earlier in life than generally appreciated. Research that facilitates better detection, treatment, and outcomes regarding early life kidney disease is needed.

Gestational Determinants

Although diabetes is the single most important determinant of CKD and end-stage kidney disease in the adult population in the United States, reduced nephron endowment secondary to prematurity/intrauterine growth retardation and early kidney injury may be determinants of susceptibility to other insults.[30] Later, we will review known determinants and pathways for CKD evolution beginning during gestation and identify some of the considerable gaps in our knowledge base.

The most overt cause of CKD and ESRD in infancy and childhood are birth defects, also known as congenital abnormalities of the kidney and urinary tract (CAKUT). These abnormalities result in inadequate kidney mass to provide internal physiological homeostasis for the provision of growth and development.[30-34] The long-term consequences of maternal effects and prematurity on kidney mass are more subtle and, therefore, less clear. The advances in neonatal intensive care in the past 50 years have been nothing less than remarkable: according to the most recent data from the Vermont Oxford Network, nearly 90% of infants born weighing 501 to 1500 g survive to neonatal intensive care unit (NICU) discharge, and nearly 60% of survivors leave the NICU without any major neonatal morbidity.[35] It is clear that today, premature infants who in another era would have died within a matter of hours are now surviving to adulthood. Although there has been a great deal of research into the neurodevelopmental outcomes of premature infants,[36] the impact of premature birth on other organ systems is less well understood. There is emerging evidence from the basic science and the clinical arenas to suggest that both prematurity and our treatments for it may have serious long-term consequences for kidney and general health.[37] Theoretical, experimental, and observational data suggest that there is an increased risk of CKD for infants born prematurely without specific kidney birth defects.

Premature birth often occurs in the context of poverty and social marginalization[38] and, in the United States, is more common among racial minorities.[39] Residential racial segregation appears to explain some of the disparity in premature delivery; intriguingly, neighborhoods with a greater proportion of African-Americans show increased premature delivery among both black and white residents.[40] The socioeconomic conditions in early childhood are likely important determinants of CKD later in the life course and deserve further study.

CKD in Early Life

The CAKUT spectrum represents relatively common birth defects, present in up to 1/500 live births, and are the leading causes of CKD and ESRD in childhood. A/hypo/dysplastic kidneys, obstructive uropathy, and vesicoureteral reflux account for 30.3% of children on dialysis in the United States.[30-33] The development of ESRD in infancy and childhood results in unique complications with a profound negative impact on growth and development. Mortality rates among children with ESRD are 30 to 150 times higher than of children in the general population.[32] Moreover, kidney and urinary tract malformations that do not result in ESRD during childhood are risk factors for CKD during adulthood and contribute to significant health-care and societal costs.[34,41,42] Genetic studies of children with CAKUT and animal studies have enabled investigators to identify multiple molecular signaling pathways, including integration/Wingless family (WNT), bone morphogenic proteins, fibroblast growth factor, sonic hedgehog, rearranged during transfection (RET)/glial cell-derived neurotrophic factor, and Notch pathways that are required for normal kidney and urinary tract development.[43-47] Although genetics may play a primary role in CAKUT, race and socioeconomic conditions may modify

Download English Version:

https://daneshyari.com/en/article/3846541

Download Persian Version:

https://daneshyari.com/article/3846541

Daneshyari.com