

Quality of Life for Children With Chronic Kidney Disease

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Medical care advancements for children with chronic kidney disease (CKD) receiving hemodialysis, peritoneal dialysis, or with a renal transplant have resulted in relatively improved long-term patient survival compared with adult patients with CKD. Optimal care for the pediatric patient with CKD requires attention not only to medical management, but also the psychosocial and developmental factors that either will ensure or prevent a pediatric patient's successful transition into adulthood. We review the range of issues that impact pediatric CKD patients' health-related quality of life (HRQOL), the history of pediatric CKD patients' HRQOL investigation, and the instruments currently available to assess HRQOL.

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Medical care advancements for children with chronic kidney disease (CKD) receiving hemodialysis, peritoneal dialysis, or with a renal transplant have resulted in relatively improved long-term patient survival compared with adult patients with CKD.¹ As a result, more pediatric patients with CKD are reaching adult age. Thus, optimal care for the pediatric patient with CKD requires attention not only to medical management, but also to the psychosocial and developmental factors that either will ensure or prevent a pediatric patient's successful transition into adulthood. This article describes the scope of the problem with respect to pediatric CKD patient health-related quality of life (HRQOL), reviews the published literature on the topic, and presents current research efforts underway to improve our understanding and measurement of pediatric CKD patient HRQOL.

The Scope of the Problem

No long-term, prospective HRQOL outcome study has been performed for children with end-stage renal disease (ESRD). The lack of long-term outcome data stems from many causes including, most importantly, the need for a multicenter study given the low prevalence of ESRD in children. CKD imparts significant constraints and restrictions that have a significant impact on normal psychosocial development. The medical requirements for CKD, including dietary restrictions and dependence on a hemodialysis or peritoneal dialysis machine, isolate children with CKD from their healthy peers. Such interruptions in the normal daily life of a child are a likely primary cause for the relatively low self-esteem and low rates of independent living, close interpersonal relationships, and employment reported in adult survivors of pediatric ESRD.^{2,3} Adolescent and young-adult ESRD patients with a renal transplant report lower employment rates and greater concern about body image than a similar cohort of diabetic patients.⁴

Another issue, albeit difficult to quantify, is the prolonged paternalistic medical team approach to the child with chronic illness, which differs significantly from the adult medical subculture in which patients themselves primarily are responsible for their own health and interactions with the health care system.⁵ Pediatric patients with chronic illness usually receive their medical care in tertiary-care facilities with significant local philanthropic support and a staff that has a disposition to advocate for the child. Patients and their families should be provided with a transition plan to proceed

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through a medical adolescence that allows greater personal patient responsibility for care, but prevents medical endangerment. A successful plan requires education not only about medical issues, but also health insurance because nearly half of young adults who survive childhood with a chronic illness are uninsured.⁶ Practical but detailed assessment of pediatric ESRD patient HRQOL will be critical to evaluate any intervention aimed at improving a patient's successful childhood psychosocial development and transition to the adult health care system.

Early Pediatric HRQOL Study

Early research into the HRQOL of pediatric ESRD patients occurring over 10 years ago showed that although pediatric patients with ESRD certainly have some similar developmental and psychosocial issues as children with other chronic illnesses, they also have challenges specifically related to ESRD.⁷⁻¹¹ Obstacles common to most chronically ill children include physical changes related to illness, the need to take many medications and undergo medical treatment, and time away from school and peers, which can lead to perceived differences and isolation. Children with ESRD have additional challenges such as maintaining a restricted dietary and fluid regimen, chronic dependence on medical equipment to sustain life, very obvious physical changes associated with transplantation, and the knowledge that they will live their whole lives with the recurrent cycle of dialysis and transplantation. To date, no follow-up evaluation from these studies has been published.

The tools used most often to measure HRQOL in previous studies were not ESRD-specific and included the Vineland Social Maturity scale, the Diagnostic Interview for Children and Adolescents, the General Health Questionnaire, the Birleson Depression Inventory, the Lipsitt Self-Concept scale, and a variety of other mental health inventories. The information gathered with these tools showed that children with ESRD have psychosocial issues and adjustment problems when compared with healthy children. These studies have shown that transplant patients cope better and have fewer psychologic problems than patients receiving peritoneal dialysis or hemodialysis. Compared with healthy children and children with a renal transplant, children receiving dialysis show increased incidences of depression, behavior disturbances, dependency on caregivers, poor school performance, lack of higher education or vocational training, cognitive delays, separation anxiety disorder, and poor social adjustment and peer relationships. In addition, patients receiving peritoneal dialysis seem to have more advanced coping skills and better emotional and academic adjustment than children receiving hemodialysis. Finally, parents of children with ESRD experience increased stress levels, increased marital strain, decreased support from friends and employers, increased incidences of anxiety and depression, and role confusion related to being both parent and medical caregiver (particularly in the case of parents of patients receiving home peritoneal dialysis).

