

# Understanding the Influence of Educational Attainment on Kidney Health and Opportunities for Improved Care



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**Educational attainment is an important but often overlooked contributor to health outcomes in patients with kidney disease. Those with lower levels of education have an increased risk of ESRD, complications of peritoneal dialysis, worse transplant outcomes, and mortality. Mediators of these associations are poorly understood but involve a complex interplay between health knowledge, behaviors, and socioeconomic and psychosocial factors. Interventions targeting these aspects of care have the potential to reduce disparities related to educational attainment; however, few programs have been described that specifically address this issue. Future research efforts should not only systematically assess level of educational attainment but also report the differential impact of interventions across educational strata. In addition, routine measurement of health literacy may be useful to identify high-risk patients independent of years of schooling. A better understanding of the influence of educational attainment on kidney health provides an opportunity to improve the care and outcomes of vulnerable patients with kidney disease.**

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## Introduction

Educational attainment—or the number of years of schooling a person has completed—has been consistently associated with health outcomes, even when adjusted for other socioeconomic risk factors.<sup>1,2</sup> Based on national data, people with higher levels of education are more likely to live longer, report better health status, and have less chronic disease. College graduates can expect to live almost 10 years longer than those with a less than high school education.<sup>3</sup> In addition, compared with college graduates, adults with less than high school level of education are 6 times as likely to rate their health status as poor (44% vs 7%) and more than twice as likely to have diabetes (19% vs 7%) or coronary heart disease (13% vs 5%).<sup>4</sup>

In this review, we describe the current understanding of the link between education and health, with particular emphasis on its relevance to patients with kidney disease. We discuss the importance of health literacy and highlight educational programs aimed at mitigating health disparities. We conclude with recommendations for the nephrology community to consider for integration into clinical practice and to extend research to address existing gaps in this important aspect of care.

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## Theoretical Model Linking Education With Health

Several interrelated pathways have been proposed to explain the relationship between educational attainment and health, including (1) health knowledge and behaviors, (2) employment and income, and (3) social and psychological factors (Fig 1).<sup>1,5</sup> In the first pathway, education contributes to health through better health knowledge, adequate health literacy, and improved coping and problem-solving skills. This allows patients to make better decisions about their health, engage in healthy behaviors, and self-manage their medical conditions. Education also contributes to health through better employment opportunities and higher income (pathway 2). Patients with higher educational attainment are more likely to be employed and to have a job with healthier working conditions, better employment benefits, and higher incomes. Higher paying jobs enable patients to afford and access health care, live in safe housing, and live in neighborhoods that promote healthy food choices and behaviors. In addition, social and psychological factors such as sense of control, social standing, and social support can influence health (pathway 3). Each of these pathways represents a potential target for interventions designed to improve health outcomes and reduce health disparities among disadvantaged patients.

## Education and Outcomes in Patients With Kidney Disease

A number of large studies have examined the association of educational attainment with outcomes in patients with kidney disease. Results vary depending on the population characteristics, adjustment for potential confounders, and outcomes studied. In the Chronic Renal Insufficiency Cohort study of 3612 participants with mild-to-moderate CKD, lower educational attainment was strongly associated with lower baseline estimated glomerular filtration rate ( $P = .0001$ ).<sup>6</sup> In contrast, in the Cardiovascular Health Study of approximately 5000 elderly individuals followed for 4 to 7 years, living in a low

socioeconomic status area was associated with a 50% greater risk of progressive CKD, but there was no independent association with education after adjusting for all other socioeconomic variables.<sup>7</sup> These findings support the theory that education contributes to health through better employment and income, allowing individuals to live in better neighborhoods that promote healthy lifestyles (pathway 2, Fig 1).

In an analysis of 61,457 participants in the Kidney Early Evaluation Program lower educational attainment was independently associated with reduced kidney function and increased mortality. In multivariable models, compared with persons not completing high school, college graduates had an 11% lower odds of decreased kidney function and a 28% lower odds of albuminuria. In addition, those who had completed college had a 24% lower mortality compared with participants who had completed at least some high school. Participants with higher educational attainment were also less likely to engage in adverse health behaviors such as smoking, and they had a lower odds of other chronic conditions such as hypertension or diabetes.<sup>8</sup> Although causation can only be speculated, these findings could be explained by the theory that those with higher educational attainment have better health knowledge, allowing them to engage in healthier behaviors and improved self-management (pathway 1, Fig 1).

