

# Clinical Indices Can Standardize and Monitor Pediatric Care: A Novel Mechanism to Improve Quality and Safety

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**Objective** The Cancer Care Index (CCI), a single metric that sums the number of undesirable patient events in a given time frame (either preventable harm events or missed opportunities to provide optimal care), resulted in a 42% improvement in performance. Our objective was to test the index concept in other service lines to determine whether similar performance improvement occurred.

**Study design** Care indices were developed and introduced in 3 additional service lines: Nephrology (Chronic Kidney Disease Care Index; CKDCI), Pulmonology (Lung Transplantation Care Index; LTCI), and Otolaryngology (Tracheostomy Care Index; TCI). After reaching agreement on specific harms to be avoided and elements of optimal care that should be reliably delivered, these items were compiled into indices that were updated monthly. Reports included each element individually and the total for all elements. Baseline performance was calculated retrospectively for the previous year.

**Results** Significant improvement in performance occurred in each program following implementation of the clinical indices. The CKDCI was decreased by 63.2% ( $P < .001$ ), the LTCI was decreased by 89.5% ( $P < .001$ ), and the TCI was decreased by 53.0% ( $P < .001$ ). Surveyed staff indicated satisfaction with use of the metric.

**Conclusions** Clinical indices are useful for evaluating and managing the overall reliability of a program's ability to deliver optimal care, and are associated with improved clinical performance and satisfaction by service line staff when incorporated into a program's operation. (*J Pediatr* 2017;■■■:■■■-■■■).

Results in quality and safety studies are often reported as rates—numbers of events per number of opportunities for that event to happen. In 2010, we introduced the Preventable Harm Index (PHI), which is not a rate but rather the sum of patient harm events occurring in a given time frame.<sup>1</sup> A lower PHI value denotes fewer events and therefore better outcomes and performance. The PHI is simple and easily understood, and has been useful in our drive to eliminate preventable harm.<sup>2,3</sup> It is now being used in multiple children's hospitals as an outcome metric (eg, Serious Harm Index) to track changes in hospital patient safety.<sup>4</sup>

We recently expanded the index concept to our cancer program, which created a set of patient and family-centered quality elements that defined best practice, including both patient harm prevention and reliable delivery of supportive care.<sup>5-7</sup> These elements were combined to create a metric termed the Cancer Care Index (CCI),<sup>8</sup> a composite score reflecting the monthly total of undesirable events: patient harm plus omissions of optimal care. A lower CCI reflects improved overall system performance without regard to cancer type or patient outcome. Multidisciplinary quality improvement (QI) teams performed interventions to improve reliability across each index domain. A 42% reduction in annual events (harm and omissions) occurred in the majority of 15 individual CCI domains,<sup>8</sup> reflecting a reduction in care variation aided by CCI implementation. Subsequent to that report, a further 34% reduction occurred through the end of 2016 (Randal Olshefski, January 15, 2017).

Based on that experience, we expanded the clinical index concept to 3 other service lines. We hypothesized that a similar approach including the use of

|       |                                   |
|-------|-----------------------------------|
| CCI   | Cancer Care Index                 |
| CKD   | Chronic kidney disease            |
| CKDCI | Chronic Kidney Disease Care Index |
| LTCI  | Lung Transplantation Care Index   |
| PHI   | Preventable Harm Index            |
| QI    | Quality improvement               |
| TCI   | Tracheostomy Care Index           |

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clinical indices could substantially improve care reliability from the 50% reliability reported in children<sup>9</sup> and adults.<sup>10</sup> Here we report our initial experience with 3 indices: the Chronic Kidney Disease Care Index (CKDCI), Lung Transplant Care Index (LTCI) (outpatient), and Tracheostomy Care Index (TCI).

## Methods

This QI work involved implementing evidence-based interventions or best practices designed to reduce preventable harm and optimize outcomes. This work was identified as QI, did not involve human subjects research, and thus was deemed exempt from Institutional Review Board approval.