Although all of this information is critical to understanding and caring for pediatric patients with CKD, none of the pre-

vious studies accounted for the cause of the existence of psychosocial issues and differences between the groups of children using different modalities of renal replacement therapy. The lack of information regarding the underlying causes of psychosocial differences results from the fact that these tools were devised without input from patients/parents/caregivers involved in ESRD and that many of these scales focus primarily on cognitive ability and mental health and not HRQOL per se. The instruments used in these early studies are not suitable for frequent re-administration to track a patient's changes in QOL over short periods of time. For instance, the Vineland scale is comprised of 577 questions to be answered only by parents and caregivers. In addition, many of these previous studies have administered 3 to 4 tools to obtain a complete HRQOL picture.

Specific HRQOL Measurement Instruments for Children With Chronic Disease

HRQOL tools including the Short Form 36, a non-ESRD specific tool, and the Kidney Disease Quality of Life, an ESRD-specific tool, have been crucial for evaluation of the impact of medical treatment on adult patients with ESRD.¹²⁻¹⁴ Data from adults have shown that the ESRD-specific Kidney Disease Quality of Life tool offered higher discrimination between dialysis modalities than the generic Short Form 36 tool.¹⁵⁻¹⁷ Although standard outcome measures used for adult patients such as death and hospitalization rates are important outcome measures for children, they clearly are insufficient. In addition, factors assessed in adult HRQOL including work status and sexual function generally are not appropriate for a pediatric population. Other factors including growth, exercise capacity, school attendance and performance, self-reliance, and functional development are crucial components for assessing the HRQOL for a pediatric patient with ESRD. A number of survey instruments addressing HRQOL have been used in school-based populations and in children with chronic illness; some of which have been studied recently in children with CKD. These tools are described later.

Child Health and Illness Profile: Adolescent Edition

The Child Health and Illness Profile Adolescent Edition (CHIP-AE) is a 153-item self-report instrument that assesses 6 domains of health status (discomfort, satisfaction, disorders, achievements, resilience, and risks). The instrument takes about 20 minutes to complete.¹⁸

Reliability (test-retest and internal) and validity (criterion and construct) studies support its use as a generic health status assessment tool for youth aged 11 to 17 years. It has been shown to be sensitive enough to distinguish between healthy and ill adolescents, and different age groups, sexes, and socioeconomic levels.^{19,20}

The CHIP-AE has been evaluated in a multicenter cross-sectional study of health status in adolescents with CKD.

Gerson et al²¹ reported on the use of the CHIP-AE in a case-control study of adolescents with CKD compared with 2 control groups of age-, socioeconomic-, and sex-matched peers. In this study, the HRQOL measured by the CHIP-AE was compared in patients with chronic renal insufficiency (CRI) on dialysis and posttransplant (TX). A total of 113 patients were studied in 7 pediatric nephrology centers in the northeast United States (mean age, 14 y; 39 CRI, 21 dialysis, 53 TX) and compared with 226 control patients. Patients with CKD had lower overall satisfaction with health and more restriction in activity. Positively, patients with CKD had more family involvement, better home safety and health practices, better social problem-solving skills, and were less likely to participate in risky social behaviors or socialize with peers who engaged in risky behavior. Patients receiving dialysis were less physically active and experienced more physical discomfort and limitations in activities than did TX or CRI patients. The investigators concluded that patients with CKD have poorer functional health status than age-matched peers. Among CKD patients, dialysis patients were found to have the poorest functional health status. These results suggested that the CHIP-AE could be used to measure functional health status in adolescent patients with CKD.