Lower educational attainment has also been associated with an increased risk of ESRD. In a large cohort of 177,570 individuals from an integrated health system who were followed for 25 years, lower educational attainment was found to be an independent risk factor for ESRD defined by US Renal Data System data (adjusted hazard ratio [HR] 1.55 for no college and 1.45 for some college vs college graduate or higher).<sup>9</sup> The strengths of this study include the long duration of follow-up, the unbiased ascertainment of ESRD, and the large size of the study cohort.

Among patients with ESRD receiving peritoneal dialysis, educational attainment has been associated with a higher risk of peritonitis.<sup>10,11</sup> A total of 2032 patients initiating peritoneal dialysis from 114 centers in Brazil were observed for a median of 12 months (range 1-32 months). The patients within the highest educational attainment group had a first peritonitis frequency of 14.6% compared with those in the lower groups of 23% to 24.5%. In analyses adjusted for age, race, dialysis center characteristics, distance of patient's home from the dialysis center, and clinical factors, the lowest educational attainment group had almost twice the risk of first peritonitis event compared with the higher education group (HR 1.75,  $P = .03$ ). Regional and geographical differences in outcomes were also seen, which can partly be explained by variations in neighborhood environments

and living conditions (pathway 2, Fig 1). However, the extent to which these differences attenuated the effect of educational attainment on peritonitis risk is not provided.

In the kidney transplant population, lower educational attainment has been associated with decreased access to kidney transplantation and worse transplant outcomes, particularly among racial minorities. Goldfarb-Rumyantzev and colleagues<sup>12</sup> studied 3224 adult patients with ESRD. African Americans were less likely to be wait-listed/transplanted in the 3 less educated groups: HR 0.67 ( $P = .005$ ) for those who never completed high school, HR 0.76 ( $P = .02$ ) for high school graduates, HR 0.65 ( $P = .003$ ) for those with partial college education, and HR 0.75 ( $P = .1$ ) for those who completed college. In another study of 79,223 individuals with ESRD, in African Americans (compared with whites), the highest risk of graft failure was associated with individuals who did not complete high school (HR 1.96,  $P < .001$ ).<sup>13</sup>

### The Role of Health Literacy

Health literacy may be an important explanatory mediator of the relationship between education and health.<sup>14</sup> Health literacy refers to the constellation of skills needed for an individual to function effectively in the health care environment and act appropriately on health information.<sup>15</sup> It involves not just reading skills (print literacy) but listening and speaking skills (oral literacy), calculating ability (numeracy), and navigation skills. Patients with lower educational attainment are at increased risk for having low health literacy; however, it is important to recognize that even those with

higher educational attainment may have low health literacy because years of schooling do not necessarily correlate with skills achieved. In 1 study of hemodialysis patients, 24% of patients with limited health literacy reported educational attainment beyond the high school level.<sup>16</sup>

There is increasing recognition that health literacy is an essential aspect of kidney care.<sup>17-20</sup> Health literacy may be particularly important for patients with kidney disease because of the complexity of tasks involved in kidney disease management. In a recent systematic review, the pooled prevalence of limited health literacy in patients with kidney disease was 23%.<sup>21</sup> Limited health literacy has been associated with poorer CKD knowledge<sup>22</sup> and, in patients at high risk for CKD, less perceived susceptibility to CKD.<sup>23</sup> In patients with mild-to-moderate CKD, limited health literacy has been independently associated with lower glomerular filtration rate.<sup>24</sup> In addition, dialysis patients with limited health literacy have been shown to have worse blood pressure control<sup>25</sup> and lower dialysis adherence.<sup>26</sup> They have also been shown to have an increased risk of hospitalization and death.<sup>26,27</sup>

#### CLINICAL SUMMARY

- Lower educational attainment is an independent predictor of worse health outcomes in patients with kidney disease.
- Three potential pathways may explain the association between educational attainment and health: (1) knowledge and behaviors, (2) employment and income, and (3) psychosocial factors.
- Further research is needed to better understand the ability of interventions to reduce education-related health disparities.

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