The 3 service lines selected were based on their organizational readiness for significant change, including the program leader's commitment to the concept, perceived capacity to add another metric with the attendant needed to collect additional data, and a strong culture of teamwork and commitment to improving outcomes. Index development began by creating consensus among a multidisciplinary team of content experts in each service line regarding elements that define "optimal care" across a spectrum of diseases within that particular discipline. Although optimal care in the currently reported indices involves largely reliably initiating elements of care deemed necessary, indices also can include avoiding preventable harm particularly relevant to the patient cohort. The TCI includes the avoidance of tracheostomy-related pressure ulcers, and the previously reported CCI<sup>8</sup> includes several types of preventable infections to be avoided.

Specific index element definitions were developed and tracked regarding whether that care element was delivered appropriately. A retrospective chart review for the preceding year was done to establish a baseline index value. The teams then established a goal for percent reduction in the index score for each subsequent year. The monthly year-to-date aggregate score, as well as scores for individual index elements, were regularly shared with microsystem QI teams, monthly with the Medical Director for QI, and 3-4 times per year with hospital QI leadership.

### CKDCI

International care guidelines exist to aid in appropriate monitoring and care of children with chronic kidney disease (CKD)

across the wide-ranging effects of CKD, including anemia, bone and mineral dysregulation, poor growth, hypertension, and cardiovascular disease.<sup>11</sup> These guidelines were used as a starting point to develop the CKDCI. The index includes elements for monitoring and communicating kidney function status; monitoring and managing CKD complications in the domains of proteinuria, anemia, mineral and bone metabolism, growth and acid-base status; and blood pressure control elements.<sup>12,13</sup>

Each domain contains more than 1 element; the CKDCI totals 24 elements (Table I). One example of an element is listed for each domain. Each patient was scored only once during the calendar year at his or her initial outpatient clinic visit for the year. The CKDCI is reported as a monthly total number of events.

### LTCI

Solid organ transplantation in children poses specific age-related challenges that differ from those in adults. Higher rates of allograft loss in kidney transplant recipients<sup>14</sup> and higher mortality in lung transplant recipients<sup>15</sup> have been noted in later adolescence and younger adulthood. Age-related mechanisms contributing to these poor outcomes in children after transplantation are not completely understood, but include issues associated with adherence to their medication regimen. Contributing factors to poor adherence with expected clinical treatment regimens include inadequate parental supervision, impact on social life, family conflict, mental health issues, treatment burden, accidental or purposeful forgetting, and no perceived benefit from the treatment regimen.<sup>16</sup> Although numerous strategies have been proposed to improve quality of life in pediatric organ transplant recipients,<sup>17</sup> no validated treatments have been studied to promote adherence to optimal care in this patient population.

Our initial focus was on outpatient aspects of patient care, primarily because that is where the largest patient population exists, thus providing the most opportunities for improvement. Because no published guidelines exist for children after lung transplantation, the LTCI was developed using accepted best practices, centering on methods to improve the quality of care using strategies that promote adherence and educate adolescent organ transplant recipients.<sup>18</sup> The LTCI contains 11 elements and is presented as a percentage of opportunities missed each month, which the index development team

**Table I. The CKDCI**

| Domains                               | Number of elements | Example  |
|---------------------------------------|--------------------|--|
| Monitoring glomerular filtration rate | 4                  | Communicate CKD stage to family annually; if stage 4, discuss dialysis and transplantation.                |
| Proteinuria                           | 2                  | Check urine protein annually   |
| Blood pressure management             | 3                  | If blood pressure is >90th percentile, treat or justify no treatment                                       |
| Acid-base management                  | 2                  | Bicarbonate level is at goal (>22 if age >6 mo; >20 if age <6 mo)  |
| Anemia management                     | 4                  | Monitoring hemoglobin and iron, with frequency based on CKD stage  |
| CKD-mineral bone disorders management | 6                  | Calcium/phosphate monitoring based on CKD stage and treatment with phosphate binder if indicated           |
| Growth management                     | 3                  | Offer growth hormone treatment if height is <3rd percentile or growth velocity <3rd percentile if age >2 y |
| Total number of elements              | 24                 |  |

Seven different domains are included, each with varying numbers of elements. One element is listed for each domain as an example.

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