The Children's Health Questionnaire

The Children's Health Questionnaire (CHQ) is another generic health status instrument that has been used in adolescents with CKD. It has both parent and child versions. The child version is appropriate for administration to children aged 10 to 19 years and takes about 20 minutes to complete. The CHQ measures 12 domains of health status (physical functioning, limitations in schoolwork and activities with friends, general health, bodily pain and discomfort, limitations in family activities, emotional/time impact on the parent, impact of emotional or behavior problems on school work and other daily activities, self-esteem, mental health, behavior, family cohesion, and change in health). Because there are both parent and youth forms, use of the CHQ allows for comparison of health status perceptions between children and their parents or guardians. The CHQ has been used previously in a single-center study with children who have kidney disease and are maintained on hemodialysis,²² and more recently in a multicenter study of adolescents with CKD.²³ The CHQ was used to show the negative impact of anemia on several aspects of HRQOL. This cross-sectional study examined the association between anemia and QOL in a prevalent cohort of adolescents with CKD using the parent version of the CHQ (Child Health Questionnaire Parent Form). The study population included 113 CKD patients (mean age, 14.4 ± 1.9 y) requiring dialysis, with functioning kidney transplants or with advanced stage 2 or stage 3 to 5 CKD, as defined by the National Kidney Foundation's Kidney Disease Outcomes Quality Initiative. Seventy-five patients were found to be anemic, defined by a hematocrit level of 36% or lower. Anemic patients scored lower than nonanemic patients within several categories of QOL, specifically in the CHQ Parent Form 50 subdomains relating to physical func-

tioning, role-physical, and general health. These findings suggest that correction of anemia in adolescents with CKD may significantly improve long-term health outcomes for children with renal disease and their corresponding QOL, and show that the use of a HRQOL measure can show clinical improvement in response to a specific therapy for one of the many complications of CKD in children.

The Pediatric Quality of Life Inventory

The Pediatric Quality of Life Inventory (PedsQL) is a 23-item generic health status instrument that assesses 5 domains of health (physical functioning, emotional functioning, psychosocial functioning, social functioning, and school functioning) in children and adolescents ages 2 to 18 years. Internal reliability and construct and clinical validity have been shown. Parent and youth forms are available. The inventory takes approximately 5 minutes to complete.²⁴ One of the most significant advantages of this instrument is its short length, which allows for quick completion by patients and their parents, rendering it ideal for assessing the impact of an intervention of HRQOL and/or for repeated longitudinal assessment. Initial work has been performed with the PedsQL in 85 pediatric patients and 96 parents of children with ESRD receiving hemodialysis (HD), peritoneal dialysis (PD) or with a renal TX.²⁵ Patient age ranges were 2 to 4 years (8 patients; PD = 3, TX = 5), 5 to 7 years (12 patients; HD = 9, TX = 3), 8 to 12 years (25 patients; HD = 5, PD = 6, TX = 14), 13 to 18 years (51 patients; HD = 18, PD = 10, TX = 23). PedsQL ESRD data were compared with healthy children ($n > 5,400$ child report; $n > 9,400$ parent report) and across HD/PD/TX. For all domains, ESRD patient HRQOL scores were significantly lower than healthy controls. Transplant patients reported better physical and psychosocial health than dialysis patients. No difference was noted between HD and PD patients for any PedsQL domain. Interestingly, significantly fewer parents of children with a renal transplant reported their child had a chronic medical condition compared with parents of children receiving dialysis.

The PedsQL will be used to assess changes in HRQOL in the Chronic Kidney Disease in Children (CKiD) study. The CKiD study is a prospective, observational cohort of children with CKD. The CKiD study population will include a cohort of 540 children, aged 1 to 16 years, with mildly to moderately decreased kidney function, expected to be enrolled over a 24-month period. Studies using the CHQ and CHIP-AE have shown that CKD substantially affects the well-being of children. In CKiD, HRQOL will be measured at annual study visits, and changes in HRQOL will be assessed as kidney function decreases. Factors that influence changes in HRQOL in this population, including age of onset of kidney disease, duration of kidney failure, anemia, limitations in physical and social roles, and depression will be assessed annually.

Finally, another advantage of the PedsQL methodology is the ability to create disease-specific modules that can be completed in conjunction with the PedsQL 4.0 Generic Core Scales to provide further insight into the specific issues that

impact HRQOL for a particular patient population.^{26,27} Currently, a pediatric ESRD-specific PedsQL module is being assessed in 4 large US pediatric centers.

Conclusions

Research efforts have expanded significantly to determine the state of pediatric CKD patient HRQOL and the factors that impact HRQOL across all stages of CKD and all modalities of renal replacement therapy. Data from all studies suggest that children with a renal transplant fare better with respect to HRQOL than those receiving dialysis. As children and adolescents with CKD show improved survival into adulthood, vigorous attention to pediatric CKD patient HRQOL will be essential to provide optimal care and the tools needed for successful transition into the adult health care system. The HRQOL assessment instruments and their associated studies described here represent the first step toward achieving these goals.

References

- McDonald SP, Craig JC: Long-term survival of children with end-stage renal disease. *N Engl J Med* 350:2654-2662, 2004
- Reynolds JM, Morton MJ, Garralda ME, et al: Psychosocial adjustment of adult survivors of a paediatric dialysis and transplant programme. *Arch Dis Child* 68:104-110, 1993
- Morton MJ, Reynolds JM, Garralda ME, et al: Psychiatric adjustment in end-stage renal disease: A follow up study of former paediatric patients. *J Psychosom Res* 38:293-303, 1994
- Henning P, Tomlinson L, Rigden SP, et al: Long term outcome of treatment of end stage renal failure. *Arch Dis Child* 63:35-40, 1988
- Reiss JG, Gibson RW, Walker LR: Health care transition: Youth, family, and provider perspectives. *Pediatrics* 115:112-120, 2005
- White PH: Access to health care: Health insurance considerations for young adults with special health care needs/disabilities. *Pediatrics* 110:1328-1335, 2002
- Brownbridge G, Fielding DM: Psychosocial adjustment and adherence to dialysis treatment regimes. *Pediatr Nephrol* 8:744-749, 1994
- Fukunishi I, Honda M: School adjustment of children with end-stage renal disease. *Pediatr Nephrol* 9:553-557, 1995
- Fukunishi I, Kudo H: Psychiatric problems of pediatric end-stage renal failure. *Gen Hosp Psychiatry* 17:32-36, 1995
- Brownbridge G, Fielding DM: Psychosocial adjustment to end-stage renal failure: Comparing haemodialysis, continuous ambulatory peritoneal dialysis and transplantation. *Pediatr Nephrol* 5:612-616, 1991
- Rosenkranz J, Bonzel KE, Bulla M, et al: Psychosocial adaptation of children and adolescents with chronic renal failure. *Pediatr Nephrol* 6:459-463, 1992
- Johansen KL, Painter P, Kent-Braun JA, et al: Validation of questionnaires to estimate physical activity and functioning in end-stage renal disease. *Kidney Int* 59:1121-1127, 2001
- Valderrabano F: Quality of life benefits of early anaemia treatment. *Nephrol Dial Transplant* 15:23-28, 2000 (suppl 3)
- Diaz-Buxo JA, Lowrie EG, Lew NL, et al: Quality-of-life evaluation using Short Form 36: Comparison in hemodialysis and peritoneal dialysis patients. *Am J Kidney Dis* 35:293-300, 2000
- Carmichael P, Popoola J, John I, et al: Assessment of quality of life in a single centre dialysis population using the KDQOL-SF questionnaire. *Qual Life Res* 9:195-205, 2000
- Rao PN, Mehta SN, Guleria S, et al: The quality of life in successful live-related renal allograft recipients in India. *Natl Med J India* 9:118-119, 1996
- Mapes DL, Bragg-Gresham JL, Bommer J, et al: Health-related quality of life in the Dialysis Outcomes and Practice Patterns Study (DOPPS). *Am J Kidney Dis* 44:54-60, 2004
- Starfield B, Riley AW, Green BF, et al: The adolescent child health and illness profile. A population-based measure of health. *Med Care* 33:553-566, 1995
- Starfield B, Forrest CB, Ryan SA, et al: Health status of well vs ill adolescents. *Arch Pediatr Adolesc Med* 150:1249-1256, 1996
- Starfield B, Riley AW, Witt WP, et al: Social class gradients in health during adolescence. *J Epidemiol Community Health* 56:354-361, 2002
- Gerson AC, Riley A, Fivush BA, et al: Assessing health status and health care utilization in adolescents with chronic kidney disease. *J Am Soc Nephrol* 16:1427-1432, 2005
- Kurtin PS, Landgraf JM, Abetz L: Patient-based health status measurements in pediatric dialysis: Expanding the assessment of outcome. *Am J Kidney Dis* 24:376-382, 1994
- Gerson A, Hwang W, Fiorenza J, et al: Anemia and health-related quality of life in adolescents with chronic kidney disease. *Am J Kidney Dis* 44:1017-1023, 2004
- Varni JW, Seid M, Kurtin PS: PedsQL™ 4.0: Reliability and validity of the Pediatric Quality of Life Inventory version 4.0 generic core scales in healthy and patient populations. *Med Care* 39:800-812, 2001
- Graham N, Burwinkle TM, Warady B, et al: Health-related quality of life (HRQOL) in pediatric ESRD patients. *Perit Dial Int* 25:546, 2005 (abstr)
- Varni JW, Burwinkle TM, Szer IS: The PedsQL™ multidimensional fatigue scale in pediatric rheumatology: Reliability and validity. *J Rheumatol* 31:2494-2500, 2004
- Varni JW, Katz ER, Seid M, et al: The pediatric cancer quality of life inventory-32 (PCQL-32): I. Reliability and validity. *Cancer* 82:1184-1196, 